

The Multidimensional Emotional Disorder Inventory (MEDI): Assessing Transdiagnostic Dimensions to Validate a Profile Approach to Emotional Disorder Classification

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There has been limited progress evaluating the validity of dimensional approaches to emotional disorder classification. This has occurred in part because of a lack of standardized assessment tools developed with the specific intent of studying dimensional classification. The goal of the current study was to develop and validate the Multidimensional Emotional Disorder Inventory (MEDI) to efficiently assess nine empirically supported transdiagnostic dimensions proposed in the Brown and Barlow (2009) profile approach to emotional disorder classification: neurotic temperament, positive temperament, depression, autonomic arousal, somatic anxiety, social anxiety, intrusive cognitions, traumatic reexperiencing, and avoidance. The MEDI factor structure, reliability, and convergent/discriminant validity was evaluated in outpatients with emotional disorders (pilot sample = 227; validation sample = 780). The final 9-factor solution fit the data well. Intercorrelations among MEDI factors were consistent with previous research, and all MEDI dimensions had acceptable reliability. Correlations with common self-report questionnaires and *DSM-5* diagnoses supported the convergent/discriminant validity of all nine MEDI dimensions. Collectively, these results support the use of 49-item MEDI in clinical research samples. The MEDI should be used in future research to evaluate the validity of the Brown and Barlow (2009) approach to emotional disorder classification. Because it provides an efficient assessment of several well-established emotional disorder traits and phenotypes, the MEDI also may have utility for general research or clinical purposes.

Public Significance Statement

The purpose of this study was to develop and validate an efficient self-report measure of nine distinct emotional disorder traits/symptoms. The measure was found to be reliable and valid, and may be useful for researchers or clinicians interested in a broad yet practical dimensional assessment of emotional disorder features.

Keywords: anxiety, mood, transdiagnostic assessment, classification, self-report

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There are well-established limitations of using the categorical approach delineated in the *Diagnostic and Statistical Manual for Mental Disorders* (5th ed. [*DSM-5*]; American Psychiatric Association [APA], 2013) to assess and diagnose emotional disorders (Brown & Barlow, 2009; Watson, 2005). Taxometric research

indicates that emotional disorders should be conceptualized as dimensional constructs rather than discrete entities (Kliem et al., 2014; Olatunji, Broman-Fulks, Bergman, Green, & Zlomke, 2010; Ruscio, 2010; Ruscio & Ruscio, 2002). High rates of comorbidity (Brown, Campbell, Lehman, Grisham, & Mancill, 2001; Kessler, Chiu, Demler, Merikangas, & Walters, 2005) suggest undue discrimination of symptoms that may be minor variants of broader, transdiagnostic emotional disorder phenotypes. Along these lines, diagnostic reliability is compromised when clinicians disagree on how to classify phenotypes shared by multiple diagnostic categories (e.g., deciding if physical symptoms and worry about health are due to panic disorder or somatic symptom disorder).

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Dimensional Approaches to Assessment and Classification

In response to the widely recognized limitations of the *Diagnostic and Statistical Manual of Mental Disorders (DSM)*, the National Institute of Mental Health developed the Research Do-

main Criteria (RDoC) initiative (Insel et al., 2010). RDoC is a transdiagnostic framework to assess, classify, and study mental health functioning. It includes five dimensions of psychological processes (negative valence, positive valence, cognitive, social, arousal/regulatory) that underlie normal-to-abnormal functioning. However, RDoC defines functioning primarily using basic biological processes that occur across species rather than clinical phenomena observable in humans (i.e., five of the eight units of analysis are biomarkers). Although some recommendations have been made for self-report assessments of RDoC constructs, most are overly broad. For example, psychometric research suggests that the Anxiety Sensitivity Index (Taylor et al., 2007) and Intolerance of Uncertainty Scale (Buhr & Dugas, 2002) measure distinct constructs (Carleton, Sharpe, & Asmundson, 2007), but both are recommended as self-report measures of “potential threat” (a negative valence construct). Many other recommended self-report measures of RDoC constructs are used infrequently in clinical practice (cf. Antony, Orsillo, & Roemer, 2001; Nezu, 2000). In its current state, it is difficult to envision how RDoC could evolve into a classification system that would be adopted by clinicians.

A more feasible approach to emotional disorder assessment and classification was recently proposed by Kotov and colleagues (2017). The Hierarchical Taxonomy of Psychopathology (HiTOP) is a quantitative-dimensional assessment and classification system based on a multilevel organization of symptom dimensions. The HiTOP framework is supported by decades of interview- and questionnaire-based research on the structure of psychopathology. At the lowest level of HiTOP are narrow homogenous components (e.g., avoidance, performance anxiety, reexperiencing symptoms) and personality traits (e.g., anxiousness, emotional lability, perseverance) that are posited to co-occur and form syndromes similar to current *DSM* diagnoses but conceptualized as dimensions rather than categories. A total of 42 internalizing (i.e., emotional disorder) components and traits are included in HiTOP. In general, HiTOP dimensions are more specific and descriptive than RDoC.

However, HiTOP is currently limited in three important ways. First, several of the 42 internalizing components and traits appear to reflect circumscribed features of specific emotional disorders. For example, HiTOP operationalizes distinct dimensions for rituals and cleaning, dysphoria and anhedonia, and situational phobia and fear of public places, among others. Although these dimensions are distinguished in HiTOP on the basis of psychometric evidence, their clinical utility is unclear (cf. more parsimonious dimensions reflecting behavior driven by nonsensical thoughts, depression, avoidance). Second, HiTOP components and traits cannot currently be measured by a single assessment tool; several lengthy self-report questionnaires would be required to assess all HiTOP dimensions. Although a HiTOP self-report measure is under development, validation may be a long and challenging process (e.g., recruiting appropriate samples to validate all traits and components). Third, HiTOP (and RDoC) does not operationalize or integrate any diagnostic categories because dimensional conceptualizations of psychopathology (i.e., confirmatory factor models) often provide better model fit than hybrid conceptualizations (i.e., factor mixture models, Eaton et al., 2013; Wright et al., 2013). However, the necessity of diagnostic categories is undeniable (First, 2005); managed care organizations will only reimburse treatment costs when a disorder is present.

Recognizing the necessity of diagnostic categories, Brown and Barlow (2009) proposed that emotional disorders be conceptualized using a set of parsimonious, yet clinically informative, transdiagnostic dimensions that could be plotted into a visual profile and categorized/labeled based on empirically derived cut-points or subgroupings. Ten dimensions are operationalized in this hybrid dimensional-categorical profile approach, all of which are strongly grounded in theory and research on factors associated with the development, expression, maintenance, and treatment of emotional disorders. Two are genetically based dimensions of temperament: neurotic and positive temperament. Whereas *neurotic temperament* reflects the trait tendency to experience negative affect in response to subjectively threatening stimuli (e.g., neuroticism, behavioral inhibition, negative affectivity), *positive temperament* is the tendency to experience positive affect in response to social and goal-oriented tasks (e.g., extraversion, behavioral activation, positive affectivity). Neurotic and positive temperament are included in the classification system because they are associated with the onset, severity, co-occurrence, and course of numerous emotional disorders and associated symptoms (Barnett et al., 2011; Brown, Chorpita, & Barlow, 1998; Conway, Craske, Zinbarg, & Mineka, 2016; Naragon-Gainey, Gallagher, & Brown, 2013). Neurotic temperament has positive associations with all emotional disorders but tends to have the strongest associations with generalized anxiety disorder and unipolar depressive disorders. Low positive temperament is uniquely associated with social anxiety and unipolar depression, whereas high positive temperament is associated with mania.

The Brown and Barlow (2009) proposal also includes several lower order transdiagnostic phenotypes, selected to balance parsimony (for ease of use) and specificity (to inform cognitive-behavioral treatment planning). The *depressed mood* and *mania* dimensions respectively capture excessive sadness and positive affect that frequently co-occur with other emotional disorders (Brown, Campbell, et al., 2001; Kessler et al., 2005). Depressed mood and mania are also important to assess for the purposes of risk management. The *autonomic arousal* dimension is defined by the experience of physiological symptoms due to sympathetic nervous system activation (i.e., panic symptoms). The experience of autonomic arousal is very common in the general population (Kessler et al., 2006), and can occur within the context of any emotional disorder (see *DSM-5* panic attack specifier). *Somatic anxiety* is included to reflect anxiety focused on somatic symptoms and associated worry about health. Somatic anxiety is recognized by *DSM-5* as a distinct category of psychopathology (somatic symptom and related disorders), but also has been observed in generalized anxiety disorder (Lee, Ma, & Tsang, 2011), panic disorder (Hiller, Leibbrand, Rief, & Fichter, 2005), and obsessive-compulsive disorders (Abramowitz, Brigidi, & Foa, 1999).

The *social anxiety* dimension represents fear of negative evaluation in interaction and performance situations. Knowledge of social evaluation concerns is important because it is the defining feature of social anxiety disorder. In addition, elevated social anxiety has been observed across the range of emotional disorders, particularly generalized anxiety disorder (Rapee, Sanderson, & Barlow, 1988) and depression (O'Connor, Berry, Weiss, & Gilbert, 2002). *Intrusive cognitions* are the experience of uncontrollable thoughts, images, and impulses. They are the defining feature of *DSM* obsessive-compulsive and related disorders, but also have

been observed within virtually all of the emotional disorders (Brewin, Gregory, Lipton, & Burgess, 2010; Tallis, 1990). The *traumatic reexperiencing* dimension represents negative affect, dissociation, and flashback experiences focused on past traumatic events. Although reexperiencing is the defining feature of *DSM-5* trauma and stress disorders, there is also evidence of reexperiencing symptoms within the context of panic attacks (e.g., reexperiencing first past attacks, Hagedaars, van Minnen, Hoogduin, & Verbraak, 2009) and social anxiety disorder (e.g., reexperiencing negative social events, Carleton, Peluso, Collimore, & Asmundson, 2011).

Finally, the *avoidance* dimension is defined as behavioral and cognitive strategies to prevent or reduce the intensity of acute states of negative or positive affect. Although a heterogeneous construct that may manifest in different ways across different emotional disorders, avoidance is inarguably a core feature and treatment target for all emotional disorders (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996; Wilamowska et al., 2010). Along with the aforementioned traits and phenotypes, information about manifestations of avoidance could greatly inform treatment planning. For example, a profile characterized by high autonomic arousal, somatic anxiety, situational avoidance, and safety behaviors would suggest a cognitive-behavioral treatment plan involving (a) cognitive restructuring or mindfulness to decrease distress focused on arousal symptoms, (b) interoceptive exposures to increase tolerance of physical symptoms and decrease somatic anxiety, and (c) in vivo exposures, with prevention of safety behaviors, to reduce situational avoidance and anxiety.

Value Proposition of a Self-Report Assessment of the Brown and Barlow Approach

The Brown and Barlow (2009) dimensions provide coverage of core transdiagnostic processes associated with the gamut of emotional disorders defined in *DSM-5* (mood, anxiety, trauma/stressor, and obsessive-compulsive/related disorders) and thus may serve as a useful starting point in developing and refining a hybrid dimensional-categorical profile approach to emotional disorder classification. In fact, Rosellini and Brown (2014) recently conducted a preliminary evaluation of the validity of a profile approach to emotional disorder classification. Several different self-report questionnaires were used to assess seven of the 10 dimensions included in the Brown and Barlow approach. Latent class analysis was used to identify six “profile types” that had convergent validity with current *DSM* diagnoses and incremental validity over and above *DSM* diagnoses in predicting several clinical outcomes.

Research on the validity of dimensional approaches to emotional disorder classification has otherwise been slow. In comparison, there has been greater progress integrating hybrid dimensional-categorical approaches to personality classification based on the widely studied five-factor conceptualization of personality traits and corresponding assessment tools (APA, 2013; Morey, Benson, & Skodol, 2016; Widiger & Trull, 2007). However, existing measures, including those used in Rosellini and Brown (2014), provide an inadequate and inefficient assessment of the broad set of emotional disorder dimensions delineated in the Brown and Barlow (2009) approach. For example, the 42-items from the Beck Depression and Anxiety Inventories (Beck & Steer, 1990; Beck,

Steer, & Brown, 1996) or 21-item Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995) could be used only to assess depressed mood and autonomic arousal. These measures, and several others, are additionally limited by the use of nonspecific constituent items (e.g., DASS-Anxiety assesses both symptoms of autonomic arousal and situational fear). Likewise, the 99-item Inventory of Depression and Anxiety Symptoms-II (IDAS-II; Watson et al., 2012) could be used to assess depressed mood (16 items assessing dysphoria and suicidality), mania (10 items assessing mania and euphoria), autonomic arousal (eight items assessing panic), and social anxiety (six items assessing social anxiety), but not neurotic or positive temperament. Not even time-consuming “omnibus” measures of personality/psychopathology designed to detect all major mental health conditions (e.g., Minnesota Multiphasic Personality Inventory-2-Restructured Form, MMPI-2-RF; Ben-Porath & Tellegen, 2008/2011) could be used to assess all the dimensions included in the Brown and Barlow approach. In other words, it is currently necessary to administer numerous self-report questionnaires to adequately assess a broad range of empirically identified emotional disorder traits and lower order phenotypes. Given associated administration times and costs, this can be a significant burden on researchers, clinicians, participants, and patients.

As they are strongly grounded in research and theory and overlap with *DSM* nomenclature, the Brown and Barlow (2009) dimensions are widely recognized by researchers and clinicians. Accordingly, there are several reasons to develop a questionnaire to efficiently assess the Brown and Barlow dimensions. First, it would promote research on hybrid dimensional-categorical approach to emotional disorder classification. Second, it could be used by researchers to study or control for severity based on a single emotional disorder dimension (e.g., identifying patients with severe panic) or severity across multiple dimensions (i.e., rather than administering a battery questionnaires). Third, it could be used by clinicians to inform additional assessment (e.g., functional analyses), plan treatment (e.g., prioritizing treatment targets), and track change across multiple dimensions over the course of treatment (i.e., rather than administering a battery questionnaires).

Current Study

The goal of the current study was to develop the Multidimensional Emotional Disorder Inventory (MEDDI), a questionnaire designed to efficiently assess the transdiagnostic dimensions include in the Brown and Barlow (2009) approach to emotional disorder classification. The current version of the MEDDI was developed to assess nine emotional disorder dimensions: Neurotic Temperament, Positive Temperament, Depressed Mood, Autonomic Arousal, Somatic Anxiety, Social Anxiety, Intrusive Cognitions, Traumatic Reexperiencing, and Avoidance. As the nine dimensions of interest all have been previously established as valid constructs, we hypothesized that a nine-factor solution would fit the data well and that the underlying dimensions would have convergent and discriminant validity with other self-report measures and *DSM-5* diagnoses.

Method

Samples

Independent samples were used to pilot ($n = 227$) and validate the MEDI ($n = 780$). Both samples consisted of adults with emotional disorders who agreed to participate in a larger parent study examining the severity, course, and classification of emotional disorders. The pilot sample included individuals who had recently completed an intake or follow-up assessment (12-months or 24-months after intake) for the parent study and were diagnosed with a current emotional disorder (at the most recent assessment). Pilot study participants were contacted by phone after completing an assessment for the parent study and asked to complete the MEDI, which was subsequently linked with diagnostic interview and questionnaire data collected as part of the parent study. Participants in the pilot were given the option of guaranteed financial compensation (\$5) or entry into a \$100 gift card raffle. In the validation sample, the MEDI was completed as part of the intake battery for the parent study. In the parent study, participants were provided \$75 compensation if they completed all intake assessment procedures (i.e., diagnostic interview, questionnaires, blood draw for genotyping).

Both samples were predominantly female (pilot sample: 68.3%; validation sample: 58.5%), Caucasian (87.7%; 82.7%), and of non-Hispanic ethnicity (94.7%; 90.6%), with smaller percentages identifying as Asian (6.6%; 10.1%) and African American (5.3%; 6.0%). The average age was 31.59 years in the pilot sample ($SD = 11.92$; range = 18 to 69) and 31.13 in the validation sample ($SD = 12.54$, range = 18 to 76). Exclusionary criteria for the parent study were current suicidal/homicidal intent and/or plan requiring crisis intervention, psychotic symptoms, or significant cognitive impairment (e.g., dementia, mental retardation). These criteria were assessed during an initial telephone screening and reassessed during the intake and follow-up diagnostic assessments. Written informed consent was obtained from all participants. All study procedures were approved by the governing Institutional Review Board.

Diagnostic Assessment

Doctoral-level clinical psychologists assessed patients for current diagnoses using the Anxiety and Related Disorder Interview Schedule for *DSM-IV* (pilot sample; ADIS-IV; Di Nardo, Brown, & Barlow, 1994) and *DSM-5* (validation sample; ADIS-5; Brown & Barlow, 2014). The ADIS is a semistructured interview designed to ascertain reliable diagnosis of *DSM* anxiety, mood, somatoform, obsessive-compulsive, trauma, and substance use disorders, and to screen for the presence of other conditions (e.g., eating and psychotic disorders). For each *DSM* diagnosis, interviewers assigned a 0 to 8 clinical severity rating (CSR) to indicate the degree of distress and lifestyle impairment associated with the disorder (0 = none, 8 = very severely disturbing/disabling). Disorders that met or exceeded the threshold for a formal *DSM* diagnosis were assigned CSRs of 4 (definitely disturbing/disabling) or higher ("clinical" diagnoses). The *principal* diagnosis refers to the disorder associated with the highest level of distress and impairment. Interviewers were required to undergo thorough training procedures that involved "matching" diagnoses and sever-

ity ratings of senior diagnosticians (see the Method section in the online supplemental material). The ADIS-IV demonstrates good-to-excellent reliability for the majority of *DSM-IV* anxiety and mood disorders (Brown, Di Nardo, Lehman, & Campbell, 2001). Data on the reliability of the ADIS-5 are forthcoming. Rates of the most common disorders were social anxiety disorder (pilot sample: 49.3%; validation sample: 48.6%), generalized anxiety disorder (36.6%; 44.7%), unipolar depression (i.e., major depression, dysthymic disorder/persistent depressive disorder, other specified depressive disorder; 23.3%; 34.1%), panic disorder/agoraphobia (24.7%; 19.6%), specific phobia (20.3%; 15.8%), and obsessive-compulsive disorder (12.8%; 14.5%).

Multidimensional Emotional Disorder Inventory

Given the diagnostic heterogeneity of the samples, our goal was to develop the MEDI to assess: Neurotic Temperament, Positive Temperament, Depression, Autonomic Arousal, Somatic Anxiety, Social Anxiety, Intrusive Cognitions, Traumatic Re-Experiencing, and Avoidance. The MEDI was developed to have a nine-point Likert response scale ranging from 0 (*not characteristic of me/does not apply to me*) to 8 (*extremely characteristic of me/applies to me very much*). The nine-point response scale was selected to provide a quasi-dimensional item-level assessment amenable to normality assumptions and maximum likelihood estimation. Research suggests that respondents find nine-point response scales easy to use (Preston & Colman, 2000).

Unfortunately, low rates and severity of manic symptoms precluded the development of a mania dimension; it would not have been possible to test convergent validity. Although an important future direction, we also opted against creating validity scales to detect response bias at this stage of MEDI development because (a) our priority was to establish the substantive scales—detecting response bias would be of little value if the scales were not reliable or valid—and (b) researchers often use statistical methods to detect response bias that do not require the addition of "validity" items (see Meade & Craig, 2012). In the current study, we used leverage tests to identify and exclude potential outliers (<1% of participants in each sample).

Numerous self-report questionnaires have been developed to assess the nine MEDI dimensions of interest. Accordingly, the initial MEDI item pool was generated based on item content with prior empirical support. Exploratory and confirmatory factor analysis studies of existing measures were reviewed to identify trait/phenotype descriptors with robust associations with the underlying constructs of interest (e.g., "discomfort/anxiety when talking" as a descriptor of social anxiety). Items were generated using similar phenotype descriptors but specifically worded to be transdiagnostic in nature and consistent with the MEDI response anchors. For example, MEDI-Intrusive Cognitions items focused on the intrusive and nonsensical nature of thoughts and images (e.g., Item 40, "I have thoughts or images that I find unacceptable") rather than their overly specific thought content (e.g., contamination, sex, violence, loss of control) or associated behaviors (e.g., cleaning, checking, rituals). The initial item pool contained 90 items.

The MEDI was developed from the 90-item pool with consultation from three expert anxiety disorder researchers. The 90 items were reduced using an expert voting approach rather than a data-driven approach to ensure the items provided adequate coverage of

heterogeneity in the dimensions of interest. In other words, we did not want to eliminate items at this stage of development based on strength of factor loadings. The items were distributed to the experts along with operational definitions of the dimensions of interest (presented in the Introduction). Each expert voted for the five “best” items to assess each dimension of interest. The 60 items receiving at least one vote were retained in the version of the MEDI that was administered in the pilot sample. As described in the following text, results of the pilot were used to determine which items to retain, revise, or omit in the version of the MEDI administered in the validation sample.

Validity Measures

Other measures included in the questionnaire battery of the parent study were used to evaluate the convergent/discriminant validity of the MEDI dimensions in the validation sample. Our goal was to identify one convergent validity measure for each purported MEDI scale, which would also be used as a discriminant validity measure for the other MEDI scales. The Neuroticism and Extraversion scales of the NEO-Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992) were selected to evaluate the validity of MEDI-Neurotic Temperament and MEDI-Positive Temperament, respectively. The Depression and Anxiety scales from the 21-item DASS (Lovibond & Lovibond, 1995) were used for MEDI-Depressed Mood and MEDI-Autonomic Arousal, the Social Interaction Anxiety Scale (SIAS total score; Mattick & Clarke, 1998) for MEDI-Social Anxiety, and the Obsessing scale of the Revised Obsessive–Compulsive Inventory (OCI-R; Foa et al., 2002) for MEDI-Intrusive Cognitions. Finally, the Distress Aversion scale of the Multidimensional Emotional Avoidance Questionnaire (MEAQ; Gámez, Chmielewski, Kotov, Ruggero, & Watson, 2011) was used to evaluate the validity of MEDI-Avoidance. The psychometric properties of these validity measures have been supported in similar clinical samples (Abramowitz & Deacon, 2006; Brown, Chorpita, Korotitsch, & Barlow, 1997; Gámez et al., 2011; Rossellini & Brown, 2011; Safren, Turk, & Heimberg, 1998). The questionnaire battery did not include other measures of somatic anxiety or reexperiencing symptoms. Thus, we also used *DSM-5* diagnoses (assessed by the ADIS-5) to evaluate the validity of MEDI-Somatic Anxiety and MEDI-Traumatic Reexperiencing (i.e., differential correlations with somatic symptom disorders and posttraumatic stress disorder).

Data Analysis

The raw data were analyzed using Mplus 7.1 (Muthén & Muthén, 1998–2018) with robust maximum likelihood minimization functions to account for non-normal and missing data. The MEDI structure was examined in both samples using exploratory structural equation modeling (ESEM; Marsh, Morin, Parker, & Kaur, 2014). ESEM was used rather than traditional exploratory factor analysis (EFA) in order to inspect solutions for localized areas of strain (i.e., standardized residuals, modification indices). Notably, an ESEM model with a fully saturated factor-loading matrix and no localized areas of strain (e.g., no correlated residuals) is statistically equivalent to traditional maximum likelihood EFA with a fully saturated factor-loading matrix. Regardless of whether localized areas of strain were identified, we also wanted to

use ESEM to estimate the correlations between the MEDI factors and convergent/discriminant validity measures in a single model (this cannot be done in traditional EFA). This approach makes it possible to account for measurement error. ESEM was used instead of confirmatory factor analysis (CFA) because the specification of a CFA measurement model in this context would be overly restrictive and unrealistic (i.e., 50 items loading on 9 factors where cross-loadings and error covariances are fixed to zero). For instance, research suggests that CFA of a measure with 50+ items or five or more factors is unlikely to fit the data well (cf. studies of the NEO Personality Inventory, Marsh, et al., 2014). Given the high rates of comorbidity in emotional disorder patient samples (Brown, Campbell, et al., 2001), we expected there to be several items with cross-loadings $\geq .30$. Accordingly, we only considered eliminating/revising items that (a) did not load on the intended factor $\geq .30$, (b) cross-loaded more strongly on an unintended factor than the intended factor, and (c) had relatively weak factor loadings onto the hypothesized factor in the context of several better functioning items.

Model fit was examined using the root mean squared error of approximation (RMSEA) and its test of close fit (C-Fit), Tucker Lewis Index (TLI), comparative fit index (CFI), and standardized root-mean-square residual (SRMR). Multiple goodness-of-fit indices were evaluated to examine various aspects of model fit (i.e., absolute fit, parsimonious fit, fit relative to the null model, Brown, 2015). Conventional guidelines for acceptable model fit include RMSEA near or below 0.06, C-Fit above .05, TLI and CFI close to or above .95, and SRMR near or below .08 (Hu & Bentler, 1999).

Results

Pilot Study

The MEDI was first evaluated in the pilot sample by comparing several competing ESEM solutions. We ultimately wanted to assess each dimension using approximately five items. The one exception was MEDI-Avoidance, which was permitted additional items to ensure adequate coverage of (heterogeneous) avoidance strategies (e.g., situational avoidance, distraction, suppression, safety signals). In total, 17 of the 60 items were identified as problematic (i.e., no loading $\geq .30$; stronger cross-loading than hypothesized loading; availability of five better functioning items). Of the 17, 12 items were eliminated and five were reworded. A list of these items and reasons for omission and revision are provided in Supplemental Table 1. Additionally, two new items were generated for MEDI-Intrusive Cognitions because preliminary convergent/discriminant validity analyses suggested this dimension was difficult to discriminate from generalized worry. Accordingly, the 50-item MEDI administered in the validation sample was intended to assess seven dimensions using five items per dimensions (Neurotic Temperament, Positive Temperament, Depression, Autonomic Arousal, Somatic Anxiety, Social Anxiety, Traumatic Reexperiencing), one dimension using seven items (Intrusive Cognitions), and one dimension using eight items (Avoidance).

Factor Structure in the Validation Sample

Eight-, nine-, and 10-factor ESEM solutions were evaluated in the validation sample. The 50-item nine-factor solution was con-

sistent with the nine purported MEDI dimensions and provided acceptable model fit, $\chi^2(811) = 1,859.2$, $p < .001$, RMSEA = 0.04 (C-Fit $p = 1.0$), TLI = 0.91, CFI = .94, SRMR = .02 (factor loadings are presented in Supplemental Table 2). The eight-factor solution was generally similar except (a) all MEDI-Neurotic Temperament and MEDI-Depressed Mood items loaded on a single factor and (b) model fit slightly decreased (but was still generally acceptable), $\chi^2(853) = 2,297.2$, $p < .001$, RMSEA = 0.05 (C-Fit $p = .99$), TLI = 0.88, CFI = .91, SRMR = .03 (see Supplemental Table 3). The 10-factor solution was also similar to the nine-factor solution and fit the data well, $\chi^2(770) = 1,621.8$, $p < .001$, RMSEA = .04, C-Fit $p = 1.0$, TLI = 0.92, CFI = .95, SRMR = .02, but distinguished an additional factor comprised of only three MEDI-Avoidance items (see Supplemental Table 4). Of the three solutions, the hypothesized nine-factor solution was determined to be the most parsimonious and conceptually interpretable.

Although the 50-item nine-factor model fit the data well, the solution was suboptimal because (a) Item 50 (“Certain thoughts cause me to act in ways that others might consider strange”) was intended to load on MEDI-Intrusive Cognitions (completely standardized loading = .38) but had a stronger loading on MEDI-Avoidance (loading = .58) and (b) two Avoidance items (9 and 31) did not have loadings $\geq .30$ on the Avoidance factor. Item 50 had the strongest of all loadings on MEDI-Avoidance and thus could have contributed to the nonsalient loadings for Items 9 and 31. We consequently reestimated the nine-factor model omitting item 50, which continued to provide an acceptable fit to the data, $\chi^2(771) = 1,679.9$, $p < .001$, RMSEA = 0.04 (C-Fit $p = 1.0$), TLI = 0.92, CFI = .94, SRMR = .02. In addition, the 49-item solution had stronger loadings ($\geq .30$) for the two previously nonsalient MEDI-Avoidance items (see Table 1). The 49-item solution had four items with cross-loadings $.30-.40$ (Items 3, 6, 15, and 42) and six items with cross-loadings $.20-.30$ (Items 11, 16, 23, 27, 30, and 35). Modification indices and standardized residuals were inspected, but no correlated residuals could be substantively justified. No further model revisions were made. This final ESEM solution is statistically equivalent to a traditional (fully saturated) nine-factor EFA solution as the model was not adjusted for any localized areas of strain.

Factor and Scale Correlations and Reliability

The nine MEDI dimensions had large factor determinacies (range = .84 to .98) indicating acceptable validity of the factor scores (Grice, 2001). In addition, all correlations between the ESEM MEDI factors and between the unweighted MEDI composite scales (raw summed) were in the expected directions (Tables 2 and 3). MEDI-Neurotic Temperament and Positive Temperament were inversely correlated (factor $r = -.24$; scale $r = -.23$). MEDI-Neurotic Temperament was positively associated with all phenotype dimensions (factor r s = .20 to .35; scale r s = .34 to .52), whereas MEDI-Positive Temperament was inversely associated with MEDI-Depressed Mood, Social Anxiety, Traumatic Re-experiencing, and Intrusive Cognitions (factor r s = $-.09$ to $-.48$; scale r s = $-.08$ to $-.47$) and negligibly associated with the other three factors (factor r s = $-.01$ to $.00$; scale r s = $-.06$ to $.00$). All the lower order phenotype dimensions had positive associations (factor r s = .09 to .48; scale r s = .17 to .56) except for

MEDI-Somatic Anxiety and Social Anxiety (factor $r = -.06$; scale $r = .00$).

Scale reliability of each MEDI dimension was calculated using the approach developed by Raykov with the Mplus Model Constraint command (Raykov, 2001). This method involves specifying dummy variables within the latent variable measurement model whose variances are constrained to equal the numerator (true score variance), denominator (total variance), and corresponding ratio of true score variance to total score variance. The Raykov method is more accurate than coefficient alpha, which misestimates scale reliability except in the rare situation where the measurement model is congeneric (e.g., no error covariances) and the items are tau-equivalent. Because it is not possible to impose model constraints in ESEM, scale reliability was estimated using exploratory factor analysis within a confirmatory factor analysis framework (E/CFA; cf. Brown, 2015). Because they are equivalent models, the goodness of fit of the E/CFA model was identical to ESEM and the factor loading estimates were comparable (see Supplemental Table 5 for E/CFA factor loadings). As shown at the bottom of Table 2, all nine MEDI dimensions had acceptable composite reliability (ρ range = .68 to .93).

Concurrent Validity

Self-report measures. The validity of the MEDI dimensions was evaluated by examining the differential magnitude of correlations between the factors and other self-report measures. The correlations were estimated using a ESEM measurement model that included the nine MEDI factors and seven single-indicator validity dimensions (assessed via the NEO-FFI, DASS-21, OCI-R, SIAS, and MEAQ) expected to be differentially related to the MEDI factors. In this measurement model, the observed validity dimensions were adjusted for measurement error by constraining the error variances (cf. Brown, 2015) to predetermined values based on scale reliability estimates from clinical samples (e.g., SIAS Cronbach's $\alpha = .94$, Mattick & Clarke, 1998). By adjusting for measurement error, this approach is more robust than evaluating validity based on observed composite (summed) scale scores. The expanded measurement model including the seven validity indicators provided an acceptable fit to the data, $\chi^2(1, 051) = 2,310.9$, $p < .001$, RMSEA = 0.04 (C-Fit $p = 1.0$), TLI = 0.92, CFI = .94, SRMR = .02.

The differential magnitude of the completely standardized correlations (ϕ) between the nine MEDI and seven self-report validity dimensions was examined using a z test procedure (Meng, Rosenthal, & Rubin, 1992; Table 4). Most MEDI factors were strongly correlated with their convergent validity measure, with the magnitude of these associations significantly larger than associations with the other validity measures (see Supplemental Table 6 for correlations based on observed scores, which were similar): MEDI-Neurotic Temperament and NEO-FFI-Neuroticism $\phi = .79$ (vs. discriminant measure ϕ s = $-.22$ to $.39$); MEDI-Positive Temperament and NEO-FFI-Extraversion $\phi = .86$ (vs. ϕ s = $-.05$ to $-.52$); MEDI-Depressed Mood and DASS-Depression $\phi = .91$ (vs. ϕ s = $-.49$ to $.74$); MEDI-Autonomic Arousal and DASS-Anxiety $\phi = .90$ (vs. ϕ s = $.01$ to $.37$); MEDI-Social Anxiety and SIAS $\phi = .92$ (vs. ϕ s = $-.64$ to $.58$); MEDI-Intrusive Cognitions and OCI-R-Obsessions $\phi = .90$ (vs. ϕ s = $-.05$ to $.34$). MEDI-Avoidance was only moderately correlated with MEAQ-Distress

Table 1
Factor Loadings From the Nine-Factor ESEM Solution (49 Items)

Item (No.)	NT	PT	DM	AA	SOM	SOC	IC	TRM	AVD
Easily upset (1)	.57	.00	.10	-.02	-.01	.04	.12	-.01	-.02
Always been worrier (10)	.56	-.15	-.10	.11	.08	.00	.02	.03	-.03
Poor stress coping (16)	.47	-.06	.24	.09	.11	.11	-.07	.02	.04
More keyed up than average (32)	.52	-.02	-.02	.19	.05	-.02	.09	.04	.12
Feelings hurt easily (35)	.39	.05	.14	-.07	.08	.20	-.08	.07	.11
Easily laughs (2)	.13	.51	.12	-.04	-.01	.01	.07	.01	-.02
Optimistic person (17)	-.08	.83	.00	-.04	-.01	.03	-.03	.00	.01
Cheerful and happy person (24)	.01	.79	-.11	.08	-.01	-.05	-.01	-.01	.00
Always motivated (33)	.05	.43	-.12	-.03	.05	-.12	.07	.00	-.06
Satisfied when finishing jobs (36)	.14	.32	-.07	-.04	.02	-.08	.01	.07	.03
Disappointed in self (3)	.30	-.10	.43	-.04	-.02	.15	.00	.01	.06
Feel sad (11)	.23	-.09	.68	.02	-.02	-.01	.08	.05	-.04
Loss of interest (25)	-.03	.01	.63	.08	.07	.09	-.02	.01	.05
Nothing to look forward to (37)	-.06	-.19	.66	.04	.00	.02	.02	.01	.05
Life not worth living (43)	-.11	-.09	.59	.04	.00	.01	.12	.06	.02
Experiencing breathlessness (4)	.04	.09	.17	.53	.07	-.02	.04	-.03	-.04
Feeling trembling/shaky (13)	.06	-.08	.00	.64	-.06	.07	.01	.09	.09
Sudden rushes fear (18)	.07	.03	.05	.47	.04	-.09	.11	.13	.07
Felt dizzy/lightheaded/faint (26)	-.05	.05	.03	.66	.13	-.01	-.07	-.02	.04
High resting heart rate (44)	.06	.01	.00	.69	-.03	.03	.01	.06	-.05
Fears physical sensations (6)	.08	-.06	-.13	.33	.35	.06	.10	.02	.06
Worry about health (19)	.04	.04	.06	.01	.81	.06	-.03	.02	-.05
Preoccupied by illnesses (28)	.01	-.03	.00	.00	.73	-.09	.10	.01	.01
Closely monitor health (38)	-.02	-.02	-.07	-.04	.80	-.03	-.05	.00	.08
Believes has undiagnosed illness (45)	-.04	-.02	.08	.17	.50	.04	.13	.00	-.08
Uncomfortable mingling (7)	.00	-.03	.02	-.06	.03	.87	.02	-.01	-.04
Uncomfortable center of attention (14)	.01	-.06	.00	.03	-.04	.68	-.12	.09	.03
Anxious with strangers (22)	.06	-.01	-.03	.06	.02	.82	.05	.00	.03
Nervous when talking to others (41)	-.01	.01	.02	.03	-.04	.88	.05	-.01	-.01
Nervous in social situations (47)	-.03	.01	.00	-.01	.00	.97	-.01	.00	.00
Odd thoughts (5)	.16	-.07	-.03	.10	-.04	.15	.57	-.13	.01
Unpleasant thoughts/images (12)	.05	-.03	.18	.01	.03	-.01	.59	.18	-.01
Inappropriate/nonsensical thoughts (21)	.02	-.01	-.04	.01	.09	.03	.79	.05	-.07
Actions driven by thoughts (30)	.00	.00	.02	-.03	.08	-.02	.49	.11	.25
Unacceptable thoughts/images (40)	-.03	.02	.08	-.04	-.04	-.01	.75	.08	.05
Unrealistic fear of losing control (46)	-.05	.00	.00	.17	.05	.05	.44	.07	.14
Thinking about horrific experiences (8)	.09	.01	-.07	.02	.06	.01	.16	.65	-.01
Disturbing dreams of past events (20)	-.03	.02	.10	.03	.04	-.06	-.07	.69	-.03
Intrusive images of past trauma (29)	-.03	-.02	-.07	.05	-.01	.01	.00	.90	-.03
Feels like reliving trauma (39)	-.05	.01	.08	.01	.01	.04	.02	.73	-.01
Distressed by trauma reminders (48)	.09	-.02	.05	-.08	-.01	.03	.05	.63	.18
Distraction coping (9)	.06	.11	.09	-.01	.03	.08	.16	.06	.30
Avoids upsetting places/things (15)	.18	.01	.07	-.02	.02	.34	-.10	.07	.40
Carries protective objects (23)	-.09	-.03	-.07	.21	.18	.03	.09	.02	.32
Gets rid of unpleasant feelings (27)	-.02	.13	.16	.21	.06	-.06	.14	-.03	.41
Tries to suppress upsetting thoughts (31)	.12	.06	-.01	-.02	-.01	-.02	.07	.14	.38
Avoids feared objects (34)	.01	-.10	.01	-.01	.08	-.04	-.07	.06	.51
Routine actions taken to cope (42)	.00	.02	-.11	.08	-.01	.01	.30	-.05	.37
Fears prevent day-to-day tasks (49)	-.02	-.03	.10	.20	.01	.08	.02	.11	.39

Note. Completely standardized factor loadings are presented. Exploratory structural equation modeling (ESEM) was conducted with robust maximum likelihood estimation and quartimin rotation. Factor loadings $\geq |.30|$ are in boldface type. NT = neurotic temperament; PT = positive temperament; DM = depressed mood; AA = autonomic arousal; SOM = somatic anxiety; SOC = social anxiety; IC = intrusive cognitions; TRM = traumatic re-experiencing; AVD = avoidance.

Aversion ($\phi = .49$), although this correlation was still significantly larger than correlations with the discriminant validity measures ($\phi_s = -.15$ to $.33$). Although not intended to serve as measures of convergent validity, MEDI-Somatic Anxiety was most strongly correlated with DASS-Anxiety ($\phi = .42$), and MEDI-Traumatic Reexperiencing with OCI-R-Obsessions ($\phi = .45$) and DASS-Anxiety ($\phi = .39$).

DSM-5 diagnoses. A similar approach was used to evaluate convergent/discriminant validity of the MEDI dimensions with

DSM-5 emotional disorder diagnoses. A specific goal of estimating correlations with DSM-5 diagnoses was to evaluate the validity of the MEDI-Somatic Anxiety and MEDI-Traumatic Reexperiencing dimensions (convergent self-report validity measures were not available). Point biserial correlations were derived from a ESEM measurement model that included the nine MEDI factors and eight dummy codes representing DSM-5 disorders: generalized anxiety disorder, panic disorder or agoraphobia, social anxiety disorder, specific phobia, obsessive-compulsive disorder, post-

Table 2
ESEM Factor Intercorrelations Determinacies, and Reliabilities

MEDI factor	NT	PT	DM	AA	SOM	SOC	IC	TRM	AVD
Neurotic temperament	—								
Positive temperament	-.24	—							
Depressed mood	.33	-.48	—						
Autonomic arousal	.27	.00	.20	—					
Somatic anxiety	.21	-.01	.09	.43	—				
Social anxiety	.35	-.35	.35	.15	-.06	—			
Intrusive cognitions	.27	-.09	.25	.31	.26	.15	—		
Traumatic re-experiencing	.21	-.11	.31	.32	.28	.19	.48	—	
Avoidance	.20	-.01	.19	.29	.23	.21	.23	.31	—
Factor determinacy	.88	.93	.93	.91	.93	.98	.93	.95	.84
Scale reliability [95% CI]	.74 [.69, .78]	.75 [.71, .79]	.84 [.80, .87]	.78 [.75, .81]	.81 [.79, .84]	.85 [.82, .87]	.93 [.92, .94]	.86 [.84, .89]	.68 [.61, .74]

Note. Correlations were derived from the exploratory structural equation modeling solution for the 49-item Multidimensional Emotional Disorder Inventory (MEDI). Robust maximum likelihood estimation and quartimin rotation were used. ϕ s ≥ 1.091 are significant at $p < .05$; ϕ s ≥ 1.141 are significant at $p < .001$. ESEM = exploratory structural equation modeling; NT = neurotic temperament; PT = positive temperament; DM = depressed mood; AA = autonomic arousal; SOM = somatic anxiety; SOC = social anxiety; IC = intrusive cognitions; TRM = traumatic re-experiencing; AVD = avoidance; CI = confidence interval.

traumatic stress disorder, depressive disorders (major or persistent depressive disorder), and somatic symptom disorders (illness anxiety or somatic symptom disorder). This model provided acceptable fit to the data, $\chi^2(1, 119) = 2,369.1, p < .001, RMSEA = 0.04$ (C-Fit $p = 1.0$), TLI = 0.90, CFI = .93, SRMR = .03 (see Supplemental Table 7 for correlations based on observed scores, which were similar).

Using the z test procedure (Meng et al., 1992), most MEDI factors displayed stronger correlations with convergent DSM-5 disorders than with other emotional disorders (see Table 5). MEDI-Depressed Mood had a stronger correlation with depressive disorders ($\phi = .57$) than other emotional disorders (ϕ s = $-.12$ to $.15$), MEDI-Autonomic Arousal with panic disorder/agoraphobia ($\phi = .45$ vs. ϕ s = $.01$ to $.17$), MEDI-Somatic Anxiety with somatic symptom disorders ($\phi = .40$ vs. ϕ s = $-.06$ to $.26$), MEDI-Social Anxiety with social anxiety disorder ($\phi = .40$ vs. ϕ s = $-.05$ to $.10$), MEDI-Intrusive Cognitions with obsessive-compulsive disorder ($\phi = .46$ vs. ϕ s = $-.07$ to $.08$), and MEDI-Traumatic Reexperiencing with posttraumatic stress disorder ($\phi = .37$ vs. ϕ s = $-.02$ to $.16$). MEDI-Neurotic Temperament was most strongly correlated with generalized anxiety disorder ($\phi = .37$ vs.

ϕ s = $-.08$ to $.20$) and MEDI-Positive Temperament with depressive disorders ($\phi = -.33$ vs. ϕ s = $-.20$ to $.07$). MEDI-Avoidance had the largest correlations with panic disorder/agoraphobia ($\phi = .28$) and specific phobia ($\phi = .21$ vs. ϕ s = $-.09$ to $.18$).

Norms Within DSM-5 Diagnostic Subgroups

We calculated composite scale means within subgroups defined by current and principal DSM-5 diagnoses to provide norms from a large emotional disorder outpatient clinic (see Table 6). The largest elevation on MEDI-Neurotic Temperament was observed among patients with a current or principal diagnosis of generalized anxiety disorder (current diagnosis $M = 27.11$; principal diagnosis $M = 27.18$), whereas the most pathological levels of MEDI-Positive Temperament were among patients with unipolar depressive disorders (current $M = 18.94$; principal $M = 19.29$). MEDI-Autonomic Arousal was most elevated among patients with somatic symptom disorders (current $M = 24.50$; principal $M = 24.94$) but similarly elevated among patients with panic disorder or agoraphobia (current $M = 24.13$; principal $M = 22.97$). MEDI-Depressed Mood, MEDI-Somatic Anxiety, MEDI-Social Anxiety,

Table 3
Composite (Observed) Scale Correlations and Means

MEDI factor (No. of items)	NT	PT	DM	AA	SOM	SOC	IC	TRM	AVD
Neurotic temperament (5)	—								
Positive temperament (5)	-.23	—							
Depressed mood (5)	.52	-.47	—						
Autonomic arousal (5)	.42	-.02	.32	—					
Somatic anxiety (5)	.34	.00	.19	.51	—				
Social anxiety (5)	.41	-.34	.43	.17	.00	—			
Intrusive cognitions (6)	.42	-.10	.40	.42	.39	.23	—		
Traumatic re-experiencing (5)	.35	-.08	.38	.39	.34	.21	.56	—	
Avoidance (8)	.41	-.06	.36	.48	.39	.29	.50	.46	—
Item M (SD)	4.76 (1.64)	4.45 (1.41)	3.27 (1.83)	3.43 (1.97)	3.25 (2.02)	4.21 (2.32)	3.17 (1.96)	2.11 (1.93)	3.66 (1.45)
Scale M (SD)	23.79 (8.19)	22.27 (7.07)	16.37 (9.17)	17.15 (9.83)	16.27 (10.08)	21.05 (11.60)	19.03 (11.78)	10.55 (9.63)	29.27 (11.60)

Note. Correlations, means, and standard deviations are based on observed composite scale scores. r s ≥ 1.081 are significant at $p < .05$; r s ≥ 1.171 are significant at $p < .001$. MEDI = multidimensional emotional disorder inventory; NT = neurotic temperament; PT = positive temperament; DM = depressed mood; AA = autonomic arousal; SOM = somatic anxiety; SOC = social anxiety; IC = intrusive cognitions; TRM = traumatic re-experiencing; AVD = avoidance.

Table 4
Differential Relationships of the MEDI Dimensions With Measures of Convergent and Discriminant Validity

MEDI factor	(NFFI) Neuroticism	(NFFI) Extraversion	(DASS) Depression	(DASS) Anxiety	(SIAS) Social	(OCI-R) Obsessions	(MEAQ) Distress Aversion
Neurotic temperament	.79_a	-.29 _{c,d}	.33 _{b,c}	.22 _d	.39 _b	.26 _{c,d}	.33 _{b,c}
Positive temperament	-.51 _b	.86_a	-.52 _b	-.05 _c	-.38 _c	-.09 _{d,e}	-.16 _d
Depressed mood	.74 _b	-.49 _c	.91_a	.29 _c	.34 _{d,e}	.27 _e	.38 _d
Autonomic arousal	.37 _b	.01 _d	.26 _c	.90_a	.07 _d	.29 _{b,c}	.21 _c
Somatic anxiety	.14 _c	-.01 _d	.13 _c	.42_a	-.04 _d	.27 _b	.21 _{b,c}
Social anxiety	.58 _b	-.64 _b	.37 _c	.18 _d	.92_a	.14 _d	.22 _d
Intrusive cognitions	.34 _b	-.05 _d	.30 _b	.33 _b	.13 _{c,d}	.90_a	.17 _c
Traumatic re-experiencing	.36 _b	-.16 _c	.33 _b	.39 _{a,b}	.16 _c	.45_a	.30 _b
Avoidance	.25 _{b,c}	-.15 _d	.19 _{c,d}	.33 _b	.18 _{c,d}	.23 _{c,d}	.49_a

Note. Coefficients are completed standardized parameter estimates (ϕ) from a measurement model of the nine Multidimensional Emotional Disorder Inventory (MEDI) factors and seven single-indicator validity dimensions. The largest ϕ within each row is in boldface type. Parameters in the same row but with different subscripts differ significantly in magnitude ($p < .05$). $\phi \geq 1.081$ are significant at $p < .05$; $\phi \geq 1.131$ are significant at $p < .001$. NFFI = NEO-Five Factor Inventory; DASS = Depression Anxiety Stress Scales; SIAS = Social Interaction Anxiety Scale; OCI-R = Obsessive Compulsive Inventory-Revised; MEAQ = Multidimensional Emotional Avoidance Questionnaire.

MEDI-Intrusive Cognitions, and MEDI-Traumatic Reexperiencing were (respectively) most elevated among patients with depressive disorders (current $M = 23.28$; principal $M = 24.52$), somatic symptom disorders (current $M = 33.08$; principal $M = 34.78$), social anxiety disorder (current $M = 28.55$; principal $M = 29.85$), obsessive-compulsive disorder (current $M = 29.73$; principal $M = 30.23$), and posttraumatic stress disorder (current $M = 26.05$; principal $M = 29.00$). MEDI-Avoidance was most elevated among patients with posttraumatic stress disorder (current $M = 35.76$; principal $M = 35.67$).

Discussion

The MEDI is the first self-report instrument developed to assess dimensions included in Brown and Barlow’s (2009) profile approach to emotional disorder classification. The final 49-item nine-factor ESEM solution had four items with cross-loadings |.30–.40| and six items with cross-loadings |.20–.30|, but all these items had stronger loadings on their intended factor and were in accord with substantive reasoning. For example, “Unexpected physical sensations scare me” (Item 6) had a salient loading on the

intended MEDI-Somatic Anxiety factor (.35), but also loaded on the MEDI-Autonomic Arousal factor (.33) operationalized in part by the experience of physical sensations. Likewise, “I avoid places or things that might upset me” (Item 15) had a salient loading on the intended MEDI-Avoidance factor (.40), but also loaded (.34) on the MEDI-Social Anxiety factor (avoidance of situations/places is a key feature of social anxiety; APA, 2013). As mentioned in the Method section, the cross-loadings were expected given the large number of MEDI items and dimensions (Marsh et al., 2014) and our use of a clinical sample with high rates of comorbidity.

Strong support was obtained for the reliability and validity of the MEDI dimensions. Factor determinacies and composite reliabilities were acceptable for all nine factors. Avoidance had the lowest scale reliability ($\rho = .68$), stemming from the fact the primary loadings for this factor were not large (range of MEDI-Avoidance primary loadings = .30 to .51). Factor intercorrelations were of small-to-moderate magnitude and largely consistent with prior research. MEDI-Neurotic Temperament and MEDI-Positive Temperament were inversely correlated, consistent with numerous studies reporting significant negative associations between

Table 5
Differential Relationships of the MEDI Dimensions With Current DSM-5 Emotional Disorders

MEDI factor	GAD	PD/A	SAD	SPEC	OCD	PTSD	DEP	SSD
Neurotic temperament	.37_a	-.08 _c	.20 _b	-.04 _c	.08 _c	-.08 _c	.08 _c	.04 _c
Positive temperament	-.07 _c	.00 _c	-.20 _b	.02 _c	-.03 _c	.07 _c	-.33_a	-.08 _c
Depressed mood	.10 _{b,c}	-.04 _c	.15 _b	-.12 _{b,c}	-.04 _c	.03 _c	.57_a	.03 _c
Autonomic arousal	.16 _b	.45_a	.04 _c	.04 _c	.01 _c	.06 _c	.04 _c	.17 _b
Somatic anxiety	.22 _b	.26 _b	-.06 _c	.05 _c	.17 _b	-.03 _c	-.03 _c	.40_a
Social anxiety	.07 _b	.03 _b	.64_a	-.05 _b	-.03 _b	.01 _b	.10 _b	-.03 _b
Intrusive cognitions	.06 _b	.01 _b	.04 _b	-.07 _b	.46_a	.04 _b	.08 _b	.08 _b
Traumatic re-experiencing	.16 _b	.05 _{c,d}	.05 _{c,d}	-.02 _d	.11 _{b,c}	.37_a	.14 _{b,c}	.00 _d
Avoidance	-.07 _c	.28_a	.13 _{b,c}	.21 _{a,b}	.18 _b	.05 _c	.05 _c	-.09 _c

Note. Coefficients are completed standardized parameter estimates (ϕ) from a measurement model of the nine Multidimensional Emotional Disorder Inventory (MEDI) factors plus eight observed (binary) Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5) diagnoses. The largest ϕ within each row is in boldface type. Parameters in the same row but with different subscripts differ significantly in magnitude ($p < .05$). $\phi \geq 1.081$ are significant at $p < .05$; $\phi \geq 1.131$ are significant at $p < .001$. GAD = generalized anxiety disorder; PD/A = panic disorder or agoraphobia; SAD = social anxiety disorder; SPEC = specific phobia; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder; DEP = major depression or persistent depressive disorder; SSD = somatic symptom or illness anxiety disorder.

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Table 6
Comparison of MEDI Scale Means and Standard Deviations Across DSM-5 Emotional Disorder Subgroups

Scale	Current DSM-5 Emotional Disorder (<i>n</i> current; <i>n</i> principal)															
	GAD (348; 154)		PD/A (151; 94)		SAD (377; 169)		SPEC (122; 59)		OCD (113; 71)		PTSD (41; 15)		DEP (265; 66)		SSD (40; 18)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Neurotic temperament	<i>27.11</i>	6.87	23.46	8.80	25.82	7.56	22.18	9.31	24.81	8.71	24.71	7.94	26.25	7.64	26.00	5.88
Positive temperament	20.95	6.88	22.83	7.03	20.58	7.14	23.37	6.93	22.74	6.91	21.83	7.48	<i>18.94</i>	6.62	21.50	7.09
Depressed mood	19.04	8.61	15.62	9.49	18.72	8.90	13.17	9.20	15.90	8.58	21.12	8.76	23.28	7.52	17.20	8.72
Autonomic arousal	19.31	9.35	24.13	9.55	16.97	9.53	16.89	10.95	17.42	10.27	21.27	7.92	18.90	9.39	24.50	8.91
Somatic anxiety	18.32	9.90	22.03	10.98	15.08	8.90	16.83	10.62	19.43	10.11	17.41	8.88	16.82	9.77	33.08	7.43
Social anxiety	22.84	10.95	19.11	11.71	28.55	8.76	18.18	11.94	18.84	12.05	24.12	10.80	23.78	10.99	16.15	9.75
Intrusive cognitions	20.79	11.78	20.22	12.30	19.76	11.62	16.96	12.16	29.73	11.68	24.54	12.35	21.63	11.61	21.25	12.36
Traumatic re-experiencing	12.85	9.79	11.46	10.37	11.37	10.06	9.33	8.27	13.40	10.54	26.05	9.19	13.50	10.67	9.98	8.70
Avoidance	30.11	11.39	34.61	12.88	30.53	11.23	31.13	11.60	33.92	12.50	35.76	8.88	31.18	11.74	28.45	12.30
	Principal DSM-5 Emotional Disorder															
Neurotic temperament	<i>27.18</i>	6.88	21.61	8.94	23.68	7.98	17.39	8.20	23.27	9.31	24.53	8.74	24.52	7.51	24.11	6.46
Positive temperament	22.60	6.44	23.47	6.77	21.18	7.27	25.69	5.91	24.46	6.42	23.47	7.79	19.29	6.97	23.83	6.54
Depressed mood	16.88	7.80	14.99	9.55	15.44	8.43	7.93	7.13	13.86	8.34	18.40	9.61	24.52	8.00	13.33	8.63
Autonomic arousal	17.49	9.51	22.97	10.08	14.35	8.58	14.17	10.83	16.08	10.51	21.80	6.25	15.64	9.11	24.94	9.01
Somatic anxiety	17.11	9.95	21.26	11.23	12.10	7.43	13.83	9.44	18.14	10.21	14.33	9.46	13.76	7.24	34.78	6.43
Social anxiety	19.84	10.29	18.07	11.73	29.85	8.69	11.92	9.66	14.86	10.97	22.93	10.27	23.36	9.38	13.89	8.33
Intrusive cognitions	17.91	10.85	19.02	12.11	16.97	10.42	11.81	10.60	30.23	12.06	27.07	11.19	19.98	11.35	22.56	9.62
Traumatic re-experiencing	10.86	8.41	10.58	9.70	9.25	9.32	6.92	7.27	12.15	10.56	29.00	8.82	11.83	9.51	6.83	6.48
Avoidance	27.47	10.76	34.73	13.78	27.83	10.25	28.88	11.35	32.45	12.28	35.67	8.37	29.45	11.76	27.06	12.08

Note. Values in italic type reflect the largest within-diagnosis elevation on a Multidimensional Emotional Disorder Inventory (MEDI) scale. Values in boldface type indicate the within-diagnosis scale mean was more severe than the total sample scale mean. The numbers under the diagnostic labels reflect the total number of patients in the sample with the diagnosis. Current diagnosis subgroups overlap, whereas principal diagnosis subgroups are mutually exclusive. We excluded participants with co-principal diagnoses when calculating means within principal diagnosis, with the exception of co-principal panic disorder and agoraphobia (by far the most common co-principal diagnoses). Means and standard deviations are based on raw score composites. *DSM-5* = *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.); GAD = generalized anxiety disorder; PD/A = panic disorder or agoraphobia; SAD = social anxiety disorder; SPEC = specific phobia; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder; DEP = major depression or persistent depressive disorder; SSD = somatic symptom or illness anxiety disorder.

neuroticism-extraversion (Jylhä & Isometsä, 2006; Rosellini & Brown, 2011) and negative-positive affectivity (Brown et al., 1998; Watson, Clark, & Tellegen, 1988). The positive associations between MEDI-Neurotic Temperament and all seven lower order phenotype dimensions, and negative associations between MEDI-Positive Temperament and MEDI-Depressed Mood and MEDI-Social Anxiety, are in line with findings from hierarchical structural models of emotional disorder traits and symptoms (Brown et al., 1998; Griffith et al., 2010; Rosellini & Brown, 2011). The significant positive correlations among most of the phenotype dimensions are not surprising given the high rates of emotional disorder comorbidity and use of a treatment-seeking sample (Brown, Campbell, et al., 2001; Kessler et al., 2005). Significant positive correlations have also been observed among most emotional disorder symptom dimensions assessed by the IDAS-II (Watson et al., 2012), the only other self-report instrument that assesses as broad of a range of emotional disorder phenotypes (but not traits such as neurotic or positive temperament).

MEDI-Neurotic Temperament, MEDI-Positive Temperament, MEDI-Depressed Mood, MEDI-Autonomic Arousal, MEDI-Social Anxiety, and MEDI-Intrusive Cognitions were strongly correlated with convergent self-report measures ($r_s \geq .79$). Although convergent self-report measures of MEDI-Somatic Anxiety and MEDI-Traumatic Reexperiencing were not available, there were nontrivial associations between MEDI-Somatic Anxiety and DASS-Anxiety and MEDI-Traumatic Reexperiencing and OCI-R-

Obsessions and DASS-Anxiety. These correlations are consistent with the frequent co-occurrence of physical symptoms and worry about health (e.g., *DSM-5* somatic symptom disorders and panic disorder) and the common experience of intrusive cognitions (Brewin et al., 2010) and increased arousal (Brown & McNiff, 2009) after traumatic events. Support was also obtained for the convergent validity of MEDI-Avoidance, although its correlation with MEAQ-Distress Aversion was somewhat modest (.49). This may have been due to the explicit assessment of behavior by the MEDI-Avoidance items (e.g., "I avoid places or things that might upset me") compared with the broader MEAQ-Distress Aversion assessment of eliminating negative emotions (e.g., "I'd do anything to feel less stressed"). In the current study, data were only available for the MEAQ-Distress Aversion subscale. Future validation of the MEDI should evaluate the convergence of MEDI-Avoidance with the other MEAQ subscales (e.g., Behavioral Avoidance, Distraction/Suppression, Gámez et al., 2011) or other measures of avoidance (e.g., Acceptance and Action Questionnaire, Hayes et al., 2004; White Bear Suppression Inventory, Wegner & Zanakos, 1994).

Although more research is also needed to evaluate the convergent validity of the MEDI-Somatic Anxiety and Traumatic Reexperiencing dimensions with comparable self-report measures, the associations observed between MEDI-Somatic Anxiety and *DSM-5* somatic symptom disorders and between MEDI-Traumatic Reexperience and *DSM-5* posttraumatic stress disorder provide

promising preliminary support. The correlations between MEDI dimensions and *DSM-5* diagnoses also provide additional support for the validity of the other lower order phenotype dimensions (e.g., MEDI-Autonomic Arousal most strongly correlated with panic disorder; MEDI-Social Anxiety with social anxiety disorder). Importantly, the correlations between MEDI dimensions and *DSM-5* disorders were estimated to evaluate differential associations. The overall magnitude of the individual associations is difficult to interpret because the sample was highly comorbid; individuals coded 0 on a dummy variable for any given *DSM-5* disorder still had other emotional disorders.

The current study provides promising initial support for the use of the MEDI in future evaluations of the [Brown and Barlow \(2009\)](#) profile approach to emotional disorder classification. The MEDI is unique in that it is designed to efficiently assess traits and phenotypes associated with the development, expression, and maintenance of a range of *DSM* emotional disorders. The primary utility of the MEDI is that it was developed with the specific intent of efficiently assessing the emotional disorder dimensions outlined in the [Brown and Barlow](#) approach. Without the MEDI, researchers would otherwise be required to select and use several different questionnaires to assess the dimensions of interest (e.g., [Rosellini & Brown, 2014](#)). Further, extant measures, although they assess constructs that overlap with the MEDI, were not designed to assess constructs in a transdiagnostic fashion.

The MEDI also might be useful to researchers investigating the nature and treatment of emotional disorders, and to clinicians treating patients with emotional disorders, regardless of interest in a new approach to diagnostic classification. Indeed, the MEDI dimensions are frequently assessed in research and clinical settings using other questionnaires that typically use 20 or more items to assess only one or two emotional disorder dimensions ([Antony et al., 2001](#); [Nezu, 2000](#)). The advantage of the MEDI over using existing measures is that it assesses a broad yet parsimonious set of emotional disorder traits and lower order phenotypes using a relatively brief set of items. The MEDI also could be useful for clinicians; elevations on the dimensions could be used along with functional analysis or item-level information from MEDI-Avoidance scale to inform cognitive-behavioral treatment planning. For instance, a MEDI profile characterized by social anxiety, traumatic reexperiencing, situational avoidance, and distraction-based avoidance could suggest a treatment plan involving (a) cognitive restructuring of negative thoughts and beliefs about past traumatic events and future social situations, (b) imaginal exposure to reduce reexperiencing symptoms and distraction avoidance, and (c) in vivo exposure with mindfulness to reduce situational avoidance and associated distraction techniques.

As a next step, the MEDI should be administered in independent samples and mixture modeling should be used to explicate and label potential diagnostic profiles (i.e., dimensional prototypes). In the [Rosellini and Brown \(2014\)](#) preliminary validation study of a profile approach to emotional disorder classification, latent class analysis was used to extract six meaningful profiles using only the dimensions of neurotic and positive temperament, depression, autonomic arousal, somatic anxiety, social anxiety, and intrusive cognitions (e.g., a panic-somatic class with large elevations on arousal and somatic anxiety; social-depressed class with elevated neurotic temperament, depression, social anxiety, and low positive temperament; severe-comorbid class with pathological levels on

all seven indicators). Hierarchical regression models were used to show the incremental validity of the profiles over *DSM* diagnoses; class probabilities consistently accounted for unique variance in severity of anxiety and mood symptoms (e.g., situational avoidance). A similar approach could be used to validate MEDI profiles as an adjunct to *DSM* diagnoses, likely a necessary intermediate step prior to adoption of any new approach to emotional disorder classification. To determine if *DSM* should be replaced with [Brown and Barlow's](#) approach (assessed via the MEDI), research would also need to demonstrate (a) improved predictive validity of the new dimensions/profiles over *DSM* diagnoses (e.g., in predicting overall impairment, symptom chronicity, treatment response) and (b) acceptance and utilization by clinicians. If proven valid, an empirically derived profile approach to classification could have several practical advantages over a purely categorical (*DSM-5*) or purely dimensional (RDoC, HiTOP) approach. A profile label would be easy to communicate and could represent the presence (yes/no) of a mental health condition for reimbursement purposes (e.g., "John Doe's profile resembles the social-depressed profile type"). At the same time, an array of subscale and item scores would be available for each patient to capture individual differences in severity.

There are several study limitations, and additional research is needed to further validate and expand the MEDI. Additional psychometric validation is necessary, as the current data were from a single outpatient clinic. The nine-factor structure of the MEDI needs to be replicated in other clinical samples as well as explored in representative community samples. It will also be important to evaluate the temporal stability of the MEDI dimensions, particularly because it uses a response scale that does not operationalize a specific timeframe. In comparison, the convergent/discriminant validity measures assessed traits in general, and tended to assess symptoms in the last 1 to 2 weeks. Accordingly, longitudinal data are needed to examine short-term test-retest reliability as well as the ability of the MEDI to capture change in symptoms over time and with treatment.¹ In addition, it will be necessary to evaluate temporal invariance of the MEDI factor structure.

In many ways, the current sample was ideal for developing and validating the MEDI (e.g., large, diagnostically heterogeneous, treatment seeking). One caveat is that it was not possible to develop a mania dimension because of the low rate and severity of manic symptoms. Given the low base rate of bipolar disorder in the population ([Merikangas et al., 2011](#)), validation of a mania dimension likely would require data collection at a bipolar specialty clinic and/or specific procedures to oversample individuals experiencing manic symptoms. With such efforts, the MEDI could be expanded to also assess other transdiagnostic emotional disorder phenotype dimensions (e.g., body image concerns, anger/irritability) or an even broader range of psychopathology. For example, it could be useful to expand the MEDI to assess dimensions of

¹ Preliminary data were available from roughly 200 patients in the validation sample who were re-administered the questionnaire battery 12-months after the initial assessment. To explore the temporal stability of the MEDI relative to the validity dimensions, we calculated correlations between baseline and 12-month scores (test-retest correlations). These correlations indicate that the MEDI dimensions are not any more or less "stable" over 12-months than questionnaires that assess traits in general or symptoms in the last 1 to 2 weeks (see [Supplemental Table 8](#)).

psychosis, particularly because individuals experiencing psychotic symptoms would be very likely to have elevations on the current MEDI dimensions (e.g., intrusive thoughts, Morrison & Baker, 2000). However, scales must be added parsimoniously; new dimensions should be operationalized only with robust empirical support for being a common transdiagnostic feature that could inform treatment but that would not be more efficiently or effectively assessed via functional analysis. If a broad expansion were to occur (e.g., psychosis or externalizing dimensions), the predictive validity of the MEDI would need to be compared with existing omnibus measures of personality/psychopathology (e.g., MMPI-2-RF; Ben-Porath & Tellegen, 2008/2011).

Although the priority of this study was to validate substantive dimensions, an important direction in the next stage of MEDI development will be to construct scales that are able to detect response bias (i.e., overreporting and underreporting). Some self-report measures of emotional disorder symptoms do not include validity scales, but these questionnaires tend to assess a circumscribed set of dimensions (e.g., DASS-21; Beck instruments). For the MEDI to be used in general outpatient settings, which often assess emotional disorders for disability claims or litigation, it will be necessary to develop clinician-friendly validity scales to detect untoward response style. Indeed, most omnibus measures used to assess both emotional/internalizing and externalizing disorder (and personality) symptoms include easy-to-score validity scales (e.g., MMPI-2-RF, Chmielewski, Zhu, Burchett, Bury, & Bagby, 2017; Personality Inventory for DSM-5, Sellbom, Dhillon, & Bagby, 2018; Personality Assessment Inventory, Ng et al., 2016).

The current study provides strong support for the 49-item MEDI as an efficient and valid assessment of nine widely studied emotional disorder traits and phenotypes. The primary reason for developing the MEDI was to have an assessment that could be used to evaluate the Brown and Barlow (2009) profile approach to emotional disorder classification. However, the MEDI may also be useful for more general research and clinical purposes; the strong convergent validity correlations suggest that the MEDI could be used in place of longer questionnaires and subscales. Using an efficient measure such as the MEDI to assess a broad range of emotional disorder dimensions would decrease the number of decisions about what self-report assessments to administer to research participants and patients. As a result, the MEDI could help reduce burden for researchers, clinicians, participants, and patients, and potentially increase standardization in routine outcome assessment in research and clinical settings.

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