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# The Hierarchical Taxonomy of Psychopathology (HiTOP): A Dimensional Alternative to Traditional Nosologies

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The reliability and validity of traditional taxonomies are limited by arbitrary boundaries between psychopathology and normality, often unclear boundaries between disorders, frequent disorder co-occurrence, heterogeneity within disorders, and diagnostic instability. These taxonomies went beyond evidence available on the structure of psychopathology and were shaped by a variety of other considerations, which may explain the aforementioned shortcomings. The Hierarchical Taxonomy Of Psychopathology (HiTOP) model has emerged as a research effort to address these problems. It constructs psychopathological syndromes and their components/subtypes based on the observed covariation of

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symptoms, grouping related symptoms together and thus reducing heterogeneity. It also combines co-occurring syndromes into spectra, thereby mapping out comorbidity. Moreover, it characterizes these phenomena dimensionally, which addresses boundary problems and diagnostic instability. Here, we review the development of the HiTOP and the relevant evidence. The new classification already covers most forms of psychopathology. Dimensional measures have been developed to assess many of the identified components, syndromes, and spectra. Several domains of this model are ready for clinical and research applications. The HiTOP promises to improve research and clinical practice by addressing the aforementioned shortcomings of traditional nosologies. It also provides an effective way to summarize and convey information on risk factors, etiology, pathophysiology, phenomenology, illness course, and treatment response. This can greatly improve the utility of the diagnosis of mental disorders. The new classification remains a work in progress. However, it is developing rapidly and is poised to advance mental health research and care significantly as the relevant science matures.

#### **General Scientific Summary**

This article introduces a new classification of mental illness, the Hierarchical Taxonomy Of Psychopathology (HiTOP). It aims to address several major shortcomings of traditional taxonomies and provide a better framework for researchers and clinicians.

**Keywords:** internalizing, externalizing, thought disorder, factor analysis, structure

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The Hierarchical Taxonomy Of Psychopathology (HiTOP; <http://medicine.stonybrookmedicine.edu/HITOP>) consortium brings together a group of clinical researchers who aim to develop an empirically driven classification system based on advances in quantitative research on the organization of psychopathology. Primary objectives of the consortium are to (a) integrate evidence generated by this research to date and (b) produce a system that reflects a synthesis of existing studies. Our motivation in articulating the HiTOP system is to facilitate translation of findings on quantitative classification to other research arenas and to clinical practice. To that end, we also seek to identify measures that can be used to assess HiTOP dimensions. Moreover, we hope that this system will stimulate and guide new nosologic research. We view the HiTOP as a set of testable hypotheses that would encourage exploration rather than constrain it. Indeed, we seek to avoid reification of the system. This article is the first publication of the consortium and reviews evidence available to date. We aim to provide regular updates to the HiTOP system as new data become available.

This article relies on several key terms and concepts, which are important to define upfront. *Structural studies* refer to research that investigates relations among signs, symptoms, maladaptive behaviors, or diagnoses. *Dimensions* are psychopathologic continua that reflect individual differences in a maladaptive characteristic across the entire population (e.g., social anxiety is a dimension that ranges from comfortable social interactions to distress in nearly all social situations); dimensions reflect differences in degree, rather than in kind. These dimensions can be organized hierarchically from narrowest to broadest, as follows. *Homogeneous components* are constellations of closely related symptom manifestations; for example, fears of working, reading, eating, or drinking in front of others form performance anxiety cluster. *Maladaptive traits* are specific pathological personality characteristics, such as submissiveness. *Syndromes* are composites of related components/traits, such as a social anxiety syndrome that encompasses both perfor-

mance anxiety and interaction anxiety. Of note, the term syndrome can be used to indicate a category, but here we use it to indicate a dimension. *Subfactors* are groups of closely related syndromes, such as the fear subfactor formed by strong links between social anxiety, agoraphobia, and specific phobia. *Spectra* are larger constellations of syndromes, such as an internalizing spectrum composed of syndromes from fear, distress, eating pathology, and sexual problems subfactors. *Superspectra* are extremely broad dimensions comprised of multiple spectra, such as a general factor of psychopathology that represents the liability shared by all mental disorders.

We also want to emphasize that although this article references disorders defined in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*; American Psychiatric Association [APA], 2013) in various passages, this only is to facilitate communication in situations wherein HiTOP dimensions parallel *DSM* diagnoses. The new system does not include any of the traditional diagnoses.

The present article covers six major topics. First, we review limitations of traditional taxonomies. Second, we discuss the history and principles of the quantitative classification movement that developed in parallel with traditional taxonomies. Third, we outline findings on the quantitative classification and the resulting HiTOP system. Fourth, we review measures currently available to implement this system. Fifth, we discuss the utility of the HiTOP model for research and clinical applications. Sixth, we conclude with an overview of limitations and future directions of this work.

#### **Limitations of Traditional Taxonomies**

The third edition of the *DSM (DSM-III)*; APA, 1980), along with its subsequent editions and counterpart editions of the International Classification of Diseases [ICD], including the current 10th edition (ICD-10; World Health Organization [WHO], 1992), substantially refined psychiatric classification, greatly reduced national variations in prevalence estimates, improved the diagnostic process, and

provided a common language for the field (Kendell & Jablensky, 2003). Nevertheless, these classification systems also have significant limitations.

First, these traditional systems consider all mental disorders to be categories, whereas the evidence to date suggests that psychopathology exists on a continuum with normal-range functioning; in fact, not a single mental disorder has been established as a discrete categorical entity (Carragher et al., 2014; Haslam, Holland, & Kuppens, 2012; Markon & Krueger, 2005; Walton, Ormel, & Krueger, 2011; Widiger & Samuel, 2005; Wright et al., 2013). More important, imposition of a categorical nomenclature on naturally dimensional phenomena leads to a substantial loss of information and to diagnostic instability (MacCallum, Zhang, Preacher, & Rucker, 2003; Markon, Chmielewski, & Miller, 2011; Morey et al., 2012).

Second, traditional diagnoses generally show limited reliability, as can be expected when arbitrary categories are forced onto dimensional phenomena (Chmielewski, Clark, Bagby, & Watson, 2015; Markon, 2013). For example, the *DSM-5* Field Trials found that 40% of diagnoses did not meet even a relaxed cutoff for acceptable interrater reliability (Regier et al., 2013), although the same disorders often showed excellent reliability when operationalized dimensionally (Markon et al., 2011; Shea et al., 2002).

Third, many existing diagnoses are quite heterogeneous and encompass multiple pathological processes (Clark, Watson, & Reynolds, 1995; Hasler, Drevets, Manji, & Charney, 2004; Zimmerman, Ellison, Young, Chelminski, & Dalrymple, 2015). Traditional taxonomies attempt to address heterogeneity by specifying disorder subtypes. However, most subtypes have been defined rationally rather than being derived from structural research, and fail to demarcate homogenous subgroups (Watson, 2003a).

Fourth, co-occurrence among mental disorders, often referred to as comorbidity, is very common in both clinical and community samples (Andrews, Slade, & Issakidis, 2002; Bijl, Ravelli, & van Zessen, 1998; Brown, Campbell, Lehman, Grisham, & Mancill, 2001; Grant et al., 2004; Kessler, Chiu, Demler, Merikangas, & Walters, 2005; Ormel et al., 2015; Teesson, Slade, & Mills, 2009). Comorbidity complicates research design and clinical decision-making, as additional conditions can distort study results and affect treatment. In terms of nosology, high comorbidity suggests that some unitary conditions have been split into multiple diagnoses, which co-occur frequently as a result, indicating the need to redraw boundaries between disorders.

Fifth, many patients fall short of the criteria for any disorder, despite manifesting significant distress or impairment that indicates the need for care. The *DSM-5* addresses this problem by providing Other Specified/Unspecified (previously Not Otherwise Specified) categories. More important, these cases represent a shortcoming of the current system, as such diagnoses provide little information.

The core issue potentially responsible for these five shortcomings is that construction of traditional taxonomies went beyond evidence available on the structure of psychopathology and was shaped by various other considerations. It appears that this rational approach to psychiatric nosology, not grounded in structural research or an understanding of the etiologic architecture of mental disorders, has failed in some instances to represent psychopathology accurately. Indeed, the sluggish pace of discovery in psychiatry has been attributed, in part, to the limited validity and certain

arbitrariness of traditional diagnoses (Cuthbert & Insel, 2013; Gould & Gottesman, 2006; Hasler et al., 2005; Hyman, 2010; Merikangas & Risch, 2003). Clinically, diagnosis is expected to help in selection of treatment, but the *DSM* and *ICD* are imperfect guides to care (Beutler & Malik, 2002; Bostic & Rho, 2006; Hermes, Sernyak, & Rosenheck, 2013; Mohamed & Rosenheck, 2008).

## The Quantitative Classification Movement

A solution to the shortcomings of traditional taxonomies is emerging in the form of a quantitative nosology, an empirically based organization of psychopathology (e.g., Achenbach & Rescorla, 2001; Forbush & Watson, 2013; Kotov, Ruggero, et al., 2011; Krueger & Markon, 2006; Lahey et al., 2008; Slade & Watson, 2006; Vollebergh et al., 2001; Wright & Simms, 2015). Rather than relying on a priori assumptions, a quantitative nosology is defined through the independent work of multiple research groups seeking to understand the organization of psychopathology (Kotov, 2016). In this section, we discuss four aspects of the quantitative approach. First, we review its history. Second, we outline ways in which the quantitative approach addresses the limitations of traditional taxonomies. Third, we respond to common concerns raised about this approach related to (a) methodological choices and (b) applicability to clinical settings. Fourth, we discuss the interface of a quantitative nosology with another dimensional approach to psychopathology, the Research Domain Criteria (RDoC; Cuthbert & Insel, 2010, 2013) framework.

## History

The quantitative movement has a long history, beginning with the pioneering work of Thomas Moore, Hans Eysenck, Richard Wittenborn, Maurice Lorr, and John Overall, who developed measures to assess signs and symptoms of psychiatric inpatients, and identified empirical dimensions of symptomatology through factor analysis of these instruments (e.g., Eysenck, 1944; Lorr, Klett, & McNair, 1963; Moore, 1930; Overall & Gorham, 1962; Wittenborn, 1951). Others have searched for natural categories using such techniques as cluster analysis (Blashfield, 1984; Macfarlane, Allen, & Honzik, 1954). Similarly, research on the structure of affect (Tellegen, 1985) helped to identify dimensions of depression and anxiety symptoms (Clark & Watson, 1991). Factor analytic studies of child symptomatology found dimensional syndromes that remain in use today (Achenbach, 1966; Achenbach, Howell, Quay, Conners, & Bates, 1991; Achenbach & Rescorla, 2001). Finally, factor analyses of comorbidity among common adult disorders revealed higher-order dimensions of psychopathology (Krueger, 1999; Krueger, Caspi, Moffitt, & Silva, 1998; Wolf et al., 1988) that inspired a growing and diverse literature.

Also relevant are factor analytic studies of normal personality. This research has identified a hierarchical taxonomy that spans many levels of generality from specific facets (e.g., 30 dimensions in the work of Costa & McCrae, 1992) to general factors (DeYoung, 2006; Digman, 1997; Markon, Krueger, & Watson, 2005). Among these levels, most attention has been devoted to the five-factor model, consisting of neuroticism, extraversion, openness, agreeableness, and conscientiousness (e.g., Costa & McCrae, 1992; Digman, 1990; Goldberg, 1993; John, Naumann, & Soto,

2008); and the “Big Three” model, consisting of neuroticism, extraversion, and disinhibition (Clark & Watson, 1999; Eysenck & Eysenck, 1975). These general traits show strong links to all common forms of psychopathology (Clark, 2005; Kotov et al., 2010; Saulsman & Page, 2004); in addition, specific facets are highly informative for understanding certain mental disorders (Samuel & Widiger, 2008; Watson, Stasik, Ellickson-Larew, & Stanton, 2015). Although extensive discussion of connections between personality and psychopathology is beyond the scope of the present paper, we should note that the taxonomy of normal personality has played a major role in shaping dimensional models of personality pathology (Widiger & Mullins-Sweatt, 2009; Widiger & Simonsen, 2005; Widiger & Trull, 2007). Personality models are also important because the scope of a quantitative nosology includes both symptoms, which are relatively transient forms of psychopathology, and maladaptive personality traits that form a more stable core of the clinical picture (Hopwood et al., 2011; Krueger & Markon, 2006).

### Addressing Limitations of Traditional Taxonomies

A quantitative psychiatric classification operates on two levels (Kotov, 2016). First, it constructs syndromes from the empirical covariation of symptoms to replace diagnoses that rely on untested assumptions, such as the assumption that mental disorders are categories. Second, it groups syndromes into spectra based on the covariation among them. Intermediate structural elements—such as components within syndromes and subfactors within spectra—are similarly elucidated. In line with existing evidence, all of these constructs have been operationalized dimensionally.

This quantitative approach responds to all aforementioned shortcomings of traditional nosologies. First, it resolves the issue of arbitrary thresholds and associated loss of information (Markon et al., 2011). It also helps to address the issue of instability, as indicated by the high test–retest reliability of dimensional psychopathology constructs (Watson, 2003b). Second, a quantitative approach groups related symptoms together and assigns unrelated symptoms to different syndromes, thereby identifying unitary constructs and reducing diagnostic heterogeneity (Clark & Watson, 2006). Third, comorbidity is incorporated into the classification system with the assignment of syndromes to spectra. Comorbidity conveys important information about shared risk factors, pathological processes, and illness course; a quantitative nosology formalizes this information, making it explicitly available to researchers and clinicians (Brown & Barlow, 2009; Krueger & Markon, 2011; Watson, 2005). Hence, if a question concerns a clinical feature common to multiple syndromes, the clinician or researcher may focus on the higher-order dimension. Alternatively, if a specific syndrome is of interest, the higher-order dimension can be controlled statistically (or for a given patient, relative elevation of the syndrome can be computed relative to score on the higher-order dimension) to elucidate information unique to this syndrome. This hierarchical organization is an important feature of a quantitative nosology; the multilevel approach (including individual symptoms, components/traits, syndromes, subfactors, and spectra) allows for a flexible description of a patient depending on the desired degree of specificity. This approach parallels established classification frameworks in the study of human individual differences more broadly, such as taxonomies of personality and cog-

nitive abilities (e.g., Markon et al., 2005). Fourth, no patients are excluded or incompletely described by the system, because everyone can be characterized on a set of dimensions, even those with low levels of pathology.

### Method

Development of a quantitative classification relies substantially on factor analysis, a statistical procedure that groups variables (e.g., symptoms, syndromes) based on the pattern of their interrelations. This family of techniques includes exploratory factor analysis, which searches for the optimal organization of variables, and confirmatory factor analysis, which tests the fit of hypothesized structures to data (Brown, 2015; Fabrigar et al., 1999). Other methods have been used to investigate natural classes or hybrid models that allow for both classes and dimensions. Class-based methods have the appeal of clustering people, rather than variables. However, when structural findings are translated to practical application, these results are operationalized as scales or other composites of variables, regardless of whether they were derived by class-based or factor analytic methods. Recent studies that used class-based methods (e.g., latent class analysis) found classes that represent extreme levels of dimensions identified in factor analytic research (Olino, Klein, Farmer, Seeley, & Lewinsohn, 2012; Vaidyanathan, Patrick, & Iacono, 2011), but older studies produced different sets of clusters (Kessler et al., 2005). Dimensional models have shown better fit to the data than latent classes or hybrid models (Carragher et al., 2014; Eaton et al., 2013; Haslam et al., 2012; Markon & Krueger, 2005; Vrieze, Perlman, Krueger, & Iacono, 2012; Walton et al., 2011; Wright et al., 2013). Individual symptoms also have been found to be dimensions rather than binary absent/present states (Flett, Vredenburg, & Krames, 1997; Strauss, 1969; Van Os et al., 2009).

These findings likely contribute to the wide reliance on factor analysis in quantitative nosology research and the shared assumption that psychopathology can be represented effectively by dimensions. There is no conclusive evidence of categorical entities in mental health to challenge this assumption (Haslam et al., 2012; Markon & Krueger, 2005; Walton et al., 2011; Widiger & Samuel, 2005; Wright et al., 2013), but if such entities were to emerge, they could be incorporated easily into a quantitative nosology. Modern statistical tools, such as factor mixture models (Hallquist & Wright, 2014; Kim & Muthén, 2009), permit modeling of dimensions and categories simultaneously.

### Applicability to Clinical Settings

A common concern with dimensional classifications is whether they are applicable to clinical settings, as clinical care often requires categorical decisions. Indeed, actionable ranges of scores will need to be specified on designated dimensions for such a classification to work effectively in clinical practice. Rather than being posited a priori, these ranges are straightforward to derive empirically, as is commonly done in medicine (e.g., ranges of blood pressure, fasting glucose, viral load, etc.). For example, more intrusive and costly interventions tend to be indicated for greater illness severity, and this can be accommodated by specifying one range for preventive interventions, a somewhat higher one for outpatient care, and the highest for inpatient treatment. In

contrast, traditional taxonomies tend to offer a single cutoff, the diagnostic threshold, regardless of the clinical question. *DSM-5* has made some progress in changing this practice, supplementing formal diagnosis (Section II) with cross-cutting and severity measures (Section III) and allowing severity specifiers (e.g., mild, moderate, and severe) for some disorders.

The diagnosis of intellectual disability may serve as a useful model of how dimensions can be adapted for diagnostics. Intellectual disability is defined by two quantitative dimensions, intelligence and adaptive functioning, that are then categorized for diagnostic purposes into profound, severe, moderate, and mild. Ranges of intelligence scores are specified for each group, and assessors have the flexibility to consider adaptive functioning when assigning the diagnostic descriptor rather than rigidly following predetermined cutoffs. Beyond intellectual and neuropsychological testing, clinicians have made effective use of a variety of dimensional assessment tools, such as the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1942), the Personality Assessment Inventory (PAI; Morey, 1991, 2007), and the Achenbach System of Empirically Based Assessment (ASEBA; Achenbach & Rescorla, 2001), for several decades; thus, a substantial precedent for the clinical utility of dimensional systems already exists.

### Interface with RDoC

The RDoC (Cuthbert & Insel, 2010, 2013) framework represents a related response to the shortcomings of traditional taxonomies. The National Institute of Mental Health created this framework to encourage the development of a dimensional research classification system of psychological processes with established neural bases and potential relevance to psychiatric symptoms. The emerging system spans eight units of analysis (from genes to behavioral tasks), a diverse range of constructs, and cuts across diagnostic categories.

This dimensional approach has the potential to address many problems of the current system. However, the RDoC framework is concerned with basic biological processes (e.g., neural circuits) as much as with pathological behavior, and seeks to link animal and human research, thus largely focusing on constructs that apply across species (Cuthbert & Kozak, 2013). As such, the RDoC system holds particular promise for advancing the understanding of biological processes relevant to psychopathology, but its coverage of clinical phenomena is neither highly detailed nor comprehensive. A substantial need remains to systematically describe dimensions of psychiatric phenotypes. A quantitative nosology goes well beyond the scope of the RDoC in meeting this need and can inform the RDoC framework with regard to key clinical dimensions that need to be considered. Another limitation of the RDoC is that it seeks to restructure psychiatric nosology at a very basic level, so that the translation of advances it produces to diagnostic practice likely lies well in the future. In contrast, the quantitative nosology is driven by clinical constructs and specifically targets shortcomings of existing diagnoses, while also defining clearer phenotypes for basic research.

At the same time, a quantitative nosology is limited by its focus on clinical manifestations. The resulting dimensions are descriptive, and their nature is not immediately clear. Validation studies, perhaps conducted within the RDoC framework, are needed to

elucidate the etiology, pathophysiology, and treatment response of these quantitative dimensions. Moreover, even a comprehensive analysis of signs and symptoms may miss disorders that are etiologically coherent but have multiple clinical manifestations (e.g., manifestations of tertiary syphilis differ dramatically depending on the organs affected). In contrast, the RDoC approach begins with research on biological systems, and may ultimately identify etiologically coherent nosologic entities even if they lack a singular clinical presentation.

Overall, these two efforts approach nosology from different perspectives, but are well positioned to advance toward one another to produce a unified system (Patrick & Hajcak, 2016). For example, a quantitative nosology can inform the RDoC initiative with regard to pivotal phenotypic dimensions that can serve as referents for biological and behavioral constructs. Conversely, the RDoC integrates information from various approaches to characterizing psychopathology (e.g., biological, animal models). Consequently, RDoC can clarify the nature of quantitative dimensions and suggest new constructs that should be operationalized phenotypically, thereby shaping a quantitative nosology. Joint analyses of quantitative and RDoC constructs are likely to reveal some points of convergence, dimensions that are clearly measurable with biological markers, behavioral tasks, and self-report (see Patrick, Venables, et al., 2013; Yancey, Venables, & Patrick, 2016). These analyses also would reveal dimensions that are not prominent in some units of analysis, such as a trait with highly complex neural architecture or a physiological process that has only weak connections with phenomenology. Such information is essential for both refinement of RDoC constructs and validation of quantitative dimensions.

### The Emerging Classification

Research on a quantitative nosology has produced considerable structural evidence on constructs at each level of the hierarchy and examined the validity of many of the identified dimensions, including common risk factors, biomarkers, illness course, and treatment response. In this section, we propose the HiTOP model based on a review of structural evidence and validity data on spectra (and superspectra), subfactors, syndromes, and traits/homogeneous components. We consider evidence from clinical disorders and personality disorders (PDs) separately, because many articles focused on one of these two domains, but also jointly when relevant studies exist.

### Spectra

**Introduction of the spectra.** Factor analytic research has consistently identified two fundamental dimensions of common mental disorders, internalizing and externalizing. The internalizing dimension accounts for the comorbidity among depressive, anxiety, posttraumatic stress, and eating disorders, as well as sexual dysfunctions and obsessive-compulsive disorder (OCD). The traditional externalizing dimension captures comorbidity among substance use disorders, oppositional defiant disorder (ODD), conduct disorder, adult antisocial behavior, intermittent explosive disorder (IED), and attention-deficit-hyperactivity disorder (ADHD). These dimensions (spectra) were first identified in child psychopathology (Achenbach, 1966; Achenbach et al., 1991; Achenbach & Re-

scorla, 2001; Blanco et al., 2015; Lahey et al., 2004; 2008) and have since been replicated in adult samples (Achenbach & Rescorla, 2003; Carragher et al., 2014; Forbush & Watson, 2013; Krueger & Markon, 2006; Røysamb et al., 2011; Slade & Watson, 2006). They also have been observed in various cultures (Kessler et al., 2011; Krueger, Chentsova-Dutton, Markon, Goldberg, & Ormel, 2003).

More recently, a thought disorder spectrum was identified, which encompasses psychotic disorders, cluster A PDs, and bipolar I disorder (Keyes et al., 2013; Kotov, Chang, et al., 2011; Kotov, Ruggero, et al., 2011; Markon, 2010a; Wright et al., 2013). This dimension has been well replicated in adults. A similar dimension of thought problems has been documented extensively in youth, and studies have found that it is not subsumed by either the internalizing or externalizing spectra (Achenbach & Rescorla, 2001). The internalizing, externalizing, and thought disorder dimensions have emerged in both community and patient samples (Kotov, Chang, et al., 2011; Kotov, Ruggero, et al., 2011; Miller, Fogler, Wolf, Kaloupek, & Keane, 2008). Extensive data are now available on these spectra with studies including as many as 25 disorders (Røysamb et al., 2011) and 43,093 participants (Eaton et al., 2013). Finally, initial evidence suggests existence of an additional somatoform spectrum (Kotov, Ruggero, et al., 2011). The resulting four dimensions are listed in Figure 1.

An important limitation of this work in adults is that nearly all of the aforementioned studies analyzed dichotomous diagnoses. One issue with such analyses is that many diagnoses are defined by symptoms that are only loosely interrelated and sometimes reflect different psychopathology dimensions. Consequently, some diagnoses are prone to cross-loading in factor analyses, complicating the resulting structure. Another limitation is that to analyze dichotomous markers, many studies assume that a continuous, normally distributed variable underlies each disorder. Internally consistent dimensional markers of psychopathology would address the aforementioned limitations. Initially, such markers were derived from

rating forms, and analyses of these data replicated the internalizing, externalizing, and thought disorder spectra (Achenbach & Rescorla, 2001, 2003; Kramer, Krueger, & Hicks, 2008; Sellbom, Ben-Porath, & Bagby, 2008). Furthermore, two studies replicated the somatoform spectrum (McNulty & Overstreet, 2014; Sellbom, in press). More recently, development of novel measures allowed for dimensional scoring of homogeneous symptom dimensions from interviews (Markon, 2010a; Kotov et al., 2015; Lahey et al., 2004; Wright et al., 2013). Factor analyses of these instruments confirmed the existence of the internalizing, externalizing, and thought disorder spectra.

**The structure of personality pathology.** In parallel, other studies investigated the structure of personality pathology. Five domains emerged from this research: negative affectivity, detachment (i.e., social withdrawal), disinhibition, antagonism, and psychoticism (the personality counterpart of thought disorder). The first body of evidence comes from factor analyses of PD diagnoses. O'Connor (2005) reanalyzed 33 such studies and found four dimensions, which he coordinated with the prominent five-factor model (FFM) of personality. The first dimension was defined by dependent, avoidant, and borderline PDs, which suggested negative affectivity as a common theme. The second was composed of antisocial, narcissistic, histrionic, borderline and paranoid PDs, and likely reflected antagonism. The third included schizoid, schizotypal, and avoidant PDs, as well as a negative loading from histrionic PD, which indicated detachment. The fourth was defined solely by obsessive-compulsive PD.

Other research examined the structure of maladaptive personality traits using dimensional markers, such as the scales of the Schedule for Nonadaptive and Adaptive Personality-2nd Edition (SNAP-2; Clark, Simms, Wu, & Casillas, 2014) and the Dimensional Assessment of Personality Pathology—Basic Questionnaire (DAPP-BQ; Livesley & Jackson, 2009). These inventories reflect somewhat different structures, but they have four fundamental dimensions in common: negative affectivity, detachment, antagonism, and disinhibition versus compulsivity (Clark, Livesley, Schroeder, & Irish, 1996). Another model, the Personality Psychopathology—Five (PSY-5; Harkness & McNulty, 1994), includes the same four dimensions plus psychoticism. The most recent efforts to map personality pathology are the Personality Inventory for DSM-5 (PID-5; Krueger et al., 2012) and the Computerized Adaptive Test of Personality Disorder (CAT-PD; Simms et al., 2011). They were developed independently from each other to assess personality pathology comprehensively and explicate its organization using factor analysis. These projects revealed very similar five-dimensional structures that are highly congruent with the PSY-5, consisting of negative affectivity, detachment, disinhibition, antagonism, and psychoticism (Krueger & Markon, 2014; Wright & Simms, 2014). These dimensions are listed in Figure 1.

Further studies conceptualized pathological personality traits as maladaptive variants of the FFM (Widiger & Trull, 2007). These variants are elaborated in the Five-Factor Model Personality Disorder (FFM-PD; Widiger, Lynam, Miller, & Oltmanns, 2012) scales and the Five Factor Form (FFF; Rojas & Widiger, 2014). For example, the FFF assesses maladaptive variants of 30 traits included within the FFM. Factor analyses of the FFF produced a five-dimensional structure that reflects neuroticism, extraversion, openness, agreeableness, and conscientiousness. With regard to the five domains, negative affectivity was found to map onto neuro-

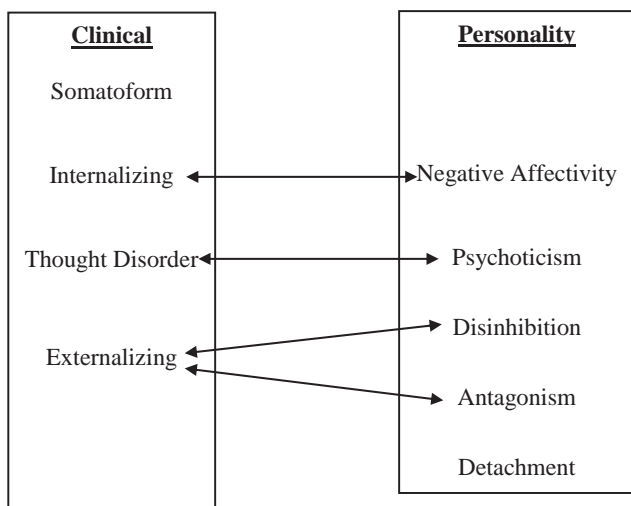


Figure 1. Cross-walk between major dimensions of clinical and personality disorders. Note: The diagram is derived from studies discussed in the “Spectra” section. Arrows indicate paired dimensions that cut across clinical and personality domains.



icism, detachment on (low) extraversion, disinhibition on (low) conscientiousness, and antagonism on (low) agreeableness, and may be conceptualized as maladaptive versions of these four traits (Krueger & Markon, 2014). Psychoticism is the only domain not clearly represented in the FFM. Nevertheless, the five domains (negative affectivity, detachment, disinhibition, antagonism, and psychoticism) have emerged clearly across different operationalizations of personality pathology.

**Joint structure.** In previous sections, we discussed studies that focused either on symptoms or on maladaptive traits. Several studies analyzed symptoms and traits together and showed that the internalizing spectrum is connected with negative affectivity, thought disorder with psychoticism, and externalizing with both disinhibition and antagonism. In contrast, somatoform appears to lack a clear personality pathology counterpart, and detachment may be lacking a clear symptom counterpart (see Figure 1).

Specifically, three studies evaluated the joint structure of *DSM* clinical and personality disorders most comprehensively. Røysamb et al. (2011) examined 25 disorders in 2,974 twins from Norway. They observed factors that clearly reflect the internalizing (anxiety and depressive disorders and borderline PD), traditional externalizing (substance use disorders, antisocial PD, and conduct disorder), antagonism (narcissistic, histrionic, borderline, and paranoid PD but also obsessive–compulsive and schizotypal PD), and pathological introversion/detachment (avoidant, dependent, schizoid, and depressive PD and dysthymia) spectra. More importantly, this investigation did not include psychotic disorders or mania, which likely precluded modeling of the thought disorder dimension.

In contrast, Kotov, Ruggero, et al. (2011) included both psychosis and mania. They analyzed 25 disorders in 2,900 outpatients and reported recognizable dimensions of internalizing (anxiety and depressive disorders along with dependent, obsessive–compulsive, borderline, and paranoid PD), traditional externalizing (substance use disorders, antisocial behavior, and conduct problems), thought disorder (psychotic disorders, bipolar I disorder, schizotypal, paranoid, and schizoid PD), and antagonism (histrionic, narcissistic, borderline, and paranoid PD as well as antisocial behavior and conduct problems) spectra; they also reported a somatoform factor (undifferentiated somatoform disorder, hypochondriasis, and pain disorder). However, Kotov, Ruggero, et al. (2011) were unable to delineate a detachment factor because their analyses excluded avoidant PD due to its high correlation with social phobia. They also attempted to model Axis II negative affectivity separately from Axis I internalizing, but found the two factors to correlate .96.

Finally, Wright and Simms (2015) conducted joint structural analyses of common mental disorders, personality disorders, and maladaptive personality traits in a sample of 628 current and recent outpatients; importantly, all disorders were scored dimensionally (i.e., as symptom counts). They found evidence of five dimensions: internalizing (anxiety and depressive disorders, along with borderline, avoidant, dependent, and paranoid PDs), disinhibition (substance use disorders, antisocial PD), antagonism (narcissistic and histrionic PDs), detachment (defined by schizoid, avoidant, and dependent PD at the high end and by histrionic PD at the low end), and thought disorder (psychotic symptoms and schizotypal PD).

Several other studies operationalized psychopathology using homogeneous symptom and trait dimensions rather than *DSM*

disorders. Two analyses of self-ratings found six dimensions that clearly reflected the aforementioned spectra: negative affectivity (internalizing), psychoticism (thought disorder), disconstraint (externalizing), aggressiveness (antagonism), introversion (detachment), and somatization (somatoform; McNulty & Overstreet, 2014; Sellbom, 2016). The most comprehensive investigation of interview-based data reported four spectra: internalizing, thought disorder, traditional externalizing, and pathological introversion/detachment, which was defined by unassertiveness, dependence, and social anxiety (Markon, 2010a). This study did not recover antagonism and somatoform dimensions likely because few relevant markers were included (e.g., only one variable for the latter).

**The six spectra in the HiTOP model.** Altogether, six spectra were included in the HiTOP model: internalizing (or negative affectivity), thought disorder (or psychoticism), disinhibited externalizing, antagonistic externalizing, detachment, and somatoform (see Figure 2). Given direct correspondence between internalizing and negative affectivity as well as between thought disorder and psychoticism, each of these pairs is represented by one dimension. Externalizing behavior has two personality counterparts: disinhibition and antagonism. Disinhibition is particularly prominent in substance-related disorders. Antagonism is especially significant in narcissistic, histrionic, paranoid, and borderline PDs. Both disinhibition and antagonism contribute to antisocial behavior, aggression, ODD, ADHD, and IED (Gomez & Corr, 2014; Herzhoff & Tackett, 2016; Jones, Miller, & Lynam, 2011; Kotov, Chang, et al., 2011; Wright & Simms, 2015). More importantly, all of these conditions comprise a broader superspectrum, and recent research has elevated the “externalizing” label to denote this general dimension (Krueger & Markon, 2014). Consequently, the two spectra may be best named disinhibited externalizing (what traditionally was called externalizing) and antagonistic externalizing (traditional antagonism).

As noted earlier, detachment appears to be limited to personality pathology. Detachment is well documented in personality pathology, but it is less clear whether it fully accounts for the pathological introversion factor reported by Markon (2010a) and Røysamb et al. (2011); thus, social phobia and dysthymic disorder were retained within the internalizing spectrum rather than assigned to detachment. Finally, somatoform is a novel dimension that emerged clearly only in three studies (Kotov, Chang, et al., 2011; McNulty & Overstreet, 2014; Sellbom, in press), whereas three other studies placed somatoform conditions on the internalizing spectrum. However, of the latter studies, one had too few markers to model the somatoform factor (Markon, 2010a), another was not designed to test whether somatoform factor was a subfactor of internalizing or a separate spectrum (Simms, Prisciandaro, Krueger, & Goldberg, 2012), and the third produced mixed results (Krueger et al., 2003). Thus, the somatoform spectrum has been included in the HiTOP model on a provisional basis.

Of note, the disorder/syndrome level of Figure 2 is described in terms of *DSM–5* diagnoses. This is done simply for convenience of communication. The objective of the HiTOP consortium is to construct the nosology from empirically derived building blocks such as homogeneous components, maladaptive traits, and dimensional syndromes, not by merely rearranging *DSM–5* disorders. Fortunately, studies of empirical homogeneous dimensions have supported these spectra (Achenbach & Rescorla, 2001, 2003; Lahey et al., 2004; Kotov et al., 2015; Kramer et al., 2008;

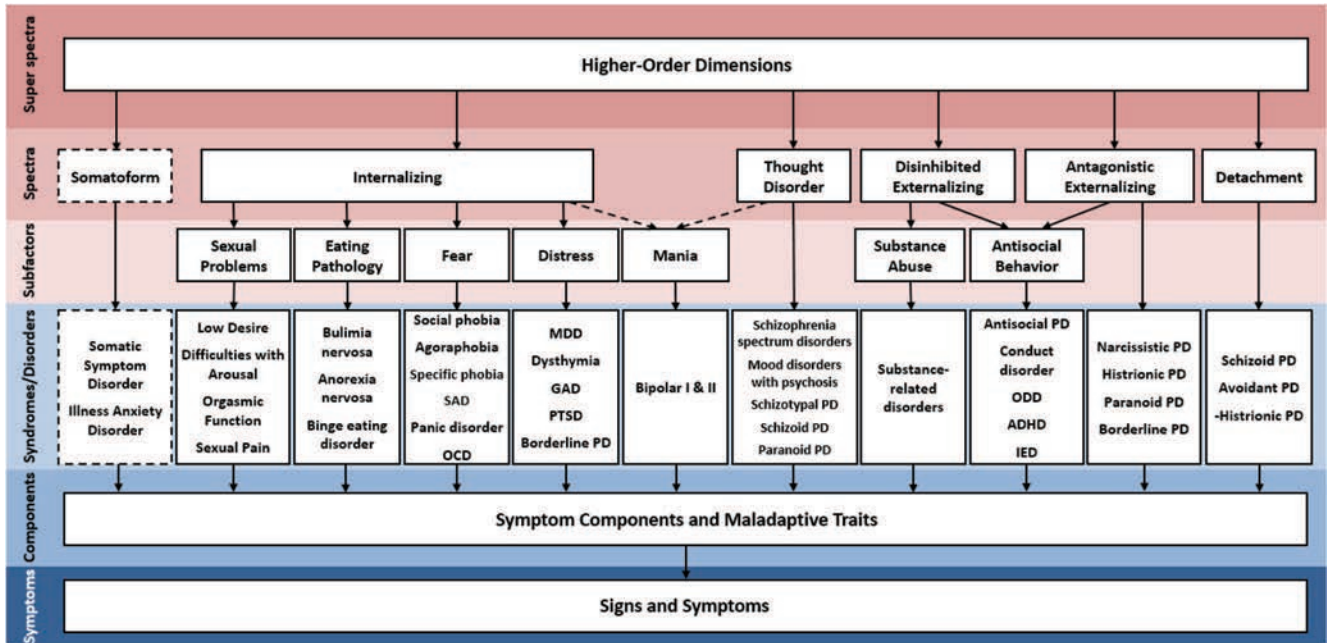


Figure 2. Spectra of the Hierarchical Taxonomy of Psychopathology. Note: Dashed lines indicate elements of the model that were included on provisional basis and require more study. Disorders with most prominent cross-loadings are listed in multiple places. Minus sign indicates negative association between histrionic personality and detachment spectrum. See the online article for the color version of this figure.

Markon, 2010a; McNulty & Overstreet, 2014; Sellbom, in press; Sellbom, Ben-Porath, & Bagby, 2008).

**Validation of Spectra**

Although structural evidence can help to identify new diagnostic entities, such constructs require further validation against criteria important for clinical practice and research. The APA Diagnostic Spectra Study Group reviewed evidence for five potential psychopathology spectra with regard to 11 validators that may be shared by, or at least be similar across, disorders within a spectrum: genetic risk factors, familial risk factors, environmental risk factors, neural substrates, biomarkers, temperamental antecedents, cognitive or emotional processing abnormalities, illness course, treatment response, symptoms, and high comorbidity within the spectrum (Andrews et al., 2009). This metastructure project examined internalizing/emotional (consisting of *DSM-IV* anxiety, depressive and somatoform disorders, and neurasthenia), disinhibited externalizing (conduct, antisocial personality, and substance-related disorders), thought disorder/psychotic (schizophrenia spectrum disorders, schizotypal PD, and bipolar I disorder), neurocognitive (delirium, dementias, amnesic and other cognitive disorders), and neurodevelopmental (learning, motor skills and communication disorders, pervasive developmental disorders, and mental retardation) spectra. Overall, data for validators included in the reviews generally supported the coherence of these five spectra (Andrews, Pine, Hobbs, Anderson, & Sunderland, 2009; Carpenter et al., 2009; Goldberg, Krueger, Andrews, & Hobbs, 2009; Krueger & South, 2009; Sachdev, Andrews, Hobbs, Sunderland, & Anderson, 2009), and more recent reviews have continued to support these conclusions (Beauchaine & McNulty, 2013; Eaton,

Rodriguez-Seijas, Carragher, & Krueger, 2015; Nelson, Seal, Pantelis, & Phillips, 2013).

However, this evidence has some caveats. In particular, bipolar disorder showed clear differences as well as similarities with both schizophrenia and emotional disorders (Goldberg, Andrews, & Hobbs, 2009). Also, validation data were relatively sparse for somatoform disorders and neurasthenia, and thus it was difficult to validate their distinctness from—or similarity to—the internalizing spectrum. Conversely, neurocognitive and neurodevelopmental clusters have not been examined in structural studies, but validity evidence was considered sufficient for inclusion of these entities as classes in the *DSM-5*. Overall, the HiTOP model covers the majority of psychopathology, even though it is not yet comprehensive.

**Hierarchy Above Spectra**

The HiTOP spectra are positively correlated (Achenbach & Rescorla, 2003; Kotov, Chang, et al., 2011; Krueger & Markon, 2006; Markon, 2010a; Røysamb et al., 2011), and these associations are consistent with the existence of a general psychopathology factor or *p* factor (Caspi et al., 2014; Lahey et al., 2011, 2012). This possibility has been supported by studies that evaluated a bifactor model, which is composed of a general dimension defined by all forms of psychopathology and specific dimensions defined by smaller groups of disorders (Caspi et al., 2014; Laceulle, Vollebergh, & Ormel, 2015; Lahey et al., 2011, 2012, 2015; Olin et al., 2014).

Another approach recognizes that a range of factors can be delineated to represent different levels of the hierarchy, and most, if not all, levels are meaningful (Goldberg, 2006; Markon et al.,

2005). All levels can be mapped jointly using Goldberg's (2006) method, which consists of a series of factor analyses with progressively greater numbers of dimensions, thus describing each level of the hierarchy. This approach has been applied to PDs (Morey, Krueger, & Skodol, 2013; Wright et al., 2012; Wright & Simms, 2014) and clinical disorders (Farmer et al., 2013; Kim & Eaton, 2015). It supported the presence of a  $p$  factor but also suggested that multiple meaningful structures of different generality exist between the six spectra and a  $p$  factor.

These higher levels of the structure are particularly useful for describing the most salient general features of patients and for studying common pathological processes. The six spectra provide a more detailed and specific picture of psychopathology and the following discussion focuses on them. More important, the hierarchy can be refined further by extension downward to smaller groups of disorders and ultimately groups of symptoms (see Figure 2). We discuss this extension next.

### Subfactors

More focused factor analyses have identified narrower dimensions within the spectra. Two subfactors have been found frequently within the internalizing spectrum: a distress cluster (consisting of MDD, dysthymic disorder, generalized anxiety disorder [GAD], and posttraumatic stress disorder [PTSD]) and a fear cluster (panic disorder, phobic disorders, OCD, and separation anxiety disorder [SAD]; Beesdo-baum et al., 2009; Eaton et al., 2013; Keyes et al., 2013; Krueger & Markon, 2006; Lahey et al., 2008; Miller et al., 2008, 2012; Vollebergh et al., 2001). There is accumulating support for a third subfactor, eating pathology, defined by bulimia nervosa, anorexia nervosa, and binge-eating disorder (Forbush et al., 2010; Forbush & Watson, 2013). Evidence also has emerged for a fourth subfactor, sexual problems, defined by symptoms of sexual dysfunctions, such as difficulties with sexual desire, arousal, orgasm, and pain (Forbes, Baillie, & Schniering, 2016a, 2016b; Figure 2). One caveat to this organization is that panic disorder appears to have features of both fear and distress, and has been found to load on both subfactors (Greene & Eaton, 2016; Kim & Eaton, 2015; Kotov et al., 2015; Nelson et al., 2015; Watson et al., 2012; Wright et al., 2013). Also, OCD is a relatively weak member of the fear cluster and shows some overlap with the thought disorder dimension (Caspi et al., 2014; Chmielewski & Watson, 2008; Kotov et al., 2015; Watson, Wu, & Cutshall, 2004). Finally, the fear and distress dimensions tend to be highly correlated and some studies were unable to model them separately (Kessler et al., 2011; Kotov et al., 2011; Markon, 2010; Røysamb et al., 2011; Wright & Simms, 2015).

The disinhibited and antagonistic externalizing spectra encompass at least two subfactors: an antisocial behavior dimension defined by ODD, ADHD, and sometimes conduct disorder, and a substance abuse dimension defined by alcohol and drug use problems (Blanco et al., 2015; Castellanos-Ryan et al., 2014; Farmer, Seeley, Kosty, & Lewinsohn, 2009; Verona, Javdani, & Sprague, 2011; Figure 2). Similar factors also have been observed in analyses of dimensional markers of the disinhibited externalizing spectrum: one resembles antisocial behavior (defined by aggression, lack of empathy, excitement seeking, rebelliousness, dishonesty, etc.) and the other resembles substance abuse (problematic substance use, theft, irresponsibility, and impulsivity; Krueger,

Markon, Patrick, Benning, & Kramer, 2007; Patrick, Kramer, et al., 2013). The antisocial dimension blends elements of disinhibition and antagonism, and thus has been linked to both spectra. The substance abuse dimension is more purely disinhibited. It currently is unclear whether the unique content of antagonism (narcissistic, histrionic, paranoid, and borderline personality pathology) defines a coherent subfactor or only indicates, along with antisocial behavior, the broader antagonistic externalizing spectrum.

The other spectra have received less attention, and it is unknown whether they also include subdimensions. It is likely that additional subfactors will be identified with time, explicating the intermediate level of the structure between individual disorders and spectra.

There is accumulating evidence that mania, and bipolar disorders generally, are related to the internalizing spectrum (Blanco et al., 2015; Forbush & Watson, 2013; Keyes et al., 2013; Kotov et al., 2015; Watson, 2005; Watson et al., 2012). However, mania also has been linked with the thought disorder spectrum (Caspi et al., 2014; Keyes et al., 2013; Kotov, Ruggero, et al., 2011). At present, it is unclear whether the mania subfactor belongs to the internalizing or thought disorder spectrum or blends features of both (see Figure 2).

More important, such interstitial constructs (i.e., dimensions associated with multiple spectra) are allowed, indeed expected, within the HiTOP model. Even when operationalized by empirically derived homogeneous measures, some dimensions show prominent cross-loadings in factor analyses (e.g., Kotov et al., 2015; Markon, 2010a; Wright & Simms, 2014).

### Symptom Structure

Lower levels of the hierarchy, namely, dimensional syndromes and the components within them, are much less studied in adult populations than the spectra. The primary reason for this is that complete symptom-level data are rarely available. The vast majority of studies of adults analyzed diagnostic interviews, which typically have used skip logic. Skip logic enables the efficient assessment of dichotomous diagnoses but results in incomplete symptom data for respondents who do not endorse the stem question. Several studies have sought to address this limitation by analyzing symptom ratings not affected by skip-outs (Markon, 2010a; Simms et al., 2012; Wright et al., 2013). However, pools of analyzable symptoms were limited as these measures were not designed for structural research. Hence, nosologists have begun developing new instruments that provide comprehensive symptom coverage of various psychopathology domains and do not use skip logic. Structural analyses of the resulting measures have elucidated symptom components and maladaptive traits within a variety of disorders (see Figure 3). This is described in the following section. Because we have greater confidence in the placement of components/traits on spectra than syndromes, Figure 3 is organized around spectra.

### Measurement of HiTOP Dimensions

Although an omnibus measure of the HiTOP model has not yet been created, a number of existing instruments can assess component/trait, syndrome, subfactor, and spectrum levels of the model. Examples of such measures are described in this section and

<p><b>INTERNALIZING Distress components</b>                  Dysphoria                  Lassitude                  Anhedonia                  Insomnia                  Suicidality                  Agitation                  Retardation                  Appetite loss                  Appetite gain                  (low) Well-being                  GAD Symptoms                  Re-experiencing                  Avoidance                  Hyperarousal                  Numbing                  Dissociation                  Irritability                  Pure obsessions</p> <p><b>Fear components</b>                  Interactive anxiety                  Performance anxiety                  Public places                  Enclosed spaces                  Animal phobia                  Situational phobia                  Blood-injection-injury                  Physiological panic                  Psychological panic                  Cleaning                  Rituals                  Checking</p> <p><b>Traits</b>                  Anxiousness                  Emotional lability                  Hostility                  Perseveration                  (low) Restricted affectivity                  Separation insecurity                  Submissiveness                  Identity problems                  Negative relationships                  Fragility                  Ineptitude                  (low) Invulnerability</p>	<p><b>THOUGHT DISORDER Components</b>                  Psychotic                  Disorganized                  Inexpressivity                  Avolition</p> <p><b>Traits</b>                  Eccentricity                  Cognitive/perceptual dysregulation                  Unusual beliefs and experiences                  Fantasy proneness</p> <p><b>Mania components</b>                  Euphoric activation                  Hyperactive cognition                  Reckless overconfidence</p>	<p><b>DISINHIBITED EXTERNALIZING Components</b>                  Alcohol use                  Alcohol problems                  Marijuana use                  Marijuana problems                  Drug use                  Drug problems</p> <p><b>Traits</b>                  Problematic impulsivity                  Irresponsibility                  Theft                  Distractibility                  Risk taking                  (low) Rigid perfectionism                  (low) Ruminative deliberation                  (low) Workaholism</p>	<p><b>ANTAGONISTIC EXTERNALIZING Traits</b>                  Attention seeking                  Callousness                  Deceitfulness                  Grandiosity                  Manipulativeness                  Rudeness                  Egocentricity                  Dominance                  Flirtatiousness                  (low) Timorousness</p>	<p><b>DETACHMENT Traits</b>                  Anhedonia                  Depressivity                  Intimacy avoidance                  Suspiciousness                  Withdrawal                  Interpersonal passivity                  Disaffiliativeness                  (low)Attention seeking</p> <p><b>SOMATOFORM Components</b>                  Conversion                  Somatization                  Malaise                  Head Pain                  Gastrointestinal                  Cognitive</p>
		<p><b>Antisocial behavior Components</b>                  Physical aggression                  Destructive aggression                  Relational aggression                  Fraud</p> <p><b>Traits</b>                  Impatient urgency                  (low) Planful control                  (low) Dependability                  Alienation                  Boredom proneness                  Blame externalization                  (low) Honesty                  Rebelliousness                  (low) Empathy                  Excitement seeking</p>		

Figure 3. Proposed symptom components and maladaptive traits organized by spectrum. Note: Selection of these dimensions is described in the “Measurement of HiTOP Dimensions” section. Mania components are listed in a separate box because they cross-load between internalizing and thought disorder spectra; likewise antisocial behavior dimensions are listed separately because they cross-load between disinhibited externalizing and antagonistic externalizing spectra.

summarized in Table 1 (further details are given in supplementary material Table 1). We selected instruments that provide maximal coverage of the model. We required them to cover either (a) at least two levels of the hierarchy in multiple spectra or (b) at least three levels of the hierarchy in a single spectrum. The only exception was the thought disorder spectrum, for which two companion measures were needed to describe three levels of the hierarchy.

The Achenbach System of Empirically Based Assessment (ASEBA; Achenbach & Rescorla, 2001) was initially constructed to assess a wide range of symptoms in youth using self-, parent-, and teacher-ratings. Factor analyses consistently identified eight dimensional syndromes, along with the internalizing and disinhibited externalizing spectra. ASEBA also includes a total problems index that mirrors the *p* factor. Subsequently, self- and informant-

report versions of the instrument were developed both for adults (Achenbach & Rescorla, 2003) and the elderly (Achenbach, Ne-warehouse, & Rescorla, 2004). Similarly, the Child and Adolescent Psychopathology Scale (CAPS; Lahey et al., 2004) is an interview—conducted with the youth or caretaker—that assesses without skip-outs *DSM-IV* and *ICD-10* symptoms common in children. Factor analyses of the CAPS found the internalizing and disinhibited externalizing spectra as well as nine syndromes. Five of these syndromes mapped clearly onto conduct disorder, ODD, social anxiety disorder, OCD, and SAD; specific phobia and agoraphobia together formed a sixth dimension, MDD and GAD together formed a seventh, and inattention and hyperactivity-impulsivity emerged as separate syndromes (Lahey et al., 2004, 2008).

The Externalizing Spectrum Inventory (ESI; Krueger et al., 2007) is a self-report measure designed for adults. The ESI as-

Table 1

*Examples of Broad-Based Dimensional Measures of the Hierarchical Taxonomy of Psychopathology*

Instrument	Reference	Format	Coverage
Achenbach System of Empirically Based Assessment (ASEBA) for youth	Achenbach and Rescorla (2001)	Parent-report, teacher-report, self-report	Internalizing and disinhibited externalizing spectra, 8 syndromes
Achenbach System of Empirically Based Assessment (ASEBA) for adults and elderly	Achenbach and Rescorla (2003) Achenbach, Newhouse, and Rescorla (2004)	Informant-report, self-report	Internalizing and disinhibited externalizing spectra, 8 syndromes
Child and Adolescent Psychopathology Scale (CAPS)	Lahey et al. (2008)	Interview	Internalizing and disinhibited Externalizing spectra, 6 syndromes
Externalizing Spectrum Inventory (ESI)	Krueger et al. (2007)	Self-report	Disinhibited externalizing spectrum, 2 subfactors, 23 traits/components
Inventory for Depression and Anxiety Symptoms (IDAS)	Watson et al. (2012)	Self-report	Internalizing spectrum, 3 subfactors, 18 components
Interview for Mood and Anxiety Symptoms (IMAS)	Kotov et al. (2015)	Interview	Internalizing spectrum, 3 subfactors, 10 syndromes, 32 components
Scale for the Assessment of Negative Symptoms (SANS) and Scale for the Assessment of Positive Symptoms (SAPS)	Andreasen (1983, 1984)	Interview	Thought disorder spectrum, 2 syndromes, 4 components
Schedule for Nonadaptive and Adaptive Personality, 2nd edition (SNAP-2)	Clark et al. (2014)	Self- and informant report	4 domains, 15 traits
Personality Inventory for <i>DSM-5</i> (PID-5)	Krueger et al. (2012)	Self and informant-report	5 domains, 25 traits
Five Factor Form (FFF)	Rojas and Widiger (2014)	Self- and therapist report	5 domains, 30 traits
Five-Factor Model Personality Disorder (FFM-PD) Scales	Widiger, Lynam, Miller, and Oltmanns (2012)	Self-report	5 domains, 99 traits
Computerized Adaptive Test of Personality Disorder (CAT-PD)	Simms et al. (2011)	Self-report	5 domains, 33 traits
Dimensional assessment of personality pathology–Basic Questionnaire (BQ)	Livesley and Jackson (2009)	Self-report	4 domains, 18 traits
Personality Assessment Inventory (PAI)	Morey (2007)	Self-report	5 spectra, 15 syndromes, 30 components/traits
Minnesota Multiphasic Personality Inventory-2 Restructured Form (MMPI-2-RF)/Personality Psychopathology–Five (PSY-5)	Ben-Porath and Tellegen (2008); Harkness et al. (2014)	Self-report	3 higher-order dimensions, 5 personality domains, 9 syndromes, 23 components/traits

*Note.* Measures were included if they either assessed (a) at least two levels of the hierarchy in multiple spectra or (b) at least three levels of the hierarchy in a single spectrum. The SANS and SAPS are companion measures, and both are needed to describe three levels of the hierarchy.

sesses the disinhibited externalizing spectrum including substance abuse and antisocial behavior subfactors. Structural analyses (Krueger et al., 2007; Patrick, Kramer, et al., 2013) revealed 23 specific dimensions (symptom components and traits). Although the ESI does not explicitly measure syndromes, it includes two scales each for alcohol, marijuana, and other drug use/abuse, allowing modeling of these three syndromes. The ESI also includes multiple scales relevant to externalizing disorders as conceptualized in the *DSM* (e.g., Antisocial PD). Sunderland et al. (2016) recently developed a computerized adaptive version of the ESI.

The Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007, 2012) is a self-report instrument designed to assess symptom components within internalizing. This measure was designed for adults but also has shown satisfactory psychometric properties in adolescents. Structural analyses of the IDAS item pool found six symptom dimensions within MDD, three within OCD, two within both PTSD and mania, and single factors related to social phobia, panic disorder, and claustrophobia (Watson et al., 2007,

2012). The Interview for Mood and Anxiety Symptoms (IMAS; Kotov et al., 2015) targets the same domain as the IDAS using an interview format. Structural analyses of the IMAS identified syndromes that mirror GAD, PTSD, panic disorder, social phobia, agoraphobia, specific phobia, OCD, major depressive episode, and manic episode (Kotov et al., 2015). Moreover, multiple dimensions were found within nearly all syndromes, amounting to 31 homogeneous components in total (Waszczuk, Kotov, Ruggero, Gamez, & Watson, in press). Parallel IMAS and IDAS scales show strong convergence (Ruggero et al., 2014; Watson et al., 2007, 2012). At the higher-order level, both instruments can operationalize distress, fear, and mania subfactors.

No comprehensive dimensional measure exists for the full thought disorder spectrum, but there is a long history of such measures for psychosis. Most notably, the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen, 1984) and the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1983) jointly provide a detailed and thorough evaluation of schizophrenia symptoms. Factor analyses of these measures have identified three

symptom dimensions: reality distortion, disorganization, and negative (Andreasen et al., 1995; Blanchard & Cohen, 2006; Grube et al., 1998). New research indicates that it is informative to subdivide negative symptoms into inexpressivity and avolition-apathy (Kotov et al., 2016; Kring, Gur, Blanchard, Horan, & Reise, 2013; Strauss et al., 2012, 2013), resulting in four homogenous components overall. Novel measures, such as the Clinical Assessment Interview for Negative Symptoms (CAINS; Kring et al., 2013) and the Brief Negative Symptom Scale (BNSS; Kirkpatrick et al., 2011), have been developed to provide reliable assessment of the two dimensions of negative symptoms, but are more narrow in scope than the SANS. Other studies have subdivided schizophrenia symptoms even further (Peralta, Moreno-Izco, Calvo-Barrena, & Cuesta, 2013), but the four-dimensional structure currently is best established. Together, the SAPS and SANS can be used to model these four components, two syndromes (positive and negative), and the overarching thought disorder spectrum. Other models have gone beyond symptoms, including such characteristics as interpersonal functioning, insight, and cognitive performance (Keefe & Fenton, 2007; Strauss, Carpenter, & Bartko, 1974), which led to a dimensional rating system for psychosis included in Section III of *DSM-5* (Barch et al., 2013). Not all of these characteristics have been considered in studies of the thought disorder spectrum, but psychotic symptoms, negative symptoms, and social withdrawal as well as their personality counterparts have all been found to fall within this spectrum (Keyes et al., 2013; Kotov, Chang, et al., 2011; Kotov, Ruggero, et al., 2011; Markon, 2010a; Wright et al., 2013).

Several dimensional instruments have been developed to assess personality pathology. Seminal measures include the PSY-5 scales of the MMPI-2/MMPI-2-RF (Harkness et al., 2014; Harkness & McNulty, 1994; tapping the five higher-order dimensions), the SNAP-2 (Calabrese, Rudick, Simms, & Clark, 2012; Clark et al., 2014; four higher-order and 15 lower-order traits), and the DAPP-BQ (Livesley & Jackson, 2009; four higher-order and 18 lower-order traits). The PID-5 (Krueger et al., 2012) was designed to cover traits included in these models and in other models of personality pathology. Factor analyses of the PID-5s 25 lower-order traits identified 5 higher-order dimensions, which became the trait structure for the alternative PD model included in Section III of the *DSM-5*. The CAT-PD (Simms et al., 2011) was developed independently of the PID-5 with the same goal. It models virtually all PID-5 dimensions and includes nine additional lower-order traits. Consistency between the PID-5 and CAT-PD is remarkable (Crego & Widiger, 2016; Wright & Simms, 2014), which highlights the feasibility of creating a consensus regarding lower-order psychopathology dimensions. Furthermore, the FFF (Rojas & Widiger, 2014) is a brief measure that assesses maladaptive variants of the traits included in the five-factor model of personality; namely five higher-order domains and 30 specific facets. The FFM-PD (Widiger et al., 2012) provides assessment of the same five domains but coordinates assessment of maladaptive facets with the *DSM-IV-TR* personality disorders, resulting in 99 scales. Overall, these measures can be used both to assess personality features of the five established spectra and to model specific maladaptive traits.

A truly omnibus measure would include both traits and symptom components. The Personality Assessment Inventory (PAI; Morey, 1991, 2007) was developed with this goal in mind for a set

of clinical problems. Overall, the PAI measures 15 broader syndromes and 30 more specific components/traits: Eight clinical syndromes (somatic complaints, anxiety, anxiety-related disorders, depression, mania, paranoia, schizophrenia, and aggression) containing three components each, three clinical syndromes without specified components (suicidality, alcohol problems, and drug problems), two personality syndromes (borderline features and antisocial features) containing three subtraits each, and two personality syndromes without subtraits (dominance/submission and warmth/coldness modeled after the interpersonal circumplex; Leary, 1996). Structural analyses revealed that the PAI captures the five spectra assessed by the PID-5 (Hopwood et al., 2013). Moreover, the somatic complaints scale may be an acceptable measure of the somatoform spectrum, thus potentially providing full coverage of the HiTOP; however, this possibility has not been formally tested.

The MMPI-2 Restructured Form (MMPI-2-RF; Ben-Porath & Tellegen, 2008) also encompasses both traits and symptoms. Structural analyses of the MMPI-2 item pool (Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989) produced scales tapping three higher-order dimensions (emotional, behavioral, and thought dysfunction), the aforementioned five personality pathology dimensions (PSY-5), nine syndromes (demoralization, somatic complaints, low positive emotions, cynicism, antisocial behavior, ideas of persecution, dysfunctional negative emotions, aberrant experiences, and hypomanic activation), and 23 components/traits. A comparison with the PID-5 suggests that emotional dysfunction combines internalizing and detachment spectra, behavioral dysfunction reflects general externalizing (i.e., it combines disinhibited and antagonistic elements), and thought dysfunction maps onto thought disorder (Anderson et al., 2015). It appears that these MMPI-2-RF scales measure more general dimensions than the PID-5, whereas the PSY-5 parallels the five PID-5 domains (Anderson et al., 2013). Moreover, there are many similarities between lower-order dimensions of the MMPI-2-RF and PID-5 (Anderson et al., 2015). The MMPI-2-RF Somatic Complaints scale appears to tap the somatoform spectrum (e.g., McNulty & Overstreet, 2014; Sellbom, in press).

Our review has focused on broader measures that assess major sections of HiTOP. We also note that many reliable and valid instruments have been developed to assess narrower aspects of the nosology. These include measures assessing multiple symptom or trait dimensions within PTSD (Gootzeit, Markon, & Watson, 2015; Weathers, Litz, Herman, Huska, & Keane, 1993), OCD (Foa et al., 2002; Watson & Wu, 2005), specific phobia (Cutshall & Watson, 2004), eating pathology (Forbush et al., 2013), sleep disorders (Koffel, 2011), somatoform disorders (Longley, Watson, & Noyes, 2005), and schizophrenia (PANSS; Kay, Flszbein, & Opler, 1987).

Further studies are needed to evaluate fully how the dimensions of these instruments relate to each other. Ongoing research is working to explicate all four levels of the quantitative classification from symptoms to syndromes to subfactors to spectra. This effort has produced both a replicated core structure (see Figure 2) and new measures to operationalize it (see Table 1).

Several of these measures have informant-report versions. Further development and routine use of informant instruments remains a high priority for future research. Of note, measures listed in Table 1 have been normed in various populations and can be

implemented in clinical practice to describe the HiTOP profile of a given patient. However, an integrated assessment of HiTOP dimensions does not yet exist, and its development (along with a comprehensive normative database for main demographic strata) is a major goal of our group. In the interim, batteries composed of several measures found in Table 1 can provide a comprehensive assessment. Finally, further research will be needed to identify ranges of scores to inform specific clinical decisions (e.g., initiation of pharmacotherapy, hospital admission).

Measures of HiTOP's lower-order dimensions are not perfectly aligned, and multiple alternative sets of maladaptive traits and homogeneous components exist. We chose lower-order dimensions based on an instrument that provides the most comprehensive coverage of a given spectrum, augmenting it with additional dimensions that are clearly missing (see Figure 3). Specifically, internalizing dimensions were drawn from nonredundant scales of the IMAS, IDAS, PID-5, PAI, and FFM-PD (Crego & Widiger, 2016; Hopwood et al., 2013; Watson et al., 2012). Mania dimensions were drawn from the IMAS. Thought disorder dimensions were drawn from the SANS, SAPS, PID-5, and CAT-PD (Kotov et al., 2016; Wright & Simms, 2014). Disinhibited externalizing dimensions were drawn from the ESI and supplemented from the FFM-PD (Crego & Widiger, 2016). Antagonistic externalizing dimensions were drawn from the ESI and supplemented from the PID-5, CAT-PD, PAI, and FFM-PD (Crego & Widiger, 2016; Hopwood et al., 2013). Detachment dimensions were drawn from nonredundant scales of the PID-5 and MMPI-2-RF (Anderson et al., 2015). Somatoform dimensions were drawn from nonredundant scales of the PAI and MMPI-2-RF.

### Research and Clinical Applications of a Quantitative Classification

An emerging quantitative classification ultimately may provide a more useful guide for researchers and clinicians than traditional categorical taxonomies. In this section, we review evidence that the HiTOP can effectively summarize information on shared genetic vulnerabilities, environmental risk factors, neurobiological abnormalities, illness course, functional impairment, and treatment efficacy for many forms of psychopathology.

First, the factor analytically derived spectra appear to reflect common genetic vulnerabilities. Twin studies have found that shared genetic factors underlie each of the six spectra (Arcos-Burgos, Velez, Solomon, & Muenke, 2012; Cosgrove et al., 2011; Hicks, Foster, Iacono, & McGue, 2013; Hicks, Krueger, Iacono, McGue, & Patrick, 2004; Kato, Sullivan, Evengård, & Pedersen, 2009; Kendler et al., 2011, 2006; Kendler, Prescott, Myers, & Neale, 2003; Lichtenstein et al., 2009; Thornton, Welch, Munn-Chernoff, Lichtenstein, & Bulik, 2016; Torgersen et al., 2008). Moreover, studies that span multiple spectra observed genetic dimensions that mirror the HiTOP spectra (Hink et al., 2013; Kendler et al., 2011, 2003; Wolf et al., 2010). Additionally, intergenerational transmission of internalizing and externalizing disorders were found to be almost completely mediated by these spectra rather than being disorder-specific (Hicks, Foster, Iacono, & McGue, 2013; Kendler, Davis, & Kessler, 1997; Starr, Conway, Hammen, & Brennan, 2014). Thus, an explicit focus on these spectra can aid research on genetic etiologies of psychopathology. In fact, some molecular genetic studies have begun targeting these

spectra to identify genetic contributions to psychopathology (Cardno & Owen, 2014; Dick et al., 2008; Hettema et al., 2008).

Second, common environmental risk factors were found to shape the spectra. Twin studies revealed that common environmental influences underpin many of the spectra alongside shared genetic influences discussed earlier (Bornovalova, Hicks, Iacono, & McGue, 2010; Kato et al., 2009; Krueger et al., 2002; Mosing et al., 2009; Torgersen et al., 2008). Moreover, research is beginning to identify specific environmental factors that contribute to the spectra (Caspi et al., 2014; Lahey et al., 2012). For instance, discrimination and childhood maltreatment are linked much more closely to spectra than to unique aspects of disorders (Eaton, 2014; Keyes et al., 2012; Rodriguez-Seijas, Stohl, Hasin, & Eaton, 2015; Vachon, Krueger, Rogosch, & Cicchetti, 2015). The HiTOP model may be able to clarify and simplify voluminous literatures on risk factors for individual disorders; thus, advancing etiologic models for a broad range of psychopathology.

Third, neurobiological abnormalities may show clearer and stronger links to the HiTOP dimensions than to traditional diagnostic categories (Hyman, 2010), because empirically derived dimensions offer greater informational value and specificity. For example, Nelson, Perlman, Hajcak, Klein, and Kotov (2015) related neural measures of emotional reactivity to the distress and fear subfactors, and found that the former was associated with blunted neural reactivity to all stimuli, whereas the latter was associated with enhanced reactivity to negative stimuli specifically. Weinberg, Kotov, & Proudfit (2015) evaluated links between neural markers of error-processing and symptom components of the internalizing domain, and found that enhanced neural reactivity to errors was specifically associated with the checking component across various disorders. Such studies promise to align the phenotypic and neural architectures of psychopathology more closely.

Fourth, quantitative dimensions can effectively capture illness course. Categorical outcomes such as remission and recovery are controversial as they lack natural benchmarks. In contrast, dimensions can characterize the outcome at every level of psychopathology from severe impairment to subthreshold symptoms to full recovery. Also, categorical descriptions of outcome may either over- or underestimate the degree of change because of their qualitative nature, whereas the dimensional approach can represent change with greater precision. Indeed, the spectra have shown impressive temporal stability over long retest intervals spanning as much as 9 years (Eaton et al., 2013; Eaton, Krueger, & Oltmanns, 2011; Fergusson, Horwood, & Boden, 2006; Krueger et al., 2003; Vollebergh et al., 2001), with the dimensional approach revealing stability of psychopathology that was partially obscured by categorical descriptions in many previous studies.

Fifth, HiTOP dimensions may account for functional impairment associated with psychopathology with greater parsimony and precision than traditional taxonomies, providing better targets for interventions to improve quality of life in psychiatric populations. Indeed, initial studies found that the spectra, rather than variance specific to individual diagnoses, account for dysfunction: (a) the internalizing dimension fully explained impairment associated with depressive and anxiety symptoms (Markon, 2010b); (b) the internalizing spectrum captured the majority of suicidality, treatment seeking, and disability present in emotional disorders (Sunderland & Slade, 2015); (c) the thought disorder dimension fully

accounted for impairment associated with psychosis (Jonas & Markon, 2013; Kotov, Chang, et al., 2011); and (d) the internalizing and disinhibited externalizing spectra jointly fully explained related marital distress (South, Krueger, & Iacono, 2011). Other studies did not compare spectra to diagnoses, but they documented robust associations of the internalizing, disinhibited externalizing, and thought disorder spectra with a wide range of criteria, including academic difficulties in kindergarten through high school, unemployment, relationship problems (e.g., divorce or never marrying), use of public assistance, suicide attempts, violence convictions, hospitalizations, and a range of systemic medical conditions (Caspi et al., 2014; Eaton et al., 2013; Lahey et al., 2012, 2015; Slade, 2007).

Sixth, a quantitative organization may explain and predict the efficacy of treatments, including limited diagnostic specificity of treatment response observed for many interventions. For example, selective serotonin reuptake inhibitors originally were regarded as antidepressants but subsequently were found to be efficacious in treating anxiety disorders and are increasingly used in eating disorders (Martinez, Marangell, & Martinez, 2008). Transdiagnostic cognitive-behavioral therapy and even disorder-specific psychotherapies have been found to reduce symptoms of various internalizing conditions (Farchione et al., 2012; Newby et al., 2013; Rodriguez-Seijas, Eaton, & Krueger, 2015). Thus, response to selective serotonin reuptake inhibitors and cognitive-behavioral therapy appears to be a shared feature of internalizing disorders. This supports the contention that a quantitative organization can inform intervention research better than traditional taxonomies, which scatter these disorders across several classes and do not provide clear guidance regarding commonalities and differences in treatment response among them. Furthermore, psychiatrists frequently prescribe medication for presenting symptoms, irrespective of diagnosis (Bostic & Rho, 2006; Hermes, Sernyak, & Rosenheck, 2013; Mohamed & Rosenheck, 2008). A quantitative nosology fits naturally with this practice by identifying transdiagnostic and psychometrically sound symptom dimensions comprehensively, and by providing a systematic list of symptom targets for pharmacotherapy.

Overall, the new classification is consistent with patterns of similarities and differences among disorders observed on various diagnostic validators, as discussed earlier. Literature reviews suggest that the internalizing (emotional), disinhibited externalizing, and thought disorder (psychosis) spectra can effectively summarize and convey information on risk factors, etiology, pathophysiology, phenomenology, illness course, and treatment response; thus, greatly improving the utility of diagnosis in psychiatry (Andrews et al., 2009).

It is important to highlight that although a quantitative classification is preliminary in many respects, it is nevertheless sufficiently ready for initial implementation. It can be assessed economically with questionnaires completed by either patients or informants, and interview measures are also available. Patients and/or informants can complete questionnaires in a waiting room or from home, so that the clinician has basic diagnostic information even before seeing them. These instruments can improve standardization of the intake process, especially compared with unstructured interviews. Brief measures sensitive to current status are also available and can be used to track patients' progress between visits. This is particularly true of inventories, such as the

IDAS, that assess current (past 2 weeks) symptoms. Indeed, the MMPI-2-RF, PAI, and especially the ASEBA provide good working models for implementing the HiTOP system in clinical settings.

## Conclusions

Existing research on the HiTOP classification is still limited in several ways. Relatively few studies have analyzed more than two spectra at a time. Consequently, some uncertainties about the overall structure remain. Data are particularly limited for the somatoform and detachment dimensions. Subfactors have been explicated only for the internalizing and disinhibited externalizing spectra. Evidence is fairly preliminary for the component/trait level of the HiTOP, as it is uncertain whether the proposed sets of dimensions are comprehensive and free from redundancies. Syndromes are the least understood level, as only a few omnibus measures have been analyzed starting with symptoms up to syndromes (Achenbach, Newhouse, & Rescorla, 2004; Achenbach & Rescorla, 2001, 2003; Kotov et al., 2015; Lahey et al., 2004, 2008). The majority of research has relied on *DSM/ICD* diagnoses as proxies for syndromes. Moreover, categorical diagnoses may distort findings, a limitation that applies to many existing studies. Fortunately, various conclusions of these studies have been confirmed with homogeneous dimensional measures (traits and symptom components). However, not all findings have been examined using such dimensions, and some may need to be revised. Future studies should administer various component-level instruments along with a comprehensive traditional diagnostic assessment to large patient samples, thereby elucidating the structure that spans all levels of the hierarchy and all known spectra.

Also, additional research is needed to incorporate psychopathology not currently included in the HiTOP and to confirm the placement of disorders/syndromes that have received limited attention in structural studies. Moreover, structural studies mostly focused on snapshots of symptoms and syndromes without modeling illness course. Future studies should consider additional markers such as age of onset, illness duration, and chronicity, and incorporate them in the HiTOP explicitly. Furthermore, some structural investigations examined lifetime disorders, whereas others analyzed past-year incidence, and still others considered only current psychopathology. Findings appear to be robust across timeframes, but this issue can be investigated even more systematically. Cross-cultural generalizability is well established for the internalizing and disinhibited externalizing spectra (Kessler et al., 2011; Krueger et al., 2003) and several empirical syndromes within them (Ivanova et al., 2007a, 2007b, 2015a, 2015b), but other HiTOP dimensions need to be similarly studied.

Much of existing research has focused on adults, and generalizability of identified dimensions to youth and older adults is not assured. Studies of children and adolescents also have documented the internalizing and disinhibited externalizing spectra, with some evidence suggesting a separate thought disorder dimension (Achenbach, 1966; Achenbach & Rescorla, 2001, 2003; Achenbach et al., 1991; Laceulle et al., 2015; Lahey et al., 2004, 2008, 2011, 2015; Olinio et al., 2014; Tackett et al., 2013). Also, some evidence suggests that certain psychopathology dimensions are already present during preschool and do not change appreciably in subsequent years (Sterba, Egger, & Angold, 2007; Sterba et al.,



2010). Nevertheless, we can expect that some elements of the structure will vary with age (Waszczuk, Zavos, Gregory, & Eley, 2014), and the HiTOP model needs to be tested across age groups. Another limitation is that existing studies focused on main effects of psychopathology dimensions on validators, although interactions between these dimensions can affect validators (Kotov et al., 2013). Future research needs to consider both the main effects of the HiTOP dimensions and the interactions among them. Also, the vast majority of studies relied on participants' report, although informant reports are crucial for accurate assessment, especially in evaluating the thought disorder and externalizing domains (Achenbach, Krukowski, Dumenci, & Ivanova, 2005). Integration of informant data is an important consideration for the design of future studies. Finally, structural evidence is essentially descriptive, and validation studies are necessary to understand the nature and utility of the identified phenotypes. Systematic efforts to organize validity data have been largely limited to spectra, and such research is needed at other levels of the hierarchy.

Despite these limitations, many aspects of the model have been investigated extensively and consistence evidence has emerged. For instance, the internalizing, disinhibited externalizing, and thought disorder spectra are now firmly established. Objectives of the present paper are to describe major known elements of a quantitative nosology rather than provide a complete system. Our consortium will continue to review evidence and address gaps in the HiTOP as more data become available.

Overall, a quantitative nosology has made impressive strides in recent years. On the level of spectra, it provides broad, although not yet complete, coverage of psychopathology that includes nearly all common conditions. Homogenous components of disorders have been proposed and corresponding measures have been developed for nearly all domains (e.g., scales of ASEBA, PID5, ESI, IDAS, IMAS, and other instruments). These psychometrically sound dimensional markers now can be used to investigate higher levels of the classification and extend findings that were based on dichotomous diagnoses. The last few years have seen a tremendous growth and maturation of this field. If this trajectory continues, we can expect the HiTOP system to provide a viable alternative to the DSM and ICD in the near future. A quantitative classification is no longer a distant goal. Clinicians and researchers can apply many aspects of the HiTOP model even now, using concepts and measures already available. These early adopters would benefit from a diagnostic formulation that is more flexible, informative, and accurate than traditional diagnoses. In fact, child psychiatry has been using many elements of a quantitative model for over three decades with considerable success. For example, this model has demonstrated cross-cultural robustness unmatched by traditional nosologies (Ivanova et al., 2007a; Rescorla et al., 2013). A quantitative nosology will substantially improve current research and clinical practice, as it will largely ameliorate problems of heterogeneity, comorbidity, arbitrary boundaries, and diagnostic instability.

## References

- Achenbach, T. M. (1966). The classification of children's psychiatric symptoms: A factor-analytic study. *Psychological Monographs*, *80*, 1–37. <http://dx.doi.org/10.1037/h0093906>
- Achenbach, T. M., Howell, C. T., Quay, H. C., Conners, C. K., & Bates, J. E. (1991). National Survey of problems and competencies among four- to sixteen-year-olds: Parents' reports for normative and clinical samples. *Monographs of the Society for Research in Child Development*, *56*, 1–131. <http://dx.doi.org/10.2307/1166156>
- Achenbach, T. M., Krukowski, R. A., Dumenci, L., & Ivanova, M. Y. (2005). Assessment of adult psychopathology: Meta-analyses and implications of cross-informant correlations. *Psychological Bulletin*, *131*, 361–382. <http://dx.doi.org/10.1037/0033-2909.131.3.361>
- Achenbach, T. M., Newhouse, P. A., & Rescorla, L. A. (2004). *Manual for ASEBA Older Adult Forms & Profiles*. Burlington, VT: University of Vermont Research Center for Children, Youth, & Families.
- Achenbach, T. M., & Rescorla, L. A. (2001). *Manual for the ASEBA school-age forms and profiles*. Burlington, VA: University of Vermont Research Center for Children, Youth, and Families.
- Achenbach, T. M., & Rescorla, L. A. (2003). *Manual for the ASEBA adult forms and profiles*. Burlington, VT: University of Vermont.
- American Psychiatric Association (APA). (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed.). Washington, DC: Author.
- American Psychiatric Association (APA). (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.
- Anderson, J. L., Sellbom, M., Ayeart, L., Quilty, L. C., Chmielewski, M., & Bagby, R. M. (2015). Associations between DSM-5 section III personality traits and the Minnesota Multiphasic Personality Inventory 2-Restructured Form (MMPI-2-RF) scales in a psychiatric patient sample. *Psychological Assessment*, *27*, 801–815. <http://dx.doi.org/10.1037/pas0000096>
- Anderson, J. L., Sellbom, M., Bagby, R. M., Quilty, L. C., Veltri, C. O. C., Markon, K. E., & Krueger, R. F. (2013). On the convergence between PSY-5 domains and PID-5 domains and facets: Implications for assessment of DSM-5 personality traits. *Assessment*, *20*, 286–294. <http://dx.doi.org/10.1177/1073191112471141>
- Andreasen, N. C. (1983). *The Scale for the Assessment of Negative Symptoms (SANS)*. Iowa City, IA: The University of Iowa.
- Andreasen, N. C. (1984). *The Scale for the Assessment of Positive Symptoms (SAPS)*. Iowa City, IA: The University of Iowa.
- Andreasen, N. C., Arndt, S., Alliger, R., Miller, D., & Flaum, M. (1995). Symptoms of schizophrenia. Methods, meanings, and mechanisms. *Archives of General Psychiatry*, *52*, 341–351. <http://dx.doi.org/10.1001/archpsyc.1995.03950170015003>
- Andrews, G., Dean, K., Genderson, M., Hunt, C., Mitchell, P., Sachdev, P. S., & Trolor, J. N. (2014). *Management of mental disorders* (5th ed.). Sydney: Amazon.com.
- Andrews, G., Goldberg, D. P., Krueger, R. F., Carpenter, W. T., Hyman, S. E., Sachdev, P., & Pine, D. S. (2009). Exploring the feasibility of a meta-structure for DSM-V and ICD-11: Could it improve utility and validity? *Psychological Medicine*, *39*, 1993–2000. <http://dx.doi.org/10.1017/S0033291709990250>
- Andrews, G., Pine, D. S., Hobbs, M. J., Anderson, T. M., & Sunderland, M. (2009). Neurodevelopmental disorders: cluster 2 of the proposed meta-structure for DSM-V and ICD-11. *Psychological medicine*, *39*, 2013–2023. <http://dx.doi.org/10.1017/S0033291709990274>
- Andrews, G., Slade, T., & Issakidis, C. (2002). Deconstructing current comorbidity: Data from the Australian National Survey of Mental Health and Well-Being. *The British Journal of Psychiatry*, *181*, 306–314. <http://dx.doi.org/10.1192/bjp.181.4.306>
- Arcos-Burgos, M., Vélez, J. I., Solomon, B. D., & Muenke, M. (2012). A common genetic network underlies substance use disorders and disruptive or externalizing disorders. *Human Genetics*, *131*, 917–929. <http://dx.doi.org/10.1007/s00439-012-1164-4>
- Barch, D. M., Bustillo, J., Gaebel, W., Gur, R., Heckers, S., Malaspina, D., . . . Carpenter, W. (2013). Logic and justification for dimensional assessment of symptoms and related clinical phenomena in psychosis: Relevance to DSM-5. *Schizophrenia Research*, *150*, 15–20. <http://dx.doi.org/10.1016/j.schres.2013.04.027>

- Beauchaine, T. P., & McNulty, T. (2013). Comorbidities and continuities as ontogenic processes: Toward a developmental spectrum model of externalizing psychopathology. *Development and Psychopathology*, *25*, 1505–1528. <http://dx.doi.org/10.1017/S0954579413000746>
- Beesdo-Baum, K., Höfler, M., Gloster, A. T., Klotsche, J., Lieb, R., Beauducel, A., . . . Wittchen, H. U. (2009). The structure of common mental disorders: A replication study in a community sample of adolescents and young adults. *International Journal of Methods in Psychiatric Research*, *18*, 204–220.
- Ben-Porath, Y. S., & Tellegen, A. (2008). *Minnesota Multiphasic Personality Inventory-2 restructured form: Manual for administration, scoring, and interpretation*. Minneapolis, MN: University of Minnesota Press.
- Beutler, L. E., & Malik, M. L. (2002). *Rethinking the DSM: A psychological perspective*. Washington, DC: American Psychological Association. <http://dx.doi.org/10.1037/10456-000>
- Bijl, R. V., Ravelli, A., & van Zessen, G. (1998). Prevalence of psychiatric disorder in the general population: Results of The Netherlands Mental Health Survey and Incidence Study (NEMESIS). *Social Psychiatry and Psychiatric Epidemiology*, *33*, 587–595. <http://dx.doi.org/10.1007/s001270050098>
- Blanchard, J. J., & Cohen, A. S. (2006). The structure of negative symptoms within schizophrenia: Implications for assessment. *Schizophrenia Bulletin*, *32*, 238–245. <http://dx.doi.org/10.1093/schbul/sbj013>
- Blanco, C., Wall, M. M., He, J. P., Krueger, R. F., Olfson, M., Jin, C. J., . . . Merikangas, K. R. (2015). The space of common psychiatric disorders in adolescents: Comorbidity structure and individual latent liabilities. *Journal of the American Academy of Child and Adolescent Psychiatry*, *54*, 45–52. <http://dx.doi.org/10.1016/j.jaac.2014.10.007>
- Blashfield, R. K. (1984). *The classification of psychopathology*. New York, NY: Plenum Press. <http://dx.doi.org/10.1007/978-1-4613-2665-6>
- Bornovalova, M. A., Hicks, B. M., Iacono, W. G., & McGue, M. (2010). Familial transmission and heritability of childhood disruptive disorders. *The American Journal of Psychiatry*, *167*, 1066–1074. <http://dx.doi.org/10.1176/appi.ajp.2010.09091272>
- Bostic, J. Q., & Rho, Y. (2006). Target-symptom psychopharmacology: Between the forest and the trees. *Child and Adolescent Psychiatric Clinics of North America*, *15*, 289–302. <http://dx.doi.org/10.1016/j.chc.2005.08.003>
- Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). New York, NY: Guilford Press Publications.
- Brown, T. A., & Barlow, D. H. (2009). A proposal for a dimensional classification system based on the shared features of the *DSM-IV* anxiety and mood disorders: Implications for assessment and treatment. *Psychological Assessment*, *21*, 256–271. <http://dx.doi.org/10.1037/a0016608>
- Brown, T. A., Campbell, L. A., Lehman, C. L., Grisham, J. R., & Mancill, R. B. (2001). Current and lifetime comorbidity of the *DSM-IV* anxiety and mood disorders in a large clinical sample. *Journal of Abnormal Psychology*, *110*, 585–599. <http://dx.doi.org/10.1037/0021-843X.110.4.585>
- Butcher, J. N., Dahlstrom, W. G., Graham, J. R., Tellegen, A., & Kaemmer, B. (1989). *The Minnesota Multiphasic Personality Inventory-2 (MMPI-2): Manual for administration and scoring*. Minneapolis, MN: University of Minnesota Press.
- Calabrese, W. R., Rudick, M. M., Simms, L. J., & Clark, L. A. (2012). Development and validation of Big Four personality scales for the Schedule for Nonadaptive and Adaptive Personality—2nd ed. (SNAP-2). *Psychological Assessment*, *24*, 751–763. <http://dx.doi.org/10.1037/a0026915>
- Cardno, A. G., & Owen, M. J. (2014). Genetic relationships between schizophrenia, bipolar disorder, and schizoaffective disorder. *Schizophrenia Bulletin*, *40*, 504–515. <http://dx.doi.org/10.1093/schbul/sbu016>
- Carpenter, W. T., Bustillo, J. R., Thaker, G. K., Van Os, J., Krueger, R. F., & Green, M. J. (2009). The psychoses: cluster 3 of the proposed meta-structure for DSM-V and ICD-11. *Psychological Medicine*, *39*, 2025–2042. <http://dx.doi.org/10.1017/S0033291709990286>
- Carragher, N., Krueger, R. F., Eaton, N. R., Markon, K. E., Keyes, K. M., Blanco, C., . . . Hasin, D. S. (2014). ADHD and the externalizing spectrum: Direct comparison of categorical, continuous, and hybrid models of liability in a nationally representative sample. *Social Psychiatry and Psychiatric Epidemiology*, *49*, 1307–1317. <http://dx.doi.org/10.1007/s00127-013-0770-3>
- Caspi, A., Houts, R. M., Belsky, D. W., Goldman-Mellor, S. J., Harrington, H., Israel, S., . . . Moffitt, T. E. (2014). The p factor: One general psychopathology factor in the structure of psychiatric disorders? *Clinical Psychological Science*, *2*, 119–137. <http://dx.doi.org/10.1177/2167702613497473>
- Castellanos-Ryan, N., Struve, M., Whelan, R., Banaschewski, T., Barker, G. J., Bokde, A. L., . . . the IMAGEN Consortium. (2014). Neural and cognitive correlates of the common and specific variance across externalizing problems in young adolescence. *The American Journal of Psychiatry*, *171*, 1310–1319. <http://dx.doi.org/10.1176/appi.ajp.2014.13111499>
- Chmielewski, M., Clark, L. A., Bagby, R. M., & Watson, D. (2015). Method matters: Understanding diagnostic reliability in *DSM-IV* and *DSM-5*. *Journal of Abnormal Psychology*, *124*, 764–769. <http://dx.doi.org/10.1037/abn0000069>
- Chmielewski, M., & Watson, D. (2008). The heterogeneous structure of schizotypal personality disorder: Item-level factors of the Schizotypal Personality Questionnaire and their associations with obsessive-compulsive disorder symptoms, dissociative tendencies, and normal personality. *Journal of Abnormal Psychology*, *117*, 364–376. <http://dx.doi.org/10.1037/0021-843X.117.2.364>
- Clark, L. A. (2005). Temperament as a unifying basis for personality and psychopathology. *Journal of Abnormal Psychology*, *114*, 505–521. <http://dx.doi.org/10.1037/0021-843X.114.4.505>
- Clark, L. A., Livesley, W. J., Schroeder, M. L., & Irish, S. L. (1996). Convergence of two systems for assessing specific traits of personality disorder. *Psychological Assessment*, *8*, 294–303. <http://dx.doi.org/10.1037/1040-3590.8.3.294>
- Clark, L. A., Simms, L. J., Wu, K. D., & Casillas, A. (2014). *Schedule for Nonadaptive and Adaptive Personality, 2nd Edition (SNAP-2): Manual for administration, scoring, and interpretation*. South Bend, IN: University of Notre Dame. <http://dx.doi.org/10.1037/t07079-000>
- Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. *Journal of abnormal psychology*, *100*, 316–336. <http://dx.doi.org/10.1037/0021-843X.100.3.316>
- Clark, L. A., & Watson, D. (1999). Temperament: A new paradigm for trait psychology. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp. 399–423). New York, NY: Guilford Press.
- Clark, L. A., & Watson, D. (2006). Distress and fear disorders: An alternative empirically based taxonomy of the “mood” and “anxiety” disorders. *The British Journal of Psychiatry*, *189*, 481–483. <http://dx.doi.org/10.1192/bjp.bp.106.03825>
- Clark, L. A., Watson, D., & Reynolds, S. (1995). Diagnosis and classification of psychopathology: Challenges to the current system and future directions. *Annual Review of Psychology*, *46*, 121–153. <http://dx.doi.org/10.1146/annurev.ps.46.020195.001005>
- Cosgrove, V. E., Rhee, S. H., Gelhorn, H. L., Boeldt, D., Corley, R. C., Ehringer, M. A., . . . Hewitt, J. K. (2011). Structure and etiology of co-occurring internalizing and externalizing disorders in adolescents. *Journal of Abnormal Child Psychology*, *39*, 109–123. <http://dx.doi.org/10.1007/s10802-010-9444-8>
- Costa, P. T., & MacCrae, R. R. (1992). *Revised NEO personality inventory (NEO PI-R) and NEO five-factor inventory (NEO FFI): Professional manual*. Lutz, FL: Psychological Assessment Resources.

- Crego, C., & Widiger, T. A. (2016). Convergent and discriminant validity of alternative measures of maladaptive personality traits. *Psychological Assessment, 28*, 1561–1575. <http://dx.doi.org/10.1037/pas0000282>
- Cuthbert, B. N., & Insel, T. R. (2010). Toward new approaches to psychotic disorders: The NIMH Research Domain Criteria project. *Schizophrenia Bulletin, 36*, 1061–1062. <http://dx.doi.org/10.1093/schbul/sbq108>
- Cuthbert, B. N., & Insel, T. R. (2013). Toward the future of psychiatric diagnosis: The seven pillars of RDoC. *BMC Medicine, 11*, 126–134. <http://dx.doi.org/10.1186/1741-7015-11-126>
- Cuthbert, B. N., & Kozak, M. J. (2013). Constructing constructs for psychopathology: The NIMH research domain criteria. *Journal of Abnormal Psychology, 122*, 928–937. <http://dx.doi.org/10.1037/a0034028>
- Cutshall, C., & Watson, D. (2004). The phobic stimuli response scales: A new self-report measure of fear. *Behaviour Research and Therapy, 42*, 1193–1201. <http://dx.doi.org/10.1016/j.brat.2003.08.003>
- DeYoung, C. G. (2006). Higher-order factors of the Big Five in a multi-informant sample. *Journal of Personality and Social Psychology, 91*, 1138–1151. <http://dx.doi.org/10.1037/0022-3514.91.6.1138>
- Dick, D. M., Aliev, F., Wang, J. C., Gruzca, R. A., Schuckit, M., Kuperman, S., . . . Goate, A. (2008). Using dimensional models of externalizing psychopathology to aid in gene identification. *Archives of General Psychiatry, 65*, 310–318. <http://dx.doi.org/10.1001/archpsyc.65.3.310>
- Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. *Annual Review of Psychology, 41*, 417–440. <http://dx.doi.org/10.1146/annurev.ps.41.020190.002221>
- Digman, J. M. (1997). Higher-order factors of the Big Five. *Journal of Personality and Social Psychology, 73*, 1246–1256. <http://dx.doi.org/10.1037/0022-3514.73.6.1246>
- Eaton, N. R. (2014). Transdiagnostic psychopathology factors and sexual minority mental health: Evidence of disparities and associations with minority stressors. *Psychology of Sexual Orientation and Gender Diversity, 1*, 244–254. <http://dx.doi.org/10.1037/sgd0000048>
- Eaton, N. R., Krueger, R. F., Markon, K. E., Keyes, K. M., Skodol, A. E., Wall, M., . . . Grant, B. F. (2013). The structure and predictive validity of the internalizing disorders. *Journal of Abnormal Psychology, 122*, 86–92. <http://dx.doi.org/10.1037/a0029598>
- Eaton, N. R., Krueger, R. F., & Oltmanns, T. F. (2011). Aging and the structure and long-term stability of the internalizing spectrum of personality and psychopathology. *Psychology and Aging, 26*, 987–993. <http://dx.doi.org/10.1037/a0024406>
- Eaton, N. R., Rodriguez-Seijas, C., Carragher, N., & Krueger, R. F. (2015). Transdiagnostic factors of psychopathology and substance use disorders: A review. *Social Psychiatry and Psychiatric Epidemiology, 50*, 171–182. <http://dx.doi.org/10.1007/s00127-014-1001-2>
- Eysenck, H. J. (1944). Types of personality: A factorial study of seven hundred neurotics. *British Journal of Psychiatry, 90*, 851–861. <http://dx.doi.org/10.1192/bjp.90.381.851>
- Eysenck, H. J., & Eysenck, S. B. G. (1975). *Manual of the Eysenck Personality Questionnaire*. London, UK: Hodder and Stoughton.
- Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4*, 272–299. <http://dx.doi.org/10.1037/1082-989X.4.3.272>
- Farchione, T. J., Fairholme, C. P., Ellard, K. K., Boisseau, C. L., Thompson-Hollands, J., Carl, J. R., . . . Barlow, D. H. (2012). Unified protocol for transdiagnostic treatment of emotional disorders: A randomized controlled trial. *Behavior Therapy, 43*, 666–678. <http://dx.doi.org/10.1016/j.beth.2012.01.001>
- Farmer, R. F., Seeley, J. R., Kosty, D. B., & Lewinsohn, P. M. (2009). Refinements in the hierarchical structure of externalizing psychiatric disorders: Patterns of lifetime liability from mid-adolescence through early adulthood. *Journal of Abnormal Psychology, 118*, 699–710. <http://dx.doi.org/10.1037/a0017205>
- Farmer, R. F., Seeley, J. R., Kosty, D. B., Olino, T. M., & Lewinsohn, P. M. (2013). Hierarchical organization of axis I psychiatric disorder comorbidity through age 30. *Comprehensive Psychiatry, 54*, 523–532. <http://dx.doi.org/10.1016/j.comppsych.2012.12.007>
- Fergusson, D. M., Horwood, L. J., & Boden, J. M. (2006). Structure of internalising symptoms in early adulthood. *The British Journal of Psychiatry, 189*, 540–546. <http://dx.doi.org/10.1192/bjp.bp.106.022384>
- Flett, G. L., Vredenburg, K., & Krames, L. (1997). The continuity of depression in clinical and nonclinical samples. *Psychological Bulletin, 121*, 395–416. <http://dx.doi.org/10.1037/0033-2909.121.3.395>
- Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The Obsessive-Compulsive Inventory: Development and validation of a short version. *Psychological Assessment, 14*, 485–496. <http://dx.doi.org/10.1037/1040-3590.14.4.485>
- Forbes, M. K., Baillie, A. J., & Schniering, C. A. (2016a). A structural equation modelling analysis of the relationships between depression, anxiety, and sexual problems over time. *Journal of Sex Research, 53*, 942–954. <http://dx.doi.org/10.1080/00224499.2015.1063576>
- Forbes, M. K., Baillie, A. J., & Schniering, C. A. (2016b). Should sexual problems be included in the internalising spectrum? A comparison of dimensional and categorical models. *Journal of Sex & Marital Therapy, 42*, 70–90. <http://dx.doi.org/10.1080/0092623X.2014.996928>
- Forbush, K. T., South, S. C., Krueger, R. F., Iacono, W. G., Clark, L. A., Keel, P. K., . . . Watson, D. (2010). Locating eating pathology within an empirical diagnostic taxonomy: Evidence from a community-based sample. *Journal of Abnormal Psychology, 119*, 282–292. <http://dx.doi.org/10.1037/a0019189>
- Forbush, K. T., & Watson, D. (2013). The structure of common and uncommon mental disorders. *Psychological Medicine, 43*, 97–108. <http://dx.doi.org/10.1017/S0033291712001092>
- Forbush, K. T., Wildes, J. E., Pollack, L. O., Dunbar, D., Luo, J., Patterson, K., . . . Watson, D. (2013). Development and validation of the Eating Pathology Symptoms Inventory (EPSI). *Psychological Assessment, 25*, 859–878. <http://dx.doi.org/10.1037/a0032639>
- Goldberg, D. P., Andrews, G., & Hobbs, M. J. (2009). Where should bipolar disorder appear in the meta-structure? *Psychological Medicine, 39*, 2071–2081. <http://dx.doi.org/10.1017/S0033291709990304>
- Goldberg, D. P., Krueger, R. F., Andrews, G., & Hobbs, M. J. (2009). Emotional disorders: Cluster 4 of the proposed meta-structure for DSM-V and ICD-11. *Psychological Medicine, 39*, 2043–2059. <http://dx.doi.org/10.1017/S0033291709990298>
- Goldberg, L. R. (1993). The structure of phenotypic personality traits. *American Psychologist, 48*, 26–34. <http://dx.doi.org/10.1037/0003-066X.48.1.26>
- Goldberg, L. R. (2006). Doing it all Bass-Ackwards: The development of hierarchical factor structures from the top down. *Journal of Research in Personality, 40*, 347–358. <http://dx.doi.org/10.1016/j.jrp.2006.01.001>
- Gomez, R., & Corr, P. J. (2014). ADHD and personality: A meta-analytic review. *Clinical Psychology Review, 34*, 376–388. <http://dx.doi.org/10.1016/j.cpr.2014.05.002>
- Gootzeit, J., Markon, K., & Watson, D. (2015). Measuring dimensions of posttraumatic stress disorder: The Iowa Traumatic Response Inventory. *Assessment, 22*, 152–166. <http://dx.doi.org/10.1177/1073191114540747>
- Gould, T. D., & Gottesman, I. I. (2006). Psychiatric endophenotypes and the development of valid animal models. *Genes, Brain and Behavior, 5*, 113–119. <http://dx.doi.org/10.1111/j.1601-183X.2005.00186.x>
- Grant, B. F., Stinson, F. S., Dawson, D. A., Chou, S. P., Dufour, M. C., Compton, W., . . . Kaplan, K. (2004). Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry, 61*, 807–816. <http://dx.doi.org/10.1001/archpsyc.61.8.807>
- Greene, A. L., & Eaton, N. R. (2016). Panic disorder and agoraphobia: A direct comparison of their multivariate comorbidity patterns. *Journal of*

- Affective Disorders*, 190, 75–83. <http://dx.doi.org/10.1016/j.jad.2015.09.060>
- Grube, B. S., Bilder, R. M., & Goldman, R. S. (1998). Meta-analysis of symptom factors in schizophrenia. *Schizophrenia Research*, 31, 113–120. [http://dx.doi.org/10.1016/S0920-9964\(98\)00011-5](http://dx.doi.org/10.1016/S0920-9964(98)00011-5)
- Hallquist, M. N., & Wright, A. G. C. (2014). Mixture modeling methods for the assessment of normal and abnormal personality, part I: Cross-sectional models. *Journal of Personality Assessment*, 96, 256–268. <http://dx.doi.org/10.1080/00223891.2013.845201>
- Harkness, A. R., & McNulty, J. L. (1994). The Personality Psychopathology Five (PSY-5): Issues from the pp. of a diagnostic manual instead of a dictionary. In S. Strack & M. Lorr (Eds.), *Differentiating normal and abnormal personality* (pp. 291–315). New York, NY: Springer
- Harkness, A. R., McNulty, J. L., Finn, J. A., Reynolds, S. M., Shields, S. M., & Arbisi, P. (2014). The MMPI-2-RF Personality Psychopathology Five (PSY-5-RF) scales: Development and validity research. *Journal of Personality Assessment*, 96, 140–150. <http://dx.doi.org/10.1080/00223891.2013.823439>
- Haslam, N., Holland, E., & Kuppens, P. (2012). Categories versus dimensions in personality and psychopathology: A quantitative review of taxometric research. *Psychological Medicine*, 42, 903–920. <http://dx.doi.org/10.1017/S0033291711001966>
- Hasler, G., Drevets, W. C., Manji, H. K., & Charney, D. S. (2004). Discovering endophenotypes for major depression. *Neuropsychopharmacology*, 29, 1765–1781. <http://dx.doi.org/10.1038/sj.npp.1300506>
- Hasler, G., LaSalle-Ricci, V. H., Ronquillo, J. G., Crawley, S. A., Cochran, L. W., Kazuba, D., . . . Murphy, D. L. (2005). Obsessive-compulsive disorder symptom dimensions show specific relationships to psychiatric comorbidity. *Psychiatry Research*, 135, 121–132. <http://dx.doi.org/10.1016/j.psychres.2005.03.003>
- Hathaway, S. R., & McKinley, J. C. (1942). *Minnesota Multiphasic Personality Inventory*. Minneapolis, MN: University of Minnesota Press.
- Hermes, E. D., Sernyak, M., & Rosenheck, R. (2013). Use of second-generation antipsychotic agents for sleep and sedation: A provider survey. *Sleep*, 36, 597–600.
- Herzhoff, K., & Tackett, J. L. (2016). Subfactors of oppositional defiant disorder: Converging evidence from structural and latent class analyses. *Journal of Child Psychology and Psychiatry*, 57, 18–29. <http://dx.doi.org/10.1111/jcpp.12423>
- Hettema, J. M., An, S.-S., Bukszar, J., van den Oord, E. J. C. G., Neale, M. C., Kendler, K. S., & Chen, X. (2008). Catechol-O-methyltransferase contributes to genetic susceptibility shared among anxiety spectrum phenotypes. *Biological Psychiatry*, 64, 302–310. <http://dx.doi.org/10.1016/j.biopsych.2008.03.014>
- Hicks, B. M., Foster, K. T., Iacono, W. G., & McGue, M. (2013). Genetic and environmental influences on the familial transmission of externalizing disorders in adoptive and twin offspring. *Journal of the American Medical Association Psychiatry*, 70, 1076–1083. <http://dx.doi.org/10.1001/jamapsychiatry.2013.258>
- Hicks, B. M., Krueger, R. F., Iacono, W. G., McGue, M., & Patrick, C. J. (2004). Family transmission and heritability of externalizing disorders: A twin-family study. *Archives of General Psychiatry*, 61, 922–928. <http://dx.doi.org/10.1001/archpsyc.61.9.922>
- Hink, L. K., Rhee, S. H., Corley, R. P., Cosgrove, V. E., Hewitt, J. K., Schulz-Heik, R. J., . . . Waldman, I. D. (2013). Personality dimensions as common and broadband-specific features for internalizing and externalizing disorders. *Journal of Abnormal Child Psychology*, 41, 939–957. <http://dx.doi.org/10.1007/s10802-013-9730-3>
- Hopwood, C. J., Malone, J. C., Ansell, E. B., Sanislow, C. A., Grilo, C. M., McGlashan, T. H., . . . Morey, L. C. (2011). Personality assessment in DSM-5: Empirical support for rating severity, style, and traits. *Journal of Personality Disorders*, 25, 305–320. <http://dx.doi.org/10.1521/pe.2011.25.3.305>
- Hopwood, C. J., Wright, A. G., Krueger, R. F., Schade, N., Markon, K. E., & Morey, L. C. (2013). DSM-5 pathological personality traits and the personality assessment inventory. *Assessment*, 20, 269–285. <http://dx.doi.org/10.1177/1073191113486286>
- Hyman, S. E. (2010). The diagnosis of mental disorders: The problem of reification. *Annual Review of Clinical Psychology*, 6, 155–179. <http://dx.doi.org/10.1146/annurev.clinpsy.3.022806.091532>
- Ivanova, M. Y., Achenbach, T. M., Dumenci, L., Rescorla, L. A., Almqvist, F., Weintraub, S., . . . Döpfner, M. (2007a). Testing the 8-syndrome structure of the child behavior checklist in 30 societies. *Journal of Clinical Child and Adolescent Psychology*, 36, 405–417. <http://dx.doi.org/10.1080/15374410701444363>
- Ivanova, M. Y., Achenbach, T. M., Rescorla, L. A., Dumenci, L., Almqvist, F., Bilenberg, N., . . . Verhulst, F. C. (2007b). The generalizability of the Youth Self-Report syndrome structure in 23 societies. *Journal of Consulting and Clinical Psychology*, 75, 729–738. <http://dx.doi.org/10.1037/0022-006X.75.5.729>
- Ivanova, M. Y., Achenbach, T. M., Rescorla, L. A., Turner, L. V., Ahmeti-Pronaj, A., Au, A., . . . Zasepa, E. (2015a). Syndromes of self-reported psychopathology for ages 18–59 in 29 societies. *Journal of Psychopathology and Behavioral Assessment*, 37, 171–183. <http://dx.doi.org/10.1007/s10862-014-9448-8>
- Ivanova, M. Y., Achenbach, T. M., Rescorla, L. A., Turner, L. V., Árnadóttir, H. A., Au, A., . . . Zasepa, E. (2015b). Syndromes of collateral-reported psychopathology for ages 18–59 in 18 societies. *International Journal of Clinical and Health Psychology*, 15, 18–28. <http://dx.doi.org/10.1016/j.ijchp.2014.07.001>
- Ivleva, E. I., Bidesi, A. S., Keshavan, M. S., Pearlson, G. D., Meda, S. A., Dodig, D., . . . Tamminga, C. A. (2013). Gray matter volume as an intermediate phenotype for psychosis: Bipolar-Schizophrenia Network on Intermediate Phenotypes (B-SNIP). *The American Journal of Psychiatry*, 170, 1285–1296. <http://dx.doi.org/10.1176/appi.ajp.2013.13010126>
- John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative big five trait taxonomy. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (3rd ed., pp. 114–158). New York, NY: Guilford Press.
- Jonas, K. G., & Markon, K. E. (2013). A model of psychosis and its relationship with impairment. *Social Psychiatry and Psychiatric Epidemiology*, 48, 1367–1375. <http://dx.doi.org/10.1007/s00127-012-0642-2>
- Jones, S. E., Miller, J. D., & Lynam, D. R. (2011). Personality, antisocial behavior, and aggression: A meta-analytic review. *Journal of Criminal Justice*, 39, 329–337. <http://dx.doi.org/10.1016/j.jcrimjus.2011.03.004>
- Kato, K., Sullivan, P. F., Evengård, B., & Pedersen, N. L. (2009). A population-based twin study of functional somatic syndromes. *Psychological Medicine*, 39, 497–505. <http://dx.doi.org/10.1017/S0033291708003784>
- Kay, S. R., Fiszbein, A., & Opler, L. A. (1987). The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin*, 13, 261–276. <http://dx.doi.org/10.1093/schbul/13.2.261>
- Keefe, R. S., & Fenton, W. S. (2007). How should DSM-V criteria for schizophrenia include cognitive impairment? *Schizophrenia Bulletin*, 33, 912–920. <http://dx.doi.org/10.1093/schbul/sbm046>
- Kendell, R., & Jablensky, A. (2003). Distinguishing between the validity and utility of psychiatric diagnoses. *The American Journal of Psychiatry*, 160, 4–12. <http://dx.doi.org/10.1176/appi.ajp.160.1.4>
- Kendler, K. S., Aggen, S. H., Knudsen, G. P., Røysamb, E., Neale, M. C., & Reichborn-Kjennerud, T. (2011). The structure of genetic and environmental risk factors for syndromal and subsyndromal common DSM-IV axis I and all axis II disorders. *The American Journal of Psychiatry*, 168, 29–39. <http://dx.doi.org/10.1176/appi.ajp.2010.10030340>
- Kendler, K. S., Czajkowski, N., Tambs, K., Torgersen, S., Aggen, S. H., Neale, M. C., & Reichborn-Kjennerud, T. (2006). Dimensional representations of

- DSM-IV cluster A personality disorders in a population-based sample of Norwegian twins: A multivariate study. *Psychological Medicine*, 36, 1583–1591. <http://dx.doi.org/10.1017/S0033291706008609>
- Kendler, K. S., Davis, C. G., & Kessler, R. C. (1997). The familial aggregation of common psychiatric and substance use disorders in the National Comorbidity Survey: A family history study. *The British Journal of Psychiatry*, 170, 541–548. <http://dx.doi.org/10.1192/bjp.170.6.541>
- Kendler, K. S., Prescott, C. A., Myers, J., & Neale, M. C. (2003). The structure of genetic and environmental risk factors for common psychiatric and substance use disorders in men and women. *Archives of General Psychiatry*, 60, 929–937. <http://dx.doi.org/10.1001/archpsyc.60.9.929>
- Kessler, R. C., Chiu, W. T., Demler, O., Merikangas, K. R., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, 62, 617–627. <http://dx.doi.org/10.1001/archpsyc.62.6.617>
- Kessler, R. C., Ormel, J., Petukhova, M., McLaughlin, K. A., Green, J. G., Russo, L. J., . . . Ustün, T. B. (2011). Development of lifetime comorbidity in the World Health Organization world mental health surveys. *Archives of General Psychiatry*, 68, 90–100. <http://dx.doi.org/10.1001/archgenpsychiatry.2010.180>
- Keyes, K. M., Eaton, N. R., Krueger, R. F., McLaughlin, K. A., Wall, M. M., Grant, B. F., & Hasin, D. S. (2012). Childhood maltreatment and the structure of common psychiatric disorders. *The British Journal of Psychiatry*, 200, 107–115. <http://dx.doi.org/10.1192/bjp.bp.111.093062>
- Keyes, K. M., Eaton, N. R., Krueger, R. F., Skodol, A. E., Wall, M. M., Grant, B., . . . Hasin, D. S. (2013). Thought disorder in the meta-structure of psychopathology. *Psychological Medicine*, 43, 1673–1683. <http://dx.doi.org/10.1017/S0033291712002292>
- Kim, H., & Eaton, N. R. (2015). The hierarchical structure of common mental disorders: Connecting multiple levels of comorbidity, bifactor models, and predictive validity. *Journal of Abnormal Psychology*, 124, 1064–1078. <http://dx.doi.org/10.1037/abn0000113>
- Kim, Y., & Muthén, B. O. (2009). Two-part factor mixture modeling: Application to an aggressive behavior instrument. *Structural Equation Modeling*, 16, 602–624. <http://dx.doi.org/10.1080/1070510903203516>
- Kirkpatrick, B., Strauss, G. P., Nguyen, L., Fischer, B. A., Daniel, D. G., Cienfuegos, A., & Marder, S. R. (2011). The Brief Negative Symptom Scale: Psychometric properties. *Schizophrenia Bulletin*, 37, 300–305. <http://dx.doi.org/10.1093/schbul/sbq059>
- Koffel, E. (2011). Further validation of the Iowa Sleep Disturbances Inventory. *Psychological Assessment*, 23, 587–598. <http://dx.doi.org/10.1037/a0022818>
- Kotov, R. (2016). The quantitative classification of mental illness: Emerging solution to boundary problems. In E. Bromet (Ed.), *Long-term outcomes in psychopathology research: Rethinking the scientific agenda* (pp. 140–157). New York, NY: Oxford University Press.
- Kotov, R., Chang, S.-W., Fochtmann, L. J., Mojtabai, R., Carlson, G. A., Sedler, M. J., & Bromet, E. J. (2011). Schizophrenia in the internalizing-externalizing framework: A third dimension? *Schizophrenia Bulletin*, 37, 1168–1178. <http://dx.doi.org/10.1093/schbul/sbq024>
- Kotov, R., Foti, D., Li, K., Bromet, E. J., Hajcak, G., & Ruggero, C. J. (2016). Validating dimensions of psychosis symptomatology: Neural correlates and 20-year outcomes. *Journal of Abnormal Psychology*, 125, 1103–1119. <http://dx.doi.org/10.1037/abn0000188>
- Kotov, R., Gamez, W., Schmidt, F., & Watson, D. (2010). Linking “big” personality traits to anxiety, depressive, and substance use disorders: A meta-analysis. *Psychological Bulletin*, 136, 768–821.
- Kotov, R., Leong, S. H., Mojtabai, R., Erlanger, A. C. E., Fochtmann, L. J., Constantino, E., . . . Bromet, E. J. (2013). Boundaries of schizoaffective disorder: Revisiting Kraepelin. *Journal of the American Medical Association Psychiatry*, 70, 1276–1286. <http://dx.doi.org/10.1001/jamapsychiatry.2013.2350>
- Kotov, R., Perlman, G., Gámez, W., & Watson, D. (2015). The structure and short-term stability of the emotional disorders: A dimensional approach. *Psychological Medicine*, 45, 1687–1698. <http://dx.doi.org/10.1017/S0033291714002815>
- Kotov, R., Ruggero, C. J., Krueger, R. F., Watson, D., Yuan, Q., & Zimmerman, M. (2011). New dimensions in the quantitative classification of mental illness. *Archives of General Psychiatry*, 68, 1003–1011. <http://dx.doi.org/10.1001/archgenpsychiatry.2011.107>
- Kramer, M. D., Krueger, R. F., & Hicks, B. M. (2008). The role of internalizing and externalizing liability factors in accounting for gender differences in the prevalence of common psychopathological syndromes. *Psychological Medicine*, 38, 51–61. <http://dx.doi.org/10.1017/S0033291707001572>
- Kring, A. M., Gur, R. E., Blanchard, J. J., Horan, W. P., & Reise, S. P. (2013). The clinical assessment interview for negative symptoms (CAINS): Final development and validation. *The American Journal of Psychiatry*, 170, 165–172. <http://dx.doi.org/10.1176/appi.ajp.2012.12010109>
- Krueger, R. F. (1999). The structure of common mental disorders. *Archives of General Psychiatry*, 56, 921–926. <http://dx.doi.org/10.1001/archpsyc.56.10.921>
- Krueger, R. F., Caspi, A., Moffitt, T. E., & Silva, P. A. (1998). The structure and stability of common mental disorders (DSM-III-R): A longitudinal-epidemiological study. *Journal of Abnormal Psychology*, 107, 216–227. <http://dx.doi.org/10.1037/0021-843X.107.2.216>
- Krueger, R. F., Chentsova-Dutton, Y. E., Markon, K. E., Goldberg, D., & Ormel, J. (2003). A cross-cultural study of the structure of comorbidity among common psychopathological syndromes in the general health care setting. *Journal of Abnormal Psychology*, 112, 437–447. <http://dx.doi.org/10.1037/0021-843X.112.3.437>
- Krueger, R. F., Derringer, J., Markon, K. E., Watson, D., & Skodol, A. E. (2012). Initial construction of a maladaptive personality trait model and inventory for DSM-5. *Psychological Medicine*, 42, 1879–1890. <http://dx.doi.org/10.1017/S0033291711002674>
- Krueger, R. F., Hicks, B. M., Patrick, C. J., Carlson, S. R., Iacono, W. G., & McGue, M. (2002). Etiologic connections among substance dependence, antisocial behavior, and personality: Modeling the externalizing spectrum. *Journal of Abnormal Psychology*, 111, 411–424. <http://dx.doi.org/10.1037/0021-843X.111.3.411>
- Krueger, R. F., & Markon, K. E. (2006). Reinterpreting comorbidity: A model-based approach to understanding and classifying psychopathology. *Annual Review of Clinical Psychology*, 2, 111–133. <http://dx.doi.org/10.1146/annurev.clinpsy.2.022305.095213>
- Krueger, R. F., & Markon, K. E. (2011). A dimensional-spectrum model of psychopathology: Progress and opportunities. *Archives of General Psychiatry*, 68, 10–11. <http://dx.doi.org/10.1001/archgenpsychiatry.2010.188>
- Krueger, R. F., & Markon, K. E. (2014). The role of the DSM-5 personality trait model in moving toward a quantitative and empirically based approach to classifying personality and psychopathology. *Annual Review of Clinical Psychology*, 10, 477–501. <http://dx.doi.org/10.1146/annurev-clinpsy-032813-153732>
- Krueger, R. F., Markon, K. E., Patrick, C. J., Benning, S. D., & Kramer, M. D. (2007). Linking antisocial behavior, substance use, and personality: An integrative quantitative model of the adult externalizing spectrum. *Journal of Abnormal Psychology*, 116, 645–666. <http://dx.doi.org/10.1037/0021-843X.116.4.645>
- Krueger, R. F., & South, S. C. (2009). Externalizing disorders: Cluster 5 of the proposed meta-structure for DSM-V and ICD-11. *Psychological Medicine*, 39, 2061–2070. <http://dx.doi.org/10.1017/S0033291709990328>

- Kupfer, D. J., First, M. B., Sirovatka, P. J., & Regier, D. A. (Eds.). (2002). *A research agenda for DSM-V*. Washington, DC: American Psychiatric Association.
- Laceulle, O. M., Vollebergh, W. A., & Ormel, J. (2015). The structure of psychopathology in adolescence replication of a general psychopathology factor in the TRAILS Study. *Clinical Psychological Science, 3*, 850–860. <http://dx.doi.org/10.1177/2167702614560750>
- Lahey, B. B., Applegate, B., Hakes, J. K., Zald, D. H., Hariri, A. R., & Rathouz, P. J. (2012). Is there a general factor of prevalent psychopathology during adulthood? *Journal of Abnormal Psychology, 121*, 971–977. <http://dx.doi.org/10.1037/a0028355>
- Lahey, B. B., Applegate, B., Waldman, I. D., Loft, J. D., Hankin, B. L., & Rick, J. (2004). The structure of child and adolescent psychopathology: Generating new hypotheses. *Journal of Abnormal Psychology, 113*, 358–385. <http://dx.doi.org/10.1037/0021-843X.113.3.358>
- Lahey, B. B., Pelham, W. E., Loney, J., Lee, S. S., & Willcutt, E. (2005). Instability of the *DSM-IV* Subtypes of ADHD from preschool through elementary school. *Archives of General Psychiatry, 62*, 896–902. <http://dx.doi.org/10.1001/archpsyc.62.8.896>
- Lahey, B. B., Rathouz, P. J., Keenan, K., Stepp, S. D., Loeber, R., & Hipwell, A. E. (2015). Criterion validity of the general factor of psychopathology in a prospective study of girls. *Journal of Child Psychology and Psychiatry, 56*, 415–422. <http://dx.doi.org/10.1111/jcpp.12300>
- Lahey, B. B., Rathouz, P. J., Van Hulle, C., Urbano, R. C., Krueger, R. F., Applegate, B., . . . Waldman, I. D. (2008). Testing structural models of *DSM-IV* symptoms of common forms of child and adolescent psychopathology. *Journal of Abnormal Child Psychology, 36*, 187–206. <http://dx.doi.org/10.1007/s10802-007-9169-5>
- Lahey, B. B., Van Hulle, C. A., Singh, A. L., Waldman, I. D., & Rathouz, P. J. (2011). Higher-order genetic and environmental structure of prevalent forms of child and adolescent psychopathology. *Archives of General Psychiatry, 68*, 181–189. <http://dx.doi.org/10.1001/archgenpsychiatry.2010.192>
- Leary, T. (1996). Interpersonal circumplex. *Journal of Personality Assessment, 66*, 301–307. [http://dx.doi.org/10.1207/s15327752jpa6602\\_8](http://dx.doi.org/10.1207/s15327752jpa6602_8)
- Lichtenstein, P., Yip, B. H., Björk, C., Pawitan, Y., Cannon, T. D., Sullivan, P. F., & Hultman, C. M. (2009). Common genetic determinants of schizophrenia and bipolar disorder in Swedish families: A population-based study. *The Lancet, 373*, 234–239. [http://dx.doi.org/10.1016/S0140-6736\(09\)60072-6](http://dx.doi.org/10.1016/S0140-6736(09)60072-6)
- Livesley, W. J., & Jackson, D. (2009). *Manual for the dimensional assessment of personality pathology—Basic Questionnaire*. Port Huron, MI: Sigma.
- Longley, S. L., Watson, D., & Noyes, R., Jr. (2005). Assessment of the hypochondriasis domain: The multidimensional inventory of hypochondriacal traits (MIHT). *Psychological Assessment, 17*, 3–14. <http://dx.doi.org/10.1037/1040-3590.17.1.3>
- Lorr, M., Klett, C. J., & McNair, D. M. (1963). *Syndromes of psychosis*. New York, NY: Pergamon Press.
- MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practice of dichotomization of quantitative variables. *Psychological Methods, 7*, 19–40. <http://dx.doi.org/10.1037/1082-989X.7.1.19>
- Macfarlane, J. W., Allen, L., & Honzik, M. P. (1954). *A developmental study of the behavior problems of normal children between 21 months and 14 years*. Berkeley, CA: University of California Press.
- Markon, K. E. (2010a). Modeling psychopathology structure: A symptom-level analysis of Axis I and II disorders. *Psychological Medicine, 40*, 273–288. <http://dx.doi.org/10.1017/S0033291709990183>
- Markon, K. E. (2010b). How things fall apart: Understanding the nature of internalizing through its relationship with impairment. *Journal of Abnormal Psychology, 119*, 447–458. <http://dx.doi.org/10.1037/a0019707>
- Markon, K. E. (2013). Epistemological pluralism and scientific development: An argument against authoritative nosologies. *Journal of Personality Disorders, 27*, 554–579. <http://dx.doi.org/10.1521/pedi.2013.27.5.554>
- Markon, K. E., Chmielewski, M., & Miller, C. J. (2011). The reliability and validity of discrete and continuous measures of psychopathology: A quantitative review. *Psychological Bulletin, 137*, 856–879. <http://dx.doi.org/10.1037/a0023678>
- Markon, K. E., & Krueger, R. F. (2005). Categorical and continuous models of liability to externalizing disorders: A direct comparison in NESARC. *Archives of General Psychiatry, 62*, 1352–1359. <http://dx.doi.org/10.1001/archpsyc.62.12.1352>
- Markon, K. E., Krueger, R. F., & Watson, D. (2005). Delineating the structure of normal and abnormal personality: An integrative hierarchical approach. *Journal of Personality and Social Psychology, 88*, 139–157. <http://dx.doi.org/10.1037/0022-3514.88.1.139>
- Martinez, M., Marangell, L. B., & Martinez, J. M. (2008). Psychopharmacology. In R. E. Hales, S. C. Yudofsky, & G. O. Gabbard (Eds.), *The American psychiatric publishing textbook of psychiatry* (5th ed., pp. 1053–1133). Arlington, VA: American Psychiatric Publishing.
- Martinez, S., & Rosenheck, R. A. (2008). Psychopharmacotherapy. In R. E. Hales, S. C. Yudofsky, & G. O. Gabbard (Eds.), *American psychiatric publishing textbook of psychiatry* (pp. 1053–1133). Arlington, VA: American Psychiatric Publishing.
- Mataix-Cols, D., Rosario-Campos, M. C., & Leckman, J. F. (2005). A multidimensional model of obsessive-compulsive disorder. *The American Journal of Psychiatry, 162*, 228–238. <http://dx.doi.org/10.1176/appi.ajp.162.2.228>
- McNulty, J. L., & Overstreet, S. R. (2014). Viewing the MMPI-2-RF structure through the Personality Psychopathology Five (PSY-5) lens. *Journal of Personality Assessment, 96*, 151–157. <http://dx.doi.org/10.1080/00223891.2013.840305>
- Merikangas, K. R., & Risch, N. (2003). Genomic priorities and public health. *Science, 302*, 599–601. <http://dx.doi.org/10.1126/science.1091468>
- Miller, M. W., Fogler, J. M., Wolf, E. J., Kaloupek, D. G., & Keane, T. M. (2008). The internalizing and externalizing structure of psychiatric comorbidity in combat veterans. *Journal of Traumatic Stress, 21*, 58–65. <http://dx.doi.org/10.1002/jts.20303>
- Miller, M. W., Wolf, E. J., Reardon, A., Greene, A., Ofrat, S., & McInerney, S. (2012). Personality and the latent structure of PTSD comorbidity. *Journal of Anxiety Disorders, 26*, 599–607. <http://dx.doi.org/10.1016/j.janxdis.2012.02.016>
- Mohamed, S., & Rosenheck, R. A. (2008). Pharmacotherapy of PTSD in the U.S. Department of Veterans Affairs: Diagnostic- and symptom-guided drug selection. *The Journal of Clinical Psychiatry, 69*, 959–965. <http://dx.doi.org/10.4088/JCP.v69n0611>
- Moore, T. V. (1930). The empirical determination of certain syndromes underlying praecox and manic-depressive psychoses. *The American Journal of Psychiatry, 86*, 719–738. <http://dx.doi.org/10.1176/ajp.86.4.719>
- Morey, L. C. (1991). *Professional manual for the Personality Assessment Inventory*. Odessa, FL: Psychological Assessment Resources.
- Morey, L. C. (2007). *Professional manual for the Personality Assessment Inventory* (2nd ed.). Lutz, FL: Psychological Assessment Resources.
- Morey, L. C., Hopwood, C. J., Markowitz, J. C., Gunderson, J. G., Grilo, C. M., McGlashan, T. H., . . . Skodol, A. E. (2012). Comparison of alternative models for personality disorders, II: 6-, 8- and 10-year follow-up. *Psychological Medicine, 42*, 1705–1713. <http://dx.doi.org/10.1017/S0033291711002601>
- Morey, L. C., Krueger, R. F., & Skodol, A. E. (2013). The hierarchical structure of clinician ratings of proposed *DSM-5* pathological personality traits. *Journal of Abnormal Psychology, 122*, 836–841. <http://dx.doi.org/10.1037/a0034003>
- Mosing, M. A., Gordon, S. D., Medland, S. E., Statham, D. J., Nelson, E. C., Heath, A. C., . . . Wray, N. R. (2009). Genetic and environmental

- influences on the co-morbidity between depression, panic disorder, agoraphobia, and social phobia: A twin study. *Depression and Anxiety*, 26, 1004–1011. <http://dx.doi.org/10.1002/da.20611>
- Nelson, B. D., Perlman, G., Hajcak, G., Klein, D. N., & Kotov, R. (2015). Familial risk for distress and fear disorders and emotional reactivity in adolescence: An event-related potential investigation. *Psychological Medicine*, 45, 2545–2556. <http://dx.doi.org/10.1017/S0033291715000471>
- Nelson, M. T., Seal, M. L., Pantelis, C., & Phillips, L. J. (2013). Evidence of a dimensional relationship between schizotypy and schizophrenia: A systematic review. *Neuroscience and Biobehavioral Reviews*, 37, 317–327. <http://dx.doi.org/10.1016/j.neubiorev.2013.01.004>
- Newby, J. M., Mackenzie, A., Williams, A. D., McIntyre, K., Watts, S., Wong, N., & Andrews, G. (2013). Internet cognitive behavioural therapy for mixed anxiety and depression: A randomized controlled trial and evidence of effectiveness in primary care. *Psychological Medicine*, 43, 2635–2648. <http://dx.doi.org/10.1017/S0033291713000111>
- O'Connor, B. P. (2005). A search for consensus on the dimensional structure of personality disorders. *Journal of Clinical Psychology*, 61, 323–345. <http://dx.doi.org/10.1002/jclp.20017>
- Olino, T. M., Dougherty, L. R., Bufferd, S. J., Carlson, G. A., & Klein, D. N. (2014). Testing models of psychopathology in preschool-aged children using a structured interview-based assessment. *Journal of Abnormal Child Psychology*, 42, 1201–1211. <http://dx.doi.org/10.1007/s10802-014-9865-x>
- Olino, T. M., Klein, D. N., Farmer, R. F., Seeley, J. R., & Lewinsohn, P. M. (2012). Examination of the structure of psychopathology using latent class analysis. *Comprehensive Psychiatry*, 53, 323–332. <http://dx.doi.org/10.1016/j.comppsy.2011.05.008>
- Ormel, J., Raven, D., van Oort, F., Hartman, C. A., Reijneveld, S. A., Veenstra, R., . . . Oldehinkel, A. J. (2015). Mental health in Dutch adolescents: A TRAILS report on prevalence, severity, age of onset, continuity and co-morbidity of DSM disorders. *Psychological Medicine*, 45, 345–360. <http://dx.doi.org/10.1017/S0033291714001469>
- Overall, J. E., & Gorham, D. R. (1962). The Brief Psychiatric Rating Scale. *Psychological Reports*, 10, 799–812. <http://dx.doi.org/10.2466/pr0.1962.10.3.799>
- Patrick, C. J., & Hajcak, G. (2016). RDoC: Translating promise into progress. *Psychophysiology*, 53, 415–424. <http://dx.doi.org/10.1111/psyp.12612>
- Patrick, C. J., Kramer, M. D., Krueger, R. F., & Markon, K. E. (2013). Optimizing efficiency of psychopathology assessment through quantitative modeling: Development of a brief form of the Externalizing Spectrum Inventory. *Psychological Assessment*, 25, 1332–1348. <http://dx.doi.org/10.1037/a0034864>
- Patrick, C. J., Venables, N. C., Yancey, J. R., Hicks, B. M., Nelson, L. D., & Kramer, M. D. (2013). A construct-network approach to bridging diagnostic and physiological domains: Application to assessment of externalizing psychopathology. *Journal of Abnormal Psychology*, 122, 902–916. <http://dx.doi.org/10.1037/a0032807>
- Peralta, V., Moreno-Izco, L., Calvo-Barrera, L., & Cuesta, M. J. (2013). The low- and higher-order factor structure of symptoms in patients with a first episode of psychosis. *Schizophrenia Research*, 147, 116–124. <http://dx.doi.org/10.1016/j.schres.2013.03.018>
- Raine, A. (2006). Schizotypal personality: Neurodevelopmental and psychosocial trajectories. *Annual Review of Clinical Psychology*, 2, 291–326. <http://dx.doi.org/10.1146/annurev.clinpsy.2.022305.095318>
- Regier, D. A., Narrow, W. E., Clarke, D. E., Kraemer, H. C., Kuramoto, S. J., Kuhl, E. A., & Kupfer, D. J. (2013). DSM-5 field trials in the United States and Canada, Part II: Test-retest reliability of selected categorical diagnoses. *The American Journal of Psychiatry*, 170, 59–70. <http://dx.doi.org/10.1176/appi.ajp.2012.12070999>
- Rescorla, L. A., Ginzburg, S., Achenbach, T. M., Ivanova, M. Y., Almqvist, F., Begovac, I., . . . Verhulst, F. C. (2013). Cross-informant agreement between parent-reported and adolescent self-reported problems in 25 societies. *Journal of Clinical Child and Adolescent Psychology*, 42, 262–273. <http://dx.doi.org/10.1080/15374416.2012.717870>
- Robertson, M. M., Althoff, R. R., Hafez, A., & Pauls, D. L. (2008). Principal components analysis of a large cohort with Tourette syndrome. *The British Journal of Psychiatry*, 193, 31–36. <http://dx.doi.org/10.1192/bjp.bp.107.039909>
- Rodriguez-Seijas, C., Eaton, N. R., & Krueger, R. F. (2015). How transdiagnostic factors of personality and psychopathology can inform clinical assessment and intervention. *Journal of Personality Assessment*, 97, 425–435. <http://dx.doi.org/10.1080/00223891.2015.1055752>
- Rodriguez-Seijas, C., Stohl, M., Hasin, D. S., & Eaton, N. R. (2015). Transdiagnostic factors and mediation of the relationship between perceived racial discrimination and mental disorders. *Journal of the American Medical Association Psychiatry*, 72, 706–713. <http://dx.doi.org/10.1001/jamapsychiatry.2015.0148>
- Rojas, S. L., & Widiger, T. A. (2014). The convergent and discriminant validity of the Five Factor Form. *Assessment*, 21, 143–157. <http://dx.doi.org/10.1177/1073191113517260>
- Røysamb, E., Kendler, K. S., Tambs, K., Orstavik, R. E., Neale, M. C., Aggen, S. H., . . . Reichbørn-Kjennerud, T. (2011). The joint structure of DSM-IV Axis I and Axis II disorders. *Journal of Abnormal Psychology*, 120, 198–209. <http://dx.doi.org/10.1037/a0021660>
- Ruggero, C. J., Kotov, R., Watson, D., Kilmer, J. N., Perlman, G., & Liu, K. (2014). Beyond a single index of mania symptoms: Structure and validity of subdimensions. *Journal of Affective Disorders*, 161, 8–15. <http://dx.doi.org/10.1016/j.jad.2014.02.044>
- Sachdev, P., Andrews, G., Hobbs, M. J., Sunderland, M., & Anderson, T. M. (2009). Neurocognitive disorders: Cluster 1 of the proposed meta-structure for DSM-V and ICD-11. *Psychological Medicine*, 39, 2001–2012. <http://dx.doi.org/10.1017/S0033291709990262>
- Sakashita, C., Slade, T., & Andrews, G. (2007). Empirical investigation of two assumptions in the diagnosis of DSM-IV major depressive episode. *The Australian and New Zealand Journal of Psychiatry*, 41, 17–23. <http://dx.doi.org/10.1080/00048670601050440>
- Samuel, D. B., & Widiger, T. A. (2008). A meta-analytic review of the relationships between the five-factor model and DSM-IV-TR personality disorders: A facet level analysis. *Clinical Psychology Review*, 28, 1326–1342. <http://dx.doi.org/10.1016/j.cpr.2008.07.002>
- Saulsman, L. M., & Page, A. C. (2004). The five-factor model and personality disorder empirical literature: A meta-analytic review. *Clinical Psychology Review*, 23, 1055–1085. <http://dx.doi.org/10.1016/j.cpr.2002.09.001>
- Sellbom, M. (2016). Mapping the MMPI-2-RF Specific Problems scales onto extant psychopathology structures. *Journal of Personality Assessment*. Advance online publication. <http://dx.doi.org/10.1080/00223891.2016.1206909>
- Sellbom, M., Ben-Porath, Y. S., & Bagby, R. M. (2008). Personality and psychopathology: Mapping the MMPI-2 Restructured Clinical (RC) Scales onto the five factor model of personality. *Journal of Personality Disorders*, 22, 291–312. <http://dx.doi.org/10.1521/pedi.2008.22.3.291>
- Shea, M. T., Stout, R., Gunderson, J., Morey, L. C., Grilo, C. M., McGlashan, T., . . . Keller, M. B. (2002). Short-term diagnostic stability of schizotypal, borderline, avoidant, and obsessive-compulsive personality disorders. *The American Journal of Psychiatry*, 159, 2036–2041. <http://dx.doi.org/10.1176/appi.ajp.159.12.2036>
- Siever, L. J., & Davis, K. L. (2004). The pathophysiology of schizophrenia disorders: Perspectives from the spectrum. *The American Journal of Psychiatry*, 161, 398–413. <http://dx.doi.org/10.1176/appi.ajp.161.3.398>
- Simms, L. J., Goldberg, L. R., Roberts, J. E., Watson, D., Welte, J., & Rotterman, J. H. (2011). Computerized adaptive assessment of personality disorder: Introducing the CAT-PD project. *Journal of Personality Assessment*, 93, 380–389. <http://dx.doi.org/10.1080/00223891.2011.577475>

- Simms, L. J., Prisciandaro, J. J., Krueger, R. F., & Goldberg, D. P. (2012). The structure of depression, anxiety and somatic symptoms in primary care. *Psychological Medicine*, *42*, 15–28. <http://dx.doi.org/10.1017/S0033291711000985>
- Slade, T. (2007). The descriptive epidemiology of internalizing and externalizing psychiatric dimensions. *Social Psychiatry and Psychiatric Epidemiology*, *42*, 554–560. <http://dx.doi.org/10.1007/s00127-007-0200-5>
- Slade, T., & Watson, D. (2006). The structure of common DSM-IV and ICD-10 mental disorders in the Australian general population. *Psychological Medicine*, *36*, 1593–1600. <http://dx.doi.org/10.1017/S0033291706008452>
- South, S. C., Krueger, R. F., & Iacono, W. G. (2011). Understanding general and specific connections between psychopathology and marital distress: A model based approach. <http://dx.doi.org/10.1037/a0025417>
- Starr, L. R., Conway, C. C., Hammen, C. L., & Brennan, P. A. (2014). Transdiagnostic and disorder-specific models of intergenerational transmission of internalizing pathology. *Psychological Medicine*, *44*, 161–172. <http://dx.doi.org/10.1017/S003329171300055X>
- Sterba, S. K., Copeland, W., Egger, H. L., Jane Costello, E., Erkanli, A., & Angold, A. (2010). Longitudinal dimensionality of adolescent psychopathology: Testing the differentiation hypothesis. *Journal of Child Psychology and Psychiatry*, *51*, 871–884. <http://dx.doi.org/10.1111/j.1469-7610.2010.02234.x>
- Sterba, S., Egger, H. L., & Angold, A. (2007). Diagnostic specificity and nonspecificity in the dimensions of preschool psychopathology. *Journal of Child Psychology and Psychiatry*, *48*, 1005–1013. <http://dx.doi.org/10.1111/j.1469-7610.2007.01770.x>
- Strauss, G. P., Hong, L. E., Gold, J. M., Buchanan, R. W., McMahon, R. P., Keller, W. R., . . . Kirkpatrick, B. (2012). Factor structure of the Brief Negative Symptom Scale. *Schizophrenia Research*, *142*, 96–98. <http://dx.doi.org/10.1016/j.schres.2012.09.007>
- Strauss, G. P., Horan, W. P., Kirkpatrick, B., Fischer, B. A., Keller, W. R., Miski, P., . . . Carpenter, W. T., Jr. (2013). Deconstructing negative symptoms of schizophrenia: Avolition-apathy and diminished expression clusters predict clinical presentation and functional outcome. *Journal of Psychiatric Research*, *47*, 783–790. <http://dx.doi.org/10.1016/j.jpsychires.2013.01.015>
- Strauss, J. S. (1969). Hallucinations and delusions as points on continua function. Rating scale evidence. *Archives of General Psychiatry*, *21*, 581–586. <http://dx.doi.org/10.1001/archpsyc.1969.01740230069010>
- Strauss, J. S., Carpenter, W. T., & Bartko, J. J. (1974). Part III. Speculations on the processes that underlie schizophrenic symptoms and signs. *Schizophrenia Bulletin*, *1*, 61–69. <http://dx.doi.org/10.1093/schbul/1.11.61>
- Sunderland, M., & Slade, T. (2015). The relationship between internalizing psychopathology and suicidality, treatment seeking, and disability in the Australian population. *Journal of Affective Disorders*, *171*, 6–12. <http://dx.doi.org/10.1016/j.jad.2014.09.012>
- Sunderland, M., Slade, T., Krueger, R. F., Markon, K. E., Patrick, C. J., & Kramer, M. D. (2016). Efficiently measuring dimensions of the externalizing spectrum model: Development of the Externalizing Spectrum Inventory-Computerized Adaptive Test (ESI-CAT). *Psychological Assessment*. Advance online publication. <http://dx.doi.org/10.1037/pas0000384>
- Tackett, J. L., Lahey, B. B., van Hulle, C., Waldman, I., Krueger, R. F., & Rathouz, P. J. (2013). Common genetic influences on negative emotionality and a general psychopathology factor in childhood and adolescence. *Journal of Abnormal Psychology*, *122*, 1142–1153. <http://dx.doi.org/10.1037/a0034151>
- Teesson, M., Slade, T., & Mills, K. (2009). Comorbidity in Australia: Findings of the 2007 National Survey of Mental Health and Wellbeing. *Australian and New Zealand Journal of Psychiatry*, *43*, 606–614. <http://dx.doi.org/10.1080/00048670902970908>
- Tellegen, A. (1985). Structures of mood and personality and their relevance to assessing anxiety, with an emphasis on self-report. In A. H. Tuma & J. D. Maser (Eds.), *Anxiety and the anxiety disorders* (pp. 681–706). Hillsdale, NJ: Erlbaum.
- Thornton, L. M., Welch, E., Munn-Chernoff, M. A., Lichtenstein, P., & Bulik, C. M. (2016). Anorexia nervosa, major depression, and suicide attempts: Shared genetic factors. *Suicide and Life-Threatening Behavior*, *46*, 525–534. <http://dx.doi.org/10.1111/sltb.12235>
- Torgersen, S., Czajkowski, N., Jacobson, K., Reichbørn-Kjennerud, T., Røysamb, E., Neale, M. C., & Kendler, K. S. (2008). Dimensional representations of DSM-IV cluster B personality disorders in a population-based sample of Norwegian twins: A multivariate study. *Psychological Medicine*, *38*, 1617–1625. <http://dx.doi.org/10.1017/S0033291708002924>
- Vachon, D. D., Krueger, R. F., Rogosch, F. A., & Cicchetti, D. (2015). Assessment of the harmful psychiatric and behavioral effects of different forms of child maltreatment. *Journal of the American Medical Association Psychiatry*, *72*, 1135–1142. <http://dx.doi.org/10.1001/jamapsychiatry.2015.1792>
- Vaidyanathan, U., Patrick, C. J., & Iacono, W. G. (2011). Patterns of comorbidity among mental disorders: A person-centered approach. *Comprehensive Psychiatry*, *52*, 527–535. <http://dx.doi.org/10.1016/j.comppsy.2010.10.006>
- van Os, J., Linscott, R. J., Myin-Germeys, I., Delespaul, P., & Krabbedam, L. (2009). A systematic review and meta-analysis of the psychosis continuum: Evidence for a psychosis proneness-persistence-impairment model of psychotic disorder. *Psychological Medicine*, *39*, 179–195. <http://dx.doi.org/10.1017/S0033291708003814>
- Verona, E., Javdani, S., & Sprague, J. (2011). Comparing factor structures of adolescent psychopathology. *Psychological Assessment*, *23*, 545–551. <http://dx.doi.org/10.1037/a0022055>
- Vollebergh, W. A., Iedema, J., Bijl, R. V., de Graaf, R., Smit, F., & Ormel, J. (2001). The structure and stability of common mental disorders: The NEMESIS study. *Archives of General Psychiatry*, *58*, 597–603. <http://dx.doi.org/10.1001/archpsyc.58.6.597>
- Vrieze, S. I., Perlman, G., Krueger, R. F., & Iacono, W. G. (2012). Is the continuity of externalizing psychopathology the same in adolescents and middle-aged adults? A test of the externalizing spectrum's developmental coherence. *Journal of Abnormal Child Psychology*, *40*, 459–470. <http://dx.doi.org/10.1007/s10802-011-9571-x>
- Walton, K. E., Ormel, J., & Krueger, R. F. (2011). The dimensional nature of externalizing behaviors in adolescence: Evidence from a direct comparison of categorical, dimensional, and hybrid models. *Journal of Abnormal Child Psychology*, *39*, 553–561. <http://dx.doi.org/10.1007/s10802-010-9478-y>
- Waszczuk, M. A., Kotov, R., Ruggero, C. J., Gamez, W., & Watson, D. (in press). Hierarchical structure of emotional disorders: From individual symptoms to the spectrum. *Journal of Abnormal Psychology*.
- Waszczuk, M. A., Zavos, H. M., Gregory, A. M., & Eley, T. C. (2014). The phenotypic and genetic structure of depression and anxiety disorder symptoms in childhood, adolescence, and young adulthood. *Journal of the American Medical Association Psychiatry*, *71*, 905–916. <http://dx.doi.org/10.1001/jamapsychiatry.2014.655>
- Watson, D. (2003a). Subtypes, specifiers, epicycles, and eccentrics: Towards a more parsimonious taxonomy of psychopathology. *Clinical Psychology: Science and Practice*, *10*, 233–238. <http://dx.doi.org/10.1093/clipsy.bpg013>
- Watson, D. (2003b). Investigating the construct validity of the dissociative taxon: Stability analyses of normal and pathological dissociation. *Journal of Abnormal Psychology*, *112*, 298–305. <http://dx.doi.org/10.1037/0021-843X.112.2.298>
- Watson, D. (2005). Rethinking the mood and anxiety disorders: A quantitative hierarchical model for DSM-V. *Journal of Abnormal Psychology*, *114*, 522–536. <http://dx.doi.org/10.1037/0021-843X.114.4.522>



- Watson, D., O'Hara, M. W., Naragon-Gainey, K., Koffel, E., Chmielewski, M., Kotov, R., . . . Ruggero, C. J. (2012). Development and validation of new anxiety and bipolar symptom scales for an expanded version of the IDAS (the IDAS-II). *Assessment, 19*, 399–420. <http://dx.doi.org/10.1177/1073191112449857>
- Watson, D., O'Hara, M. W., Simms, L. J., Kotov, R., Chmielewski, M., McDade-Montez, E. A., . . . Stuart, S. (2007). Development and validation of the Inventory of Depression and Anxiety Symptoms (IDAS). *Psychological Assessment, 19*, 253–268. <http://dx.doi.org/10.1037/1040-3590.19.3.253>
- Watson, D., Stasik, S. M., Ellickson-Larew, S., & Stanton, K. (2015). Extraversion and psychopathology: A facet-level analysis. *Journal of Abnormal Psychology, 124*, 432–446. <http://dx.doi.org/10.1037/abn0000051>
- Watson, D., & Wu, K. D. (2005). Development and validation of the Schedule of Compulsions, Obsessions, and Pathological Impulses (SCOPI). *Assessment, 12*, 50–65. <http://dx.doi.org/10.1177/1073191104271483>
- Watson, D., Wu, K. D., & Cutshall, C. (2004). Symptom subtypes of obsessive-compulsive disorder and their relation to dissociation. *Journal of Anxiety Disorders, 18*, 435–458. [http://dx.doi.org/10.1016/S0887-6185\(03\)00029-X](http://dx.doi.org/10.1016/S0887-6185(03)00029-X)
- Weathers, F. W., Litz, B. T., Herman, D. S., Huska, J. A., & Keane, T. M. (1993, October). *The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility*. Paper presented at the annual meeting of the International Society for Traumatic Stress Studies, San Antonio, TX.
- Weich, S., McBride, O., Hussey, D., Exeter, D., Brugha, T., & McManus, S. (2011). Latent class analysis of co-morbidity in the Adult Psychiatric Morbidity Survey in England 2007: Implications for DSM-5 and ICD-11. *Psychological Medicine, 41*, 2201–2212. <http://dx.doi.org/10.1017/S0033291711000249>
- Weinberg, A., Kotov, R., & Proudfit, G. H. (2015). Neural indicators of error processing in generalized anxiety disorder, obsessive-compulsive disorder, and major depressive disorder. *Journal of Abnormal Psychology, 124*, 172–185. <http://dx.doi.org/10.1037/abn0000019>
- Widiger, T. A., Lynam, D. R., Miller, J. D., & Oltmanns, T. F. (2012). Measures to assess maladaptive variants of the five-factor model. *Journal of Personality Assessment, 94*, 450–455. <http://dx.doi.org/10.1080/00223891.2012.677887>
- Widiger, T. A., & Mullins-Sweatt, S. N. (2009). Five-factor model of personality disorder: A proposal for DSM-V. *Annual Review of Clinical Psychology, 5*, 197–220. <http://dx.doi.org/10.1146/annurev.clinpsy.032408.153542>
- Widiger, T. A., & Samuel, D. B. (2005). Diagnostic categories or dimensions? A question for the Diagnostic and statistical manual of mental disorders—fifth ed. *Journal of Abnormal Psychology, 114*, 494–504.
- Widiger, T. A., & Simonsen, E. (2005). Alternative dimensional models of personality disorder: Finding a common ground. *Journal of Personality Disorders, 19*, 110–130. <http://dx.doi.org/10.1521/pepi.19.2.110.62628>
- Widiger, T. A., & Trull, T. J. (2007). Plate tectonics in the classification of personality disorder: Shifting to a dimensional model. *American Psychologist, 62*, 71–83. <http://dx.doi.org/10.1037/0003-066X.62.2.71>
- Wittenborn, J. R. (1951). Symptom patterns in a group of mental hospital patients. *Journal of Consulting Psychology, 15*, 290–302. <http://dx.doi.org/10.1037/h0054947>
- Wolf, A. W., Schubert, D. S., Patterson, M. B., Grande, T. P., Brocco, K. J., & Pendleton, L. (1988). Associations among major psychiatric diagnoses. *Journal of Consulting and Clinical Psychology, 56*, 292–294. <http://dx.doi.org/10.1037/0022-006X.56.2.292>
- Wolf, E. J., Miller, M. W., Krueger, R. F., Lyons, M. J., Tsuang, M. T., & Koenen, K. C. (2010). Posttraumatic stress disorder and the genetic structure of comorbidity. *Journal of Abnormal Psychology, 119*, 320–330. <http://dx.doi.org/10.1037/a0019035>
- World Health Organization (WHO). (1992). *The ICD-10 Classification of Mental Disorders*. Geneva, Switzerland: World Health Organization.
- Wright, A. G., Krueger, R. F., Hobbs, M. J., Markon, K. E., Eaton, N. R., & Slade, T. (2013). The structure of psychopathology: Toward an expanded quantitative empirical model. *Journal of Abnormal Psychology, 122*, 281–294. <http://dx.doi.org/10.1037/a0030133>
- Wright, A. G., & Simms, L. J. (2014). On the structure of personality disorder traits: Conjoint analyses of the CAT-PD, PID-5, and NEO-PI-3 trait models. *Personality Disorders: Theory, Research, and Treatment, 5*, 43–54. <http://dx.doi.org/10.1037/per0000037>
- Wright, A. G. C., & Simms, L. J. (2015). A metastructural model of mental disorders and pathological personality traits. *Psychological Medicine, 45*, 2309–2319. <http://dx.doi.org/10.1017/S0033291715000252>
- Wright, A. G., Thomas, K. M., Hopwood, C. J., Markon, K. E., Pincus, A. L., & Krueger, R. F. (2012). The hierarchical structure of DSM-5 pathological personality traits. *Journal of Abnormal Psychology, 121*, 951–957. <http://dx.doi.org/10.1037/a0027669>
- Yancey, J. R., Venables, N. C., & Patrick, C. J. (2016). Psychoneurometric operationalization of threat sensitivity: Relations with clinical symptom and physiological response criteria. *Psychophysiology, 53*, 393–405. <http://dx.doi.org/10.1111/psyp.12512>
- Yufik, T., & Simms, L. J. (2010). A meta-analytic investigation of the structure of posttraumatic stress disorder symptoms. *Journal of Abnormal Psychology, 119*, 764–776. <http://dx.doi.org/10.1037/a0020981>
- Zimmerman, M., Ellison, W., Young, D., Chelminski, I., & Dalrymple, K. (2015). How many different ways do patients meet the diagnostic criteria for major depressive disorder? *Comprehensive Psychiatry, 56*, 29–34. <http://dx.doi.org/10.1016/j.comppsy.2014.09.007>

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