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PSYCHIATRIC DIAGNOSIS (MB FIRST, SECTION EDITOR)

Challenges and Strategies in Helping the DSM Become More Dimensional and Empirically Based

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Abstract The DSM-5 creation process and outcome underlines a core tension in psychiatry between empirical evidence that mental pathologies tend to be dimensional and a historical emphasis on delineating categorical disorders to frame psychiatric thinking. The DSM has been slow to reflect dimensional evidence because doing so is often perceived as a disruptive paradigm shift. As a result, other authorities are making this shift, circumventing the DSM in the process. For example, through the Research Domain Criteria (RDoC), NIMH now encourages investigators to focus on a dimensional and neuroscientific conceptualization of mental disorder research. Fortunately, the DSM-5 contains a dimensional model of maladaptive personality traits that provides clinical descriptors that align conceptually with the neuroscience-based dimensions delineated in the RDoC and in basic science research. Through frameworks such as the DSM-5 trait model, the DSM can evolve to better incorporate evidence of the dimensionality of mental disorder.

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Introduction

Those of us who have devoted our careers to trying to help people with mental disorders live in interesting times. Historically, much research and clinical conceptualization of mental disorders has been tied closely to the DSM and the categorical diagnostic paradigm it embodies. For example, grant proposals often begin by citing the prevalence of a DSM mental disorder category as evidence that the proposal is focused on a topic of importance to public health. Similarly, the category label we apply to a specific patient often frames our work in the clinic. For example, a clinician might decide, after careful consideration, that a given patient has a psychotic disorder, which indicates a specific course of pharmacological and behavioral treatment, whereas in contrast, the next patient better matches the criteria for severe obsessive-compulsive disorder, indicating distinct interventions.

These activities, however, are becoming increasingly untenable for many clinicians and researchers. Clinicians are frequently frustrated with the inability to characterize patients in terms of a single "best categorical diagnosis," often relying on vague formulations such as not-otherwise-specified (NOS) diagnoses, as opposed to more specific descriptive labels because patients often do not fit neatly into single DSM categories [1]. Similarly, it is difficult to identify patients for research studies who meet criteria for a single, specific mental disorder category (e.g., persons who meet criteria for major depression but not for any anxiety disorders) [2], leading NIMH to withdraw support for research on DSM categories. Instead, NIMH now encourages contemporary investigators to frame their research by dimensions closely connected with neurobiology, under the aegis of the Research Domain Criteria

(RDoC) project (http://www.nimh.nih.gov/research-priorities/rdoc/index.shtml).

In spite of frustrations with the limited clinical utility of categories and NIMH curtailing its support for research on psychiatric categories, the DSM-5 is a fairly conservative document. The DSM-5 construction process began with the task force co-chairs (Drs. Kupfer and Regier) explicitly seeking a progressive and dimensionally oriented manual [3•], but ended up with a manual that is more an updated version of DSM-IV-TR, as opposed to the sea change that the DSM-5 task force chairs originally envisioned [4].

This tension between preserving the past and looking toward the future is most obvious when one examines the way personality disorders (PDs) are described in DSM-5. This essay focuses primarily on PDs for this reason, although the issues we underline are not unique to PDs. In one section (Section II), PDs are described identically to DSM-IV, in terms of 11 putative categories, with the PD-NOS category being the one used most frequently in clinical practice [5]. In another section (Section III), the dimensionally oriented model developed for DSM-5 is described as the "Alternative DSM-5 PD Model." This unusual outcome resulted from a complex series of events, including reviews of the alternative model by a number of advisory committees, culminating in the APA's board of trustees' final decision to preserve the DSM-IV PD model in Section II of DSM-5 (for a more detailed description of these events, see [6]). This outcome occurred in spite of unanimous DSM-5 task force support for the transition to the alternative model and clear evidence that front line clinicians see the pathological trait ratings in the alternative model as significantly more useful than the DSM-IV PD categories [7].

In this brief essay, we suggest that a compelling path forward would involve connecting the personality dimensions in the Alternative DSM-5 PD Model with the neuroscientific constructs of the RDoC. We first review the fundamental problems with DSM PD categories that limit their utility in both research and in the clinic, i.e., extensive problems with comorbidity and within-category heterogeneity. We then review evidence that these problems emerge because PD (and psychopathology in general) is dimensional in nature and occur because the classical psychiatric paradigm attempts to impose categorical distinctions where they do not exist. We then briefly describe the NIMH's RDoC strategy, which is designed to extricate psychopathology research from the political miasma of the APA and DSM categories. We conclude that NIMH's RDoC approach is a promising way of facilitating progress, but also suggest that it could benefit from a closer connection with clinical phenomenology, e.g., the personality dimensions delineated in DSM-5. Ultimately, if the complex political challenges in the field can be surmounted, we may be on the verge of a period of rapid progress in our ability to effectively study and ultimately ameliorate psychopathology.

Conundrums Arising From DSM Categories: Comorbidity, Heterogeneity, Empirical Dimensionality

Comorbidity

Comorbidity is a term from medical epidemiology and is a sensible way of describing the situation where clearly distinguishable disorders (i.e., with distinguishable pathophysiology or etiology) co-occur in a patient [8, 9]. The term has also been used to refer to the way DSM defined disorders co-occur at much greater than chance levels. High levels of DSM disorder co-occurrence mean that assigning a single "optimal" diagnosis to a patient is difficult at best. The comorbidity problem occurs throughout the DSM, but is particularly acute with regard to the PDs. As we have also emphasized elsewhere [10], it is remarkable that this problem was well known during the construction of the DSM-IV PD system, yet we are aware of no attempt to address the problem during the DSM-IV construction process. Specifically, the DSM-IV Sourcebook notes that, "The average number of personality disorder diagnoses per patient in inpatient samples has ranged from 2.8 (Zanarini et al., 1987) to 4.6 (Skodol et al., 1988). The weak evidentiary base for the existing definitions and the documentation of problems with overlap and coverage were reasons for the committee to consider making radical changes" [11]. These very high levels of comorbidity make it difficult, if not impossible, to work with the DSM-IV PD system because the intent of the system is to identify the primary PD diagnosis.

Within Category Heterogeneity

Heterogeneity is readily documented by examining the criteria for specific DSM PDs and by studying persons who meet criteria for specific PDs. For example, DSM-IV borderline PD criteria are heterogeneous in their content, describing both more internalizing (e.g., emotionally dysregulated) and externalizing (e.g., impulse dyscontrol) features [12, 13], resulting in distinguishable subgroups of both more internalizing and externalizing presentations within the BPD category [14]. This kind of heterogeneity creates conceptual problems because the idea behind assigning a label such borderline PD is to provide a concentrated focus for intervention. Heterogeneity within categories obscures this kind of focus because patients who are supposed to be homogenous in presentation vary significantly (e.g., borderline PD patients differ in the extent of their problems with generalized impulse control,

against a background of general emotional dysregulation). The problem is also worsened when considered in light of the comorbidity phenomenon. That is, DSM PD labels do not work well for framing intervention efforts because, often, more than one label is appropriate for PD patients (the comorbidity phenomenon) and, also, because patients in a specific PD group are different in fundamental ways (the heterogeneity phenomenon).

Dimensionality of Putatively Categorical DSM Mental Disorders

Problems such as comorbidity and heterogeneity occur because DSM rubrics attempt to parse continuous psychopathological phenomena into categories, in the absence of natural points of categorical demarcation. Essentially, DSM categories presume the existence of numerous "zones of rarity" to distinguish PDs from each other and from other mental disorders. No evidence for such zones of rarity has been adduced, however. Models positing continuous psychopathological variation tend to fit data better than models positing discrete variation [15, 16]. Discrete "taxa" (nonarbitrary categorical groups of patients) have not been identified [17]. This is true even of serious forms of PD that merge into the psychotic spectrum. For example, a highly comprehensive study in two large epidemiological samples found no support for categorical models of schizotypal PD; a dimensional account of schizotypal PD functioned considerably better in predicting psychosis, intellectual functioning, disability, and treatment seeking [18].

In sum, although the DSM describes hundreds of categories, those categories that are prevalent in the general population and in everyday practice actually delineate a series of dimensional domains of psychopathology, such as the internalizing spectrum (containing disorders involving disturbances of mood and anxiety) and the externalizing spectrum (containing disorders involving problems with impulse control) [19]. For example, the DSM defined diagnoses of major depressive disorder, dysthymic disorder, generalized anxiety disorder, panic disorder (with agoraphobia), social phobia, specific phobia, and bipolar I disorder do not delineate seven separate categories, empirically speaking. Instead, these disorders delineate the internalizing spectrum and sub-dimensions such as distress (e.g., major depression and generalized anxiety) and fear (e.g., specific and social phobias). These underlying dimensions, more so than the categories that indicate the underlying dimensions, are predictive of future behavioral (e.g., suicide attempts) and medical (e.g., angina and ulcer) sequelae of psychopathology [20].

The NIMH RDoC Strategy: Circumventing the DSM and Investing in Neuroscience

Well aware of the inability of DSM categories to parse psychopathology as it occurs in nature, the NIMH has signaled their intention to withdraw support for research on psychiatric categories such as those in the DSM. The NIMH is focusing instead on promoting research on a dimensional approach to neural circuits and their connections with psychopathology, the Research Domain Criteria (RDoC) project. Not surprisingly, the RDoC has attracted much interest from the scholarly community; for example, the reader may wish to consult recent special sections of the *Journal of Abnormal Psychology* [21] and *World Psychiatry* [22] for discussions of the RDoC.

The RDoC approach to studying biological systems relevant to psychopathology is framed by a series of dimensional domains. As of this writing, the RDoC approach includes five broad domains: negative valence systems, positive valence systems, cognitive systems, systems for social processes, and arousal/regulatory processes. These RDoC domains are instantiated primarily in terms of constructs from neuroscience and refer to mental faculties, which may or may not generally differ from person to person. For example, in listing example constructs within the domain of negative valence systems, the RDoC website points primarily to specific aspects of brain anatomy, such as the amygdala, hippocampus, and ventromedial prefrontal cortex (as well as hormones, e.g., cortisol). However, the connections between these constructs, individual differences in these constructs, and phenomena encountered in the psychiatry clinic are not fully articulated on the NIMH RDoC website. The RDoC website describes this lack of articulated connections as purposeful. That is, within the RDoC approach, brain circuitry provides the organization for currently proposed RDoC constructs, and patterns of links to clinical phenomena and individual differences can be studied through research conducted under the RDoC approach. For example, "potential threat (anxiety)" is a "construct" within the domain of negative valence systems that can be instantiated in various "units of analysis," ranging from genes to self reports. The idea is that connections between brain circuits and problem behaviors are hypotheses to be tested in NIMH-supported research. Brain circuits delineating negative valence systems can be imaged and probed, and their empirical association with other indicators of anxiety (e.g., subjective reports, avoidance behaviors) can be studied.

Connecting RDoC, DSM, and the Scientific Endeavor

RDoC is a striking move given the historical investment of NIMH in research on DSM categories. Moreover, RDoC only provides hypotheses about potential relationships between RDoC constructs and clinical symptomatology, as opposed

to articulating an empirically based account of clinical symptomatology. Indeed, much of what we see in the clinic on a daily basis is difficult to locate in the RDoC matrix. For example, many patients experience problems with reality testing (e.g., auditory hallucinations and delusions), but these clinical phenomena are emergent properties linked to a variety of brain systems acting in concert with each other and with the environment and not typically the result of simple lesions of a specific aspect of neuroanatomy. Hallucinations and delusions typically have emotional, cognitive, and social aspects and, therefore, do not link in a one-to-one fashion with a single overarching RDoC domain, such as "cognitive systems" or "systems for social processes."

Could the DSM evolve in a way that helps to connect it with NIMH's new dimensional and neuroscientific priorities and, in the process, help in connecting neuroscience with clinical symptomatology? One potential pathway that may be helpful in forging these connections would involve focusing on specific innovations in DSM-5 that, because of their dimensional nature, have a closer potential conceptual connection with RDoC than do traditional DSM categories [23], such as the personality domains described in the DSM-5's alternative model for PDs. For example, the DSM-5 trait domains tie directly into the empirical structure of human personality and psychopathology and are therefore likely to be helpful in pursuing a neuroscientifically informed approach to clinical psychopathology. Rather than being organized into a series of categories (e.g., the PD categories of DSM-IV), human personality pathology organizes empirically into five broad dimensions reflected in the DSM-5 trait model, and generally known as the five-factor model (FFM) of personality: (1) negative affect (or neuroticism) vs. emotional stability, (2) detachment vs. extraversion, (3) antagonism vs. agreeableness, (4) disinhibition vs. conscientiousness, and (5) psychoticism (thought disorganization) vs. lucidity in thought content and process [24, 25]. These dimensions, in turn, organize into even broader spectra of human variation that help connect empirical research on human individual differences with the classical categories of DSM, via their connection to research on the empirical structure of DSM psychopathology. Specifically, the negative affect and detachment domains form the broader domain of internalizing psychopathology, and the disinhibition and antagonism domains form the broader domain of externalizing psychopathology [26]. Along these lines, research exploring connections between these dimensional domains of personality and psychopathology and the RDoC domains would be a productive pathway for connecting RDoC to the kinds of phenomena that are the focus of contemporary clinical practice. For example, do indices of neural functioning corresponding with the RDoC domain of "negative valence systems" correlate with measures of the DSM-5's negative affect personality domain and DSM-5 categories that reflect the internalizing spectrum [23]? Beyond this plausible match, there are other potential counterparts (e.g., positive valence with extraversion vs. detachment; cognitive systems with conscientiousness vs. disinhibition; social processes with agreeableness vs. antagonism), even if the RDoC domains describe putative processes that may not be isomorphically aligned with phenotypically derived dimensions of clinical personality and psychopathology.

In addition to the five broad domains in the DSM-5 trait model, there are 25 clinically relevant facets (i.e., more fine-grained personality tendencies) designed to capture more specific aspects of PD (e.g., emotional lability, anhedonia, manipulativeness, irresponsibility, eccentricity). These 25 facets organize empirically into the five broad domains that structure human personality and psychopathology as described above and in DSM-5 (APA, 2013, pp. 779–781). Those five domains, in turn, organize empirically into the internalizing and externalizing spectrums (see [27•] for a recent review of this aspect of the DSM-5 alternative PD model).

Interestingly, concerns that RDoC paid insufficient attention to human development seem to have resulted in recent changes to the RDoC webpage that make some of these connections between empirical dimensional classification of clinical phenotypes and RDoC more explicit. Specifically, as of this writing, the RDoC website notes that "The types of constructs typically found in the child temperament literature are (not coincidentally) similar to the RDoC domains, and many areas of the child psychopathology literature (e.g., broadly addressed to Internalizing or Externalizing problems) serve as a more compatible model for a dimensionally-based approach compared to the highly specified categories of adult psychopathology." Importantly, these statements apply equally well to adult personality, which is organized by essentially the same structures as childhood temperament [28].

These recent amendments suggest the potential for RDoC to be connected with empirically based psychopathology classification, inasmuch as connections between empirical models of personality and psychopathology and brain circuitry are already being forged. For example, intrinsic connectivity networks that have been identified by imaging the human brain at rest align empirically and conceptually with broad personality domains, such as negative affect and detachment [29•].

Conclusion

In conclusion, the intellectual landscape in the scientific study of psychopathology is shifting toward a more dimensional approach, driven by evidence that psychopathology is more dimensional than categorical in nature. The APA has been somewhat slower than the NIMH in making this shift. Nevertheless, DSM-5 contains elements that connect with the NIMH's dimensionally oriented RDoC endeavor. In this brief piece, we focused primarily on DSM-5's empirical model of

major personality trait domains because this provides a good example of a dimensional approach that, while well established in the research literature (via its connections with the FFM literature), is novel in the pages of the DSM. Nevertheless, there are other dimensional elements described in DSM-5 Section III that are also relevant to a more thorough discussion of the potential role of dimensions in the DSM, going forward. For example, Section III also describes a series of cross cutting symptom measures (e.g., somatic symptoms, sleep problems, suicidal ideation). Technically speaking, the DSM-5 does not require the clinician to make these ratings, in arriving at a diagnostic formulation. However, these kinds of cross cutting symptoms have obvious clinical utility (e.g., assessing suicidal ideation is part and parcel of many clinical encounters), suggesting that "requiring" them as part of a complete diagnostic formulation would not be burdensome or very different from typical clinical practice.

How various dimensional approaches described in DSM-5 Section III will evolve in future DSMs is not entirely clear at this point. Thus, it is worth contemplating strategies that may be helpful in introducing more dimensional elements into the main body of DSM-5. Our sense is that strategies for making DSM more dimensional in general may have less to do with acceptance on the clinical front lines and more to do with navigating the conservative nature of the DSM revision process. For example, as we noted earlier, a recent survey of clinicians (both psychologists and psychiatrists) suggests that they find the DSM-5 trait dimensions to have greater clinical utility than DSM-IV PD categories [7]. Nevertheless, the generally conservative nature of the DSM revision process resulted in many dimensional elements appearing in Section III as options for further study. This conservative bias is understandable in some ways, e.g., in avoiding the appearance that changes in the DSM can be made in a capricious manner. Nevertheless, a conservative revision strategy also runs the risk of stifling innovations linked to more recent scientific developments (e.g., research on the dimensional structure of personality pathology and the relevance of this structure in the clinic).

In some ways, the APA's difficulties shifting DSM to a more dimensional approach are understandable because psychiatric training and practice has been historically organized by DSM categories and the costs of restructuring training and practice need to be weighed against the benefits of better reflecting recent scientific advances [30]. Nevertheless, the political challenges inherent in this shift must be overcome if the DSM aims to have a basis in more contemporary science, which generally points toward the dimensional nature of psychopathology. At the same time, if RDoC is to have applied utility, the endophenotypes it posits need to be validated and linked to the full range of constructs observed in clinical settings. Ultimately, as the DSM and RDoC evolve, delineating dimensions underlying the two and how they are connected should improve the empirical basis of both, leading to better clinical care and reduction of the burden of psychopathology.

Compliance with Ethics Guidelines

Conflict of Interest Robert F. Krueger, Christopher J. Hopwood, and Aidan G. C. Wright declare that they have no conflict of interest.

Kristian E. Markon was an Adviser to the DSM-5 Personality and Personality Disorders Workgroup.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as:

- Of importance

1. Widiger TA, Simonsen E, Krueger RF, Livesley JW, Verheul R. Personality disorder research agenda for the DSM-V. J Pers Disord. 2005;19:315–38.
2. Brown TA, Campbell LA, Lehman CL, Grisham JR, Mancill RB. Current and lifetime comorbidity of the DSM-IV anxiety and mood disorders in a large clinical sample. J Abnorm Psychol. 2001;110:585–99.
3. • Kupfer DJ, Kuhl EA, Regier DA. DSM-5—the future arrived. JAMA. 2013;309(16):1691–2. doi:10.1001/jama.2013.2298. *Reviews efforts of the DSM-5 Task Force co-chairs (Kupfer and Regier) to make DSM better reflect evidence of the dimensional nature of psychopathology.*
4. Whooley O, Horwitz AV. The paradox of professional success: grand ambition, furious resistance, and the derailment of the DSM-5 revision process. In: Paris J, Philips J, editors. Making the DSM-5: concepts and controversies. New York: Springer; 2013. p. 75–92.
5. Verheul R. Clinical utility of dimensional models for personality pathology. J Pers Disord. 2005;19:283–302.
6. Skodol AE, Morey LC, Bender DS, Oldham JM. The ironic fate of the personality disorders in DSM-5. Personal Disord. 2013;4:342–9. doi:10.1037/per0000029.
7. Morey LC, Skodol AE, Oldham JM. Clinician judgments of clinical utility: a comparison of DSM-IV-TR personality disorders and the alternative model for DSM-5 personality disorders. J Abnorm Psychol. 2014;123:398–405. doi:10.1037/a0036481.
8. Lilienfeld SO, Waldman ID. Comorbidity and chairman Mao. World Psychiatry. 2004;3:26–7.
9. Maj M. 'Psychiatric comorbidity': an artifact of current diagnostic systems? Br J Psychiatry. 2005;186:182–4.
10. Krueger RF, Hopwood CJ, Wright, AGC, Markon KE. DSM-5 and the Path toward Empirically Based and Clinically Useful Conceptualization of Personality and Psychopathology. Clin Psychol Sci Pract. 2014;21(3):245–261. doi:10.1111/cpsp.12073
11. Gunderson JG. Introduction to section IV: personality disorders. In: Widiger TA, Frances A, Pincus H, et al., editors. DSM IV sourcebook, vol. 2. Washington DC: American Psychiatric Association; 1996.

12. Eaton N, Krueger RF, Keyes KM, Skodol AE, Markon KE, Grant BF, et al. Borderline personality disorder co-morbidity: relationship to the internalizing-externalizing structure of common mental disorders. Psychol Med. 2011;41:1041–50.
13. James LM, Taylor J. Revisiting the structure of mental disorders: borderline personality disorder and the internalizing/externalizing spectra. Br J Clin Psychol. 2008;47:361–80.
14. Ramos V, Canta G, deCastro F, Leal I. Discrete subgroups of adolescents diagnosed with borderline personality disorder: a latent class analysis of personality features. J Pers Dis. 2014. In press.
15. Conway C, Hammen C, Brennan P. A comparison of latent class, latent trait, and factor mixture models of DSM-IV borderline personality criteria in a community setting: implications for DSM-5. J Pers Disord. 2012;26:793–803.
16. Hallquist MN, Wright AGC. Mixture modeling methods for the assessment of normal and abnormal personality part I: cross-sectional models. J Pers Assess. 2014;96(3):256–68.
17. Haslam N, Holland E, Kuppens P. Categories versus dimensions in personality and psychopathology: a quantitative review of taxometric research. Psychol Med. 2012;42:903–20.
18. Ahmed AO, Green BA, Goodrum NM, Doane NJ, Birgenheir D, Buckley PF. Does a latent class underlie Schizotypal personality disorder? Implications for schizophrenia. J Abnorm Psychol. 2013;122:475–91.
19. Kendler KS, Myers J. The boundaries of the internalizing and externalizing genetic spectra in men and women. Psychol Med. 2014;44(3):647–55. doi:10.1017/S0033291713000585
20. Eaton NR, Krueger RF, Markon KE, Keyes K, Skodol AE, Wall M, et al. The structure and predictive validity of the internalizing disorders. J Abnorm Psychol. 2013;122:86–92.
21. MacDonald III AW, Krueger RF. Mapping the country within: a special section on reconceptualizing the classification of mental disorders. J Abnorm Psychol. 2013;122:891–3.
22. Maj M. Keeping an open attitude towards the RDoC project. World Psychiatry. 2014;13:1–3.
23. Trull TJ, Widiger TA. Dimensional models of personality: the five factor model and the DSM-5. Dialogues Clin Neurosci. 2013;15:135–46.
24. Costa Jr PT, Widiger TA. Personality disorders and the five-factor model of personality. 3rd ed. Washington, DC: American Psychological Association; 2012.
25. Harkness AR, McNulty JL. The Personality Psychopathology Five (PSY-5): Issues from the pages of a diagnostic manual instead of a dictionary. In: Strack S, Lorr M, editors. Differentiating normal and abnormal personality. New York: Springer; 1994. p. 291–315.
26. Wright AGC, Simms LJ. On the structure of personality disorder traits: conjoint analyses of the CAT-PD, PID-5, and NEO-PI-3 trait models. Personality Disord: Theory Res Treat. 2014;5:43–54.
27.• Krueger RF, Markon KE. The role of the DSM-5 personality trait model in moving toward a quantitative and empirically based approach to classifying personality and psychopathology. Annu Rev Clin Psychol. 2014;10:477–501. doi:10.1146/annurev-clinpsy-032813-153732. *Provides a recent review of empirical literature on the DSM-5 personality trait model.*
28. Shiner RL. The development of personality disorders: perspectives from normal personality development in childhood and adolescence. Dev Psychopathol. 2009;21:715–35.
29.• Adelstein JS et al. Personality is reflected in the brain's intrinsic functional architecture. PLoS One. 2011;6(11):e27633. doi:10.1371/journal.pone.0027633. *Provides evidence that aspects of the intrinsic functional organization of the brain reflect major domains of human personality.*
30. First MB. Clinical utility: a prerequisite for the adoption of a dimensional approach in DSM. J Abnorm Psychol. 2005;114(4):560–4.