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Integrating structural and epidemiological research to inform the classification of psychopathology

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Abstract

Given the enormous influence of classification on the major clinical, research, and administrative activities of mental health professionals, understanding the true number and nature of disorders and the reasons for their comorbidity is an important public health priority. However, while studies of latent structure have yielded valuable information about disorder boundaries, their reliance on non-representative samples and failure to evaluate the practical implications of structural findings has limited their ability to effect nosological change. Conversely, community epidemiology studies, which inform classification by assessing the implications of diagnostic criteria in representative samples, have been limited by their focus on mental disorders as they are currently conceptualized by the field rather than on correlates and consequences of these disorders as they actually exist in nature. I consider the potential value of integrating systematically the methods of structural research with the methods of epidemiological research, exploring five ways in which these largely independent traditions may profitably be combined to inform the next classifications of mental disorders. By capitalizing on the complementary strengths of structural and epidemiological research, an integrated approach has significant potential to advance understanding of the nature of psychopathology and improve the validity and utility of its diagnosis.

The classification problem

A fundamental goal of any science is to describe phenomena as they exist in nature and to organize them in a manner that enhances understanding, stimulates research, improves prediction, and increases control over the phenomena and their consequences. Classification has led to revolutionary advances in fields such as biology (biological species), chemistry (chemical elements), astronomy (astral bodies), and medicine (disease entities), demonstrating the impressive gains that may result from 'carving nature at its joints.' Within the comparatively young science of psychopathology, however, the full promise of classification has yet to be realized. Efforts to classify mental disorders have been challenged by the complexity of the phenomena to be classified, the conflicting theoretical perspectives on these phenomena, the sway of non-scientific considerations and committee influence in the development of formalized systems, and the diverse and at times competing purposes for which these systems are used. Although succeeding editions of the predominant classification systems have shown some important

improvements, it is generally agreed that the field has not yet solved the classification problem: The question of where boundaries should be drawn between cases, and whether these boundaries represent differences in degree or differences in kind.

The classification problem in psychopathology encompasses two major debates. The first is the *continuity debate* – the controversy over the boundary separating disorder from normality. While proponents of a categorical model regard mental disorders as discrete, tightly bounded entities that are qualitatively distinct from normal functioning (Goodwin and Guze, 1989; Guze, 1992; Wakefield, 1997), this view is regarded by others as less plausible than a dimensional model in which disorder and normality lie along a continuum and differ only quantitatively in their severity (Carson, 1997; Eysenck, 1986; Krueger and Piasecki, 2002). While the continuity debate has principally been concerned with the outer boundaries of mental disorders, an important extension concerns the nature of any boundaries that exist *within* disorders, such as whether diagnosed cases can meaningfully be classified into subtypes or distinguished by their severity on one or more subfactors. Together, these boundary questions concern the latent structure of a disorder as it exists in nature, regardless of how we choose to conceptualize or measure it.

The classification problem also encompasses the *comorbidity debate* – the controversy over the boundary that separates disorders from each other. It has been argued that the frequent co-occurrence of diagnoses within individuals represents the strongest challenge to current nosological systems, suggesting that we have not yet configured or clustered symptoms correctly (Maser and Patterson, 2002). Although diagnoses may overlap for meaningful as well as artifactual reasons (Klein and Riso, 1993), the sheer extent of the diagnostic comorbidity observed has led to questions about whether the present criteria truly delineate distinct conditions. Such questions have been fueled by a virtual explosion in the number of disorders included in successive editions of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM), leading to concerns that some subset of disorders may represent artificial divisions of broader underlying conditions (Barlow *et al.*, 2004). Questions have further been fanned by the substantial number of treatment-seeking individuals who appear to fall in the 'gray area' between categories (Clark *et al.*, 1995; Frances *et al.*, 1991), a number that has remained substantial despite the introduction of an increasing number of boundary conditions (e.g. schizoaffective disorder, bipolar II disorder) to attempt to reduce gaps in coverage. These and other factors have led some to conclude that the boundaries separating existing diagnostic categories may be misplaced or, still worse, may misrepresent the relations of conditions that are not clearly distinct, but that shade into one another along latent dimensions (Widiger, 1997).

The classification problem is so contentious because of its far-reaching ramifications for virtually all of the major clinical, research, and administrative activities of mental health professionals. The accuracy with which a disorder is defined and described in relation to neighboring conditions affects all subsequent scientific and clinical applications, including the search for etiology (Haslam, 1997; Maser and Cloninger, 1990; Merikangas *et al.*, 1996; Widiger and Sankis, 2000), the refinement of nosological systems (Ruscio and Ruscio, 2004a), the development of valid and useful measures (Ruscio and Ruscio, 2002, 2004a), and the propagation of increasingly effective and efficient treatments. For these reasons, solving the classification problem may be one of the most important challenges facing the mental health community.

Studying the classification problem

Prior research approaches

Historically, questions about the boundaries of mental disorders were debated mainly on philosophical, ideological, or disciplinary grounds. Since the publication of DSM-III (American Psychiatric Association, 1980), however, there has been increasing emphasis on using research to inform classification (Widiger and Clark, 2000), with research efforts facilitated by the introduction of specific, explicit diagnostic criteria that enhanced diagnostic reliability (Millon, 1986). Consistent with this shift, in recent decades there has been growing recognition of the classification problem as an empirical question that can and should be approached scientifically (Meehl, 1986; Ruscio and Ruscio, 2000). A growing number of studies have examined the continuity and comorbidity of mental disorders, providing valuable information about these disorders and their association within individuals. At the same time, methodological limitations of many prior studies have hindered their ability to address fundamental questions about latent boundaries.

First, some studies have sought to address boundary questions by studying the manifest, or observable, distributions and associations of mental disorders (e.g. Flett *et al.*, 1997). Such studies are limited by the critical fact that manifest structure need not, and often does not, match latent structure (Grayson, 1987; Haslam, 1999; Murphy, 1964). These studies are further limited by their reliance on the fallible diagnostic algorithms of current

nosological systems, which are transitory and doubtlessly imperfect representations of the disorders as they exist in nature. In research on comorbidity, a focus on the manifest level remains the norm, despite apparent problems of symptom overlap, problematic diagnostic hierarchies (Zimmerman and Chelminski, 2003), and unreliability due to difficulties of differential diagnosis (Brown *et al.*, 2001) that exist at the manifest level of analysis and may distort the true relationships between disorders.

Other studies have focused appropriately on modeling the latent structure and associations of mental disorders rather than inferring this structure from manifest scores. However, these studies often begin with the assumption that the disorders in question are continuous or categorical, automatically turning to statistical methods that were designed for use with latent dimensions (e.g. factor analysis, structural equation modeling) or categories (e.g. latent class analysis, cluster analysis). Such methods presume either a categorical structure or a dimensional structure rather than attempting to evaluate which of the two structural possibilities is more consistent with the observed data. As a result, the fundamental question posed by the classification problem – whether a mental disorder differs qualitatively or quantitatively from normal functioning and from other disorders – has not been directly evaluated for most disorders.

Studying latent structure

Fortunately, classification researchers have at their disposal a statistical method that was expressly designed to address this basic structural question. Meehl and his colleagues developed a family of taxometric procedures that test whether a construct is categorical (taxonic) or continuous (dimensional) at the latent level (Meehl, 1973, 1995, 1999; Meehl and Golden, 1982; Meehl and Yonce, 1994, 1996; Waller and Meehl, 1998). These procedures test for one taxonic boundary at a time by searching for a predictable pattern of relations among a set of indicators that together identify that boundary. Each procedure yields estimates of important data characteristics (e.g. indicator validity, taxon base rate) as well as graphical results that are visually inspected to judge whether the data are more consistent with categorical or dimensional structure. The method is distinguished by its evaluation of the consistency of results (within a tolerable margin of error) across multiple, mathematically non-redundant procedures in lieu of traditional significance tests. Monte Carlo studies have demonstrated the ability of taxometric procedures to correctly distinguish latent classes from dimensions, and the utility of the method – along with the importance of the question that it addresses – has led to its notable rise in popularity in recent years (Cole, 2004; Ruscio *et al.*, 2006). While other statistical methods such as cluster analysis, finite mixture modeling, and latent class analysis can also be used to distinguish categories from continua, each has been shown to have difficulty identifying the correct number of existing latent classes, making it less suited for rendering this fundamental distinction (Ruscio and Ruscio, 2004a, 2004b).

Although the taxometric method appears to have substantial promise to inform the classification of mental disorders, it addresses a fairly circumscribed question among many possible questions regarding the latent structure of these disorders. For example, if a disorder is found to be qualitatively distinct from normal functioning, additional questions inevitably arise about the existence of subtypes within the disorder group, the nature of differences among disorder group members, and the nature of the boundary with less severe but symptomatically similar disorders. Conversely, if a disorder is found to be continuous with normal functioning, questions arise about its unidimensionality or multidimensionality, the existence of lower-order factors, and the existence of higher-order factors that may also encompass related conditions. Thus, taxometric analysis offers only a skeletal outline of the latent structure of a disorder, an outline that remains to be elaborated by other statistical techniques addressing complementary structural questions (Ruscio and Ruscio, 2004a). Techniques that have been developed to elaborate latent categories include latent class analysis, latent profile analysis, finite mixture modeling, cluster analysis, and grade-of-membership analysis. Techniques that have been designed to delineate dimensional variables include exploratory and confirmatory factor analysis and multidimensional scaling. Additional techniques make use of structural results to evaluate indicators of the disorder with the goal of improving assessment, classification, and diagnosis; such methods include item response theory (IRT), receiver operating characteristic (ROC) curves, and Bayesian statistics. Together, these techniques constitute a powerful toolkit for outlining, filling in, and building on the latent structure of a mental disorder.

The need for an integrated approach

Structural investigations have great potential for improving the validity of classification. Nevertheless, such investigations historically have not had a major impact on the development or revision of classification systems. Although there may be several reasons for this, one

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important possibility is that the developers of such systems are concerned not only with representing reality as accurately as possible, but also with meeting the practical needs of users of the system. Thus, in the domain of classification, the basic science concern of validity is often balanced against the applied concerns of clinical and practical utility. Intuitively, it seems plausible to suggest that a more valid nosology would yield diagnoses with greater predictive power that are more useful in practice. However, empirical demonstrations of this possibility have been regrettably rare.

To date, the twin goals of validity and utility have been explored in relatively isolated literatures. The question of validity has traditionally been the focus of structural research, which uses analyses of latent structure to describe the organization of latent entities underlying observable signs and symptoms of disorders. Such studies typically stop at describing the obtained structural findings, without performing construct validation of the uncovered structures or considering the practical (as well as theoretical) value of modifying existing diagnostic criteria to more closely reflect these latent structures. This diminishes the potential impact of structural research and its likelihood of stimulating significant nosological change, especially when the changes that it recommends deviate substantially from the current classification system.

In contrast, the practical utility of diagnostic criteria has traditionally been the concern of psychiatric epidemiology, which studies the distribution, determinants, and consequences of diagnosed disorders, most often in community samples (Kessler, 2007). Epidemiological research evaluates the implications of diagnostic criteria for such practically important estimates as the prevalence, demographic distribution, comorbidity, disability, and service utilization associated with a disorder. However, because epidemiological findings are typically based on current diagnostic criteria, they run the risk of becoming obsolete as these frequently shifting criteria are revised over time. Moreover, the focus of epidemiological research on diagnosed disorders means that it can only teach us about disorders as we have chosen to conceptualize them, rather than enriching our knowledge of disorders as they actually exist in nature. Finally, although epidemiological methods have the capacity to identify and evaluate improvements to the existing nosology, psychiatric epidemiologists have historically been less interested in suggesting improvements to diagnostic criteria as they have been in documenting the prevalence, risk factors, and consequences of disorders as they are presently diagnosed (Kessler, 2002a).

The integration of structural and epidemiological research represents a logical and powerful step toward resolving the classification problem in psychopathology. Merging these formerly independent fields and capitalizing on their respective strengths has the potential to yield more informative investigations of latent boundaries and a more valid and useful nosology. In the remainder of this paper, I describe five ways of blending together the data, methods, and variables of these research traditions to help address the classification problem and inform the forthcoming revisions of the DSM and the International Classification of Diseases (ICD) system.

Integrating structural and epidemiological research

I. Delineating latent structure

Perhaps the simplest integration of structural and epidemiological research is to apply techniques for studying latent structure in representative epidemiological samples. Although research on latent structure is becoming increasingly widespread, this research has heretofore been conducted mainly with clinical or college student samples. These samples have some important advantages, but pose potential problems with selection bias and range restriction that may distort the relationship of disorders to normality and to each other. In contrast, community epidemiology samples are highly advantageous for structural research. They encompass the broad range of symptom severity needed for the study of continuity and are free of the selection biases that can lead to spurious taxonic results (Grove, 1991b) or the distortion of comorbidity rates (Kessler, 2000). They tend to be large, meeting the often high sample size requirements of structural research. They generally provide good coverage of current diagnostic criteria and may also include items assessing alternative criteria or related clinical features. Finally, they have the advantage of yielding structural results that can be generalized to the population at large. Epidemiological samples are less useful for studying the structure of rare disorders which have such a low prevalence in the population that they may escape detection by statistical procedures that search for latent classes. However, so long as samples are sufficiently large to include an adequate number of affected cases (Ruscio and Ruscio, 2004a, 2004c), epidemiological data have a largely untapped potential to advance the study of boundaries in psychopathology.

It has been proposed that efforts to delineate latent structure begin with taxometric analysis, testing whether a given disorder is categorical or dimensional (Ruscio and

Ruscio, 2004a). Of the few methods that test (rather than presume) the categorical versus dimensional latent structure of a construct, the taxometric method has arguably the strongest base of simulation studies attesting to its ability to make this structural distinction accurately and reliably (Ruscio *et al.*, 2006; Ruscio and Ruscio, 2008). Moreover, among the family of analytic procedures and consistency tests that make up the taxometric method, several are especially powerful at distinguishing small latent classes from latent dimensions using data that are positively skewed (Ruscio *et al.*, 2004), a common occurrence when pathological phenomena are assessed in general population samples. After determining the categorical versus dimensional structure of a disorder, complementary statistical analyses will need to be performed to further elaborate the underlying structure (Ruscio and Ruscio, 2004a). For disorders found to be categorical, complementary analyses could include: (a) testing for further boundaries within the two latent classes (e.g. searching for a cyclothymia taxon distinct from a bipolar I taxon), (b) testing for subtypes within the disorder class (e.g. searching for a melancholic subtype within a major depression taxon), and (c) testing for syndrome-relevant dimensional variation within each class (e.g. determining whether individuals in a bulimia nervosa taxon can be reliably distinguished by the severity of their bingeing, purging, and associated symptoms). For disorders revealed to be dimensional, complementary analyses might include: (a) determining whether the construct is unidimensional or multidimensional (e.g. testing whether the symptoms of panic disorder are best represented by a single dimension, separate physiological and cognitive dimensions, or further meaningful subdivisions), and (b) testing for the existence of higher- and lower-order factors (e.g. examining whether circumscribed and generalized social phobia are subsumed beneath a single higher-order social anxiety factor). Regardless of the structural solution suggested by initial taxometric analysis, the goal should be to draw as complete a picture as possible of the underlying structure of each disorder using analytic procedures appropriate to that structure (Ruscio and Ruscio, 2004a).

II. Refining diagnostic thresholds and criteria

Structural and epidemiological research may also profitably be combined to refine diagnostic algorithms. It is likely that the latent structure of a disorder will not correspond perfectly to the algorithm set forth in DSM-IV or ICD-10, either in the set of criteria that are used to define the disorder or in the decision rules that are applied to these criteria to separate cases from non-cases. Where latent structure differs from current algorithms in significant ways, epidemiological data can be used to modify diagnostic algorithms so that the classification of cases aligns more closely to the organization of cases at the latent level.

One particularly useful target for diagnostic refinement concerns the optimal location of the diagnostic threshold. The approach that is used to identify the threshold is appropriately guided by the latent structure of the disorder. For categorical disorders, the goal in setting a diagnostic threshold may be to match, as closely as possible, the boundary between cases and non-cases at the latent level. For dimensional disorders, the location of a threshold is more complex, as there is no latent boundary for analyses to try to match. Here, epidemiological variables may be used to locate defensible thresholds along the dimension to guide the unavoidable categorical decisions encountered in clinical, research, and policy settings (Widiger, 1997; Widiger and Clark, 2000). The particular variables that are used to draw thresholds may vary somewhat across disorders, but could include disorder characteristics (e.g. symptom severity), course characteristics (e.g. persistence, deterioration, recurrence risk), risk factors (e.g. familial aggregation), and consequences (e.g. functional impairment, suicidality, treatment utilization), with some variables having relatively more importance than others for a given disorder (Kendler, 1990). Epidemiological analysis could identify critical levels or inflection points on the variables of interest, then evaluate the consistency with which different variables point to the same optimal diagnostic threshold. As Kessler (2002b) has noted, comparable thresholds have been identified for non-categorical medical conditions such as hypertension by examining epidemiological data on the risks of heart attack and stroke associated with varying blood pressure levels. Diagnostic thresholds identified in relation to meaningful practical outcomes may allow better detection of individuals in need of services, improved guidance in selecting an appropriate level of intervention, and more useful estimates in needs assessment research (Kessler, 2002b; Widiger and Clark, 2000). In addition, epidemiological data may allow more explicit consideration of the relative costs, risks, and benefits of treatment versus non-treatment and may facilitate identification of different thresholds with maximal utility for different decisions (Maser and Patterson, 2002; Swets *et al.*, 2000).

After a defensible threshold is identified, an integrative approach may also be useful for determining the combination and weighting of symptoms that maximizes

measurement precision and classification accuracy at this threshold. Analyses could identify the set of available symptoms that best represents each disorder, jointly considering the criteria of validity (How well does the symptom distinguish cases at the latent level?) and efficiency (How redundant is the symptom with other indicators of the latent disorder?). Analyses could also determine whether assigning different weights to different symptoms results in sufficient improvement in classification accuracy to justify the increased complexity and burden to users. Once again, performing these analyses in community epidemiology samples would provide an opportunity to study the relation between symptoms and disorder without the potential distortions of method-based range restriction or selection effects that characterize many other samples.

III. Evaluating the practical implications of latent structure

Adjusting existing diagnostic algorithms to more closely match the latent distribution of cases will, by definition, result in a more valid classification. What is less clear is whether improved alignment with latent structure 'matters' for classification – whether consideration of structure translates into more useful diagnoses that better predict outcomes of interest. An integrated approach offers an empirical basis for determining whether the diagnostic changes proposed by structural research produce sufficient improvement in diagnostic utility to offset the costs of nosological change (Kendell, 2002; Kendler, 1990).

Epidemiological data and methods are well-suited to evaluate the practical significance of structural results. Variables such as social and occupational impairment, functional disability, treatment seeking, and related outcomes of interest to clinicians and policy-makers are routinely included in epidemiological surveys. This makes it possible to compare structure-based diagnosis with existing DSM and ICD diagnoses in their prediction of important outcomes. If attention to structural information is shown to substantially improve prediction, the increased diagnostic utility would argue powerfully for nosological change.

For categorical disorders, such analyses can address two questions of particular interest. First, to what extent does the structure-based diagnosis, denoting a separation between latent groups, correspond to meaningful thresholds on critical outcomes? Second, which individuals are identified as cases versus non-cases by the structure-based diagnosis, and how well does their new diagnostic status predict outcomes relative to their DSM-IV and ICD-10 diagnostic status?

For dimensional disorders, analyses of practical significance may be especially informative given ongoing debate over the role of dimensions in the next classification systems (Krueger *et al.*, 2005; Regier, 2007). Proponents of a dimensional model of psychopathology have argued that utility as well as validity would improve by shifting to a dimensional classification (Widiger & Trull, 2007). Epidemiological analysis could help test this claim by directly comparing the performance of categorical and dimensional diagnosis in predicting outcomes of practical importance (Ruscio, 2008). Such comparisons would be most relevant for disorders which are shown to be dimensional by structural research, but may also be of interest for categorical disorders, given a lack of consensus about the general conditions under which categorical classification is more powerful than dimensional measurement of taxonic constructs (Grove, 1991a; Ruscio and Ruscio, 2002).

Epidemiological analysis could also help determine the value of retaining dimensional information in addition to setting a categorical diagnostic threshold (Helzer *et al.*, 2007; Kraemer, 2007). For categorical disorders, supplementary dimensional ratings may have particular value when structural research reveals meaningful dimensional variation at the latent level (that is, reliable disorder-specific variation among affected individuals that is not due to measurement error). For dimensional disorders, supplementary dimensional ratings may help retain important predictive information when thresholds are imposed for categorical decisions. Epidemiological research could be used in such cases to evaluate whether dimensional measurement of severity adds significantly to categorical diagnosis in predicting outcomes of interest. Epidemiological data may also aid in selecting from among numerous possible dimensions those that optimize prediction (Shear *et al.*, 2007) and in determining the number of dimensions that are worth assessing by weighing the burden to users against predictive value in cost-benefit analyses. In sum, an integrated approach may help researchers move beyond descriptive investigation of latent structure to considering whether and how structural knowledge can be used to increase the value of classification.

IV. Reducing artifactual comorbidity

The methods described earlier focus on how an integrated approach could inform the classification of individual disorders. However, to fully address the classification

problem, there is a need to consider comorbidity as well. Researchers have identified as many as 11 possible explanations for the co-occurrence of diagnoses within an individual (Klein and Riso, 1993), nine of which reflect artifacts of sampling, nosology, or measurement and only two of which represent meaningful etiological associations between disorders. Thus, an important research priority is to rule out competing explanations for diagnostic comorbidity and to address modifiable sources of artifactual comorbidity so that research and intervention efforts can target meaningful relationships between disorders. Doing so has the potential to advance not only the classification of disorders, but the search for etiology and the effective detection and treatment of those at risk for multiple conditions (Van Praag, 1996).

Epidemiological research on comorbidity has typically aimed to describe the associations between disorders classified by contemporary diagnostic criteria. This approach has led to a number of important discoveries, most notably the high overall rate of co-occurrence among mental disorder diagnoses as well as the much higher associations between some pairs of diagnoses than others (Kessler, 1997; Merikangas and Kalaydjian, 2007). At the same time, because it conflates the associations between disorders with the fallible measurement of those disorders, this approach is unable to distinguish artifactual from meaningful comorbidity. By contrast, structural research on comorbidity has typically aimed to identify common dimensions that underlie groups of disorders and contribute to their apparent co-occurrence (Brown *et al.*, 1998; Krueger, 1999). Important strengths of this approach include its emphasis on the more meaningful latent level of analysis and its potential to identify shared risk factors for disorders. However, the approach has tended to rely on statistical methods that presume dimensional latent structure and to focus simultaneously on a set of disorders rather than on disorder pairs, despite mounting evidence for finer, potentially important distinctions between specific disorders even among disorder classes (such as the anxiety and mood disorders) where the overall pattern of diagnostic comorbidity is high (Kendler *et al.*, 1995; Regier *et al.*, 1998).

A natural integration of these research traditions would be to study the overlap of disorder pairs diagnosed on the basis of latent structure. Ruscio and Ruscio (2004a) have described one such approach that draws on the results of taxometric analysis. For each disorder, cases are classified into the latent disorder taxon or located along the latent disorder dimension. Analyses can then examine the degree of association between each pair of disorders, yielding an estimate of latent comorbidity. This value can be compared with the association between the same disorders diagnosed according to current diagnostic algorithms. For categorical disorders, these analyses could identify cases who are diagnosed with both disorders at the manifest level but who belong to only one disorder taxon at the latent level. For dimensional disorders, analyses could examine the extent to which patterns of associations among current diagnoses correspond to the relationships between disorders at the latent level. For all disorders, subsequent analyses could explore adjustments to the diagnostic algorithm that would lead it to better represent the relations between disorders at the latent level, without substantially reducing its validity for representing the index disorder. Such research has the potential to yield more accurate estimates of disorder co-occurrence and to pinpoint improvements in artifactual comorbidity.

V. Comparing pure and comorbid disorders

Epidemiological and structural research can be combined in other ways to advance understanding of comorbidity. Epidemiologists have long used certain descriptive variables to evaluate the validity and distinctness of specific mental disorders (Robins and Guze, 1970). Examples include age of onset, disorder course, sociodemographic correlates, patterns of associations with other disorders, temporal priority relative to other disorders, and family history of the disorder.

These traditional epidemiological validators of mental disorders can readily be applied to the problem of comorbidity. Comparing the profiles of particular mental disorders on these variables can help determine whether the disorders are distinct from one another or represent variants of the same disorder. Moreover, comparing the pure (non-comorbid) disorders with their comorbid presentation can help determine whether their diagnostic co-occurrence within individuals represents a mixture of disorders or a third, distinct condition. To enhance the informativeness of the analyses, an integrated approach would focus on individual and comorbid conditions as they are distributed at the latent level, rather than at the manifest level as in traditional epidemiological research. For each disorder pair, cases would again be classified into the latent disorder class or located along the latent disorder dimension. Subsequent analyses would assess the degree to which the two pure disorders could be distinguished from one another and from the comorbid cases on the validator variables.

These analyses would help to test whether the boundaries that have been drawn between diagnoses designate

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truly distinct conditions. If important differences are found between the course and correlates of the disorders, results may support a 'splitting' approach to classification emphasizing disorder-specific etiological models, measures, and treatments. Conversely, if few differences emerge, results may support a 'lumping' approach promoting inclusive etiological models and broadly applicable assessment and treatment strategies stressing common features and mechanisms of change. Regardless of the outcome, an integrated approach might begin to differentiate theoretically important comorbidity from artifactual comorbidity arising from poorly drawn diagnostic boundaries.

Conclusions

Structural and epidemiological research offer complementary strengths for addressing the classification problem but have long proceeded along separate lines. Integrating these research traditions would promote an interdisciplinary exchange of ideas, methodological and statistical strategies, and research findings that may greatly enrich the study of classification. Possible outcomes of this integration include improved understanding of the boundaries of mental disorders, more defensible diagnostic criteria and thresholds that more powerfully predict critical outcomes, and better identification of meaningful comorbidity with implications for etiology and treatment. Ultimately, such research has the potential to increase the value of classification and diagnosis for the diversity of users in the field.

The preceding discussion highlights unique strengths of community epidemiology samples and variables for advancing this research effort. Nevertheless, it is also important to acknowledge several limitations of community data for classification research. Common limitations include relatively few cases of rare disorders, interview skip-out patterns that reduce the sample available for analysis, assessment by lay interviewers rather than expert clinicians, and greater breadth than depth of assessment compared with specialty clinics and research studies that focus on particular disorders. Attempts to address these limitations in future surveys might require compromising key strengths of community epidemiology data, such as the large, representative samples and the broad range of disorders and correlates assessed. For this reason, a better approach may be to replicate the findings that are obtained with community samples in other samples that offer complementary strengths. In particular, it will be important to extend the findings to clinical samples, both to evaluate prediction of vital clinical outcomes (e.g. treatment response) and to ensure that results obtained in the community are applicable to the clinical settings that current classification systems are primarily intended to serve. Converging results would also increase confidence that the findings reflect genuine properties of disorders that are not limited to a given sample or setting.

The strategies described here are just some of the ways in which structural and epidemiological methods could fruitfully be combined to inform the next classifications of psychopathology. Longer term efforts ideally would extend this integration to other research traditions (genetic, neurobiological, psychosocial) that would bring valuable, additional methods and perspectives to the study of classification. As the classification systems resulting from these efforts are used to accumulate new knowledge, limitations of the systems will doubtlessly be revealed, prompting further evaluation and revision. Thus, the most useful approach may be an iterative process in which increments in knowledge continuously inform, and are informed by, corresponding diagnostic refinements suggested by varying methodological approaches. The complexity of the classification problem, and the challenges posed by its constituent continuity and comorbidity debates, call for the creative and sophisticated application of all available tools to move toward its successful resolution.

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Declaration of interest statement

The author has no competing interests.

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