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Review article

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Diversity and the Hierarchical Taxonomy of Psychopathology (HiTOP)

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Abstract

The Hierarchical Taxonomy of Psychopathology (HiTOP) is an empirically based, hierarchical model of the structure of psychopathology that was created in response to the limitations of traditional, categorical psychiatric classification frameworks. The HiTOP model has become increasingly popular in clinical psychology and psychiatry since its publication in 2017. In this Review, we consider the applicability of the HiTOP model to diverse, underrepresented and epistemically excluded populations. We first review the philosophy underlying psychopathology research in general to understand the impact of scientific norms on the inclusion of diverse populations within the research canon. We then review the HiTOP approach to modelling psychopathology, and how diverse populations have been included within HiTOP-related research to date. We conclude by highlighting ways for future research to increase the applicability of the HiTOP framework to diverse populations. Seriously engaging with the HiTOP model's suitability for diverse, underrepresented and epistemically excluded populations is imperative in order to achieve the HiTOP consortium's goal of delineating a fully empirical classification of psychopathology, and to provide a model that can guide the field of psychopathology research and training to increase representation.

Sections

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Introduction

The HiTOP consortium was formally established in 2015, comprising mental health researchers and clinicians bonded by a common philosophy: that traditional diagnoses have fundamental limitations; that quantitative approaches can address these limitations; that psychopathology can be organized and understood in an interpretable, hierarchical manner; and that empirical evidence should guide decision-making for and understanding of psychopathology. Since the initial publication of the HiTOP model[1], 32 consortium papers have been published to describe the HiTOP model[2,3] and outline its importance for clinical practice[4], its integration with neurobiology[5,6] and genetics[7], and its overlap with other modern classification frameworks[8]. Efforts within the HiTOP consortium over the past two years have been directed towards the development of a formal HiTOP self-report assessment measure[9–14] that aims to codify the model into a useable clinical tool, and the development of a standardized and transparent process for revising the framework[15].

However, there has been no review of HiTOP research with respect to diverse, underrepresented and epistemically excluded populations. Such a review is important for several reasons. First, seriously contending with issues related to diversity, equity, inclusion and justice is essential to achieving the HiTOP consortium's ultimate goal: to articulate a fully empirical classification of psychopathology[3] that can be applied broadly across populations and groups. Second, making explicit the assumptions related to diversity, equity, inclusion, and justice that remain implicit within HiTOP research — and within psychopathology research more broadly — demonstrates how these assumptions affect the consortium's scientific output. Third, the HiTOP model is dynamic and designed to evolve and/or iterate as rapidly as the supporting science is generated. Therefore, outlining where improvement is needed charts a research agenda that can be acted upon to improve the model in both the short- and long-term. Finally, if the HiTOP consortium seriously incorporates a focus on context, underrepresented populations and scientific approaches, and other issues related to diversity, equity, inclusion and justice in a meaningful way, it can serve as a model for the broader field of psychopathology research, practice and training.

In this Review, we consider how the HiTOP model and the associated research literature apply to populations other than those which have traditionally been dominant in psychopathology research (that is, populations that are not non-Hispanic white, cisgender, heterosexual, or Western, educated, industrialized, rich and democratic (WEIRD)[16]). First, we discuss the general philosophy of clinical psychological and psychiatric science related to diverse, underrepresented and epistemically excluded populations. We then relate this philosophy to that of the HiTOP model. Next, we review the extant HiTOP literature with a specific focus on how research pertinent to understanding psychopathology among underrepresented populations is incorporated. We end with a discussion of future actions that will enable the HiTOP consortium to achieve its goal of articulating a fully empirical classification of psychopathology that can be applied accurately and equitably to individuals from across the spectrum of human diversity.

Norms in psychopathology research

The remediation of psychopathology and other mental health challenges necessitates accurate classification[3]. Improved classification has substantial benefit for monitoring symptoms, communicating about psychiatric dysfunction, and treating psychopathology with the ultimate goal of improving mental health. However, the dominant norms within psychopathology and clinical psychology and psychiatry research might stunt progress towards these goals by marginalizing the philosophies, epistemologies and methodologies that are likely to be particularly useful for understanding psychopathology among underrepresented populations. The dominant norms in clinical psychological science thereby act as barriers to scholarship devoted to social justice as well as to understanding diverse, underrepresented and epistemically excluded populations[17–19] (Fig. 1).

The first norm is that quantitative methods are prioritized. Quantitative methodological approaches are favoured over qualitative ones and are considered to be more objective and rigorous[20–23]. However, scientists who have marginalized identities (for example, women, Black or Indigenous people, or people from other ethnoracially marginalized groups) and/or who study marginalized populations (that is, those who are underrepresented in psychopathology research) are more apt to use qualitative and other mixed-methods approaches. Indeed, quantitative approaches present methodological difficulties when considering the complexities of underrepresented populations[24]. For example, quantitative approaches often operate from an assumption that experiences can be neatly parsed apart and understood in isolation from one another. Thus, techniques like multiple regression might be used to understand experiences of racism and homophobic discrimination experienced by a Black lesbian woman independently of one another. However, in reality, individuals who have multiple marginalized identities experience societal stigma in ways that are intertwined and impossible to disentangle from one another, making their experiences too complex for simple decomposition via typical quantitative analysis.

Furthermore, research on basic, mechanistic processes is preferred to scholarship devoted to prevention, intervention and inequity research[25]. The decontextualized mechanistic assumptions underlying basic research align with quantitative approaches. These methodological norms reflect an ideology that assumes singular — or very few — explanations for (psychopathological) phenomena. The field of clinical psychology and psychiatry reflects this underlying positivist philosophy[21,26], often operating from unspoken assumptions that a singular 'truth' exists that can be uncovered with rigorous research; pluralism is the exception rather than the rule.

The second norm is that psychopathology research largely stems from a framework that assumes intra-individual dysfunction, aligned with neo-Kraepelinian models of psychopathology (the use of signs, symptoms and course in psychiatric diagnosis to assume some intra-individual mechanism of dysfunction to be the cause of the psychiatric disorder)[27–30]. Research on basic, mechanistic processes typically does not consider contextual factors[22,23], such as social structures, power imbalances and racism, which are imperative for an understanding of the social and structural determinants of health. Thus, traditionally dominant psychology research focuses on internal psychological processes and assumes that they are separable from social context[31].

The third norm is that nondominant populations are excluded because of the assumed universality and generalizability of constructs; psychopathology research overwhelmingly propagates on the basis of limited, homogenized samples that do not represent diverse populations. Indeed, there is poor representation of samples other than those reflecting non-Hispanic white ethnoracial samples in research published in prestigious, mainstream outlets[19,32–36]. For example, ethnoracial-minority populations remain underrepresented in randomized controlled trials[37], leaving it unclear how beneficial psychological and psychiatric interventions are for participants who are not racialized as white. As another example, ethnoracial disparities persist in the

diagnosis of psychotic disorders[38,39], such that African American/Black people, Latinx American/Hispanic people and immigrants are diagnosed with psychotic disorders more frequently than Euro-American/white people; some evidence suggests that bias plays a part in this disparity[40]. Nonetheless, only 59% of studies related to schizophrenia in four major USA journals reported the racial and ethnic identities of their samples and only 9% focused on racial or ethnic identity as a primary topic[35].

This poor representation limits generalizability and stems from assumptions that applying results to diverse populations (rather than developing an understanding from those populations) is sufficient. Research on psychopathology specific to diverse and underrepresented populations is thereby deemed niche and derivative as it is considered auxiliary rather than a main finding; such research reflects exceptions to the general norm or universal truth assumed from homogenized samples.

Scientific institutions further uphold and reinforce the exclusion of research devoted to understanding diverse and underrepresented samples. Mainstream scientific journals rarely publish research devoted to underrepresented populations or reliant on methodologies that are not strictly quantitative[32]. Scientists with foci on marginalized populations understand this and are more apt to avoid mainstream journals; for instance, in the face of racially homogeneous journal editorial boards, scholars focusing on ethnoracial-minority populations are more likely than scholars without a focus on ethnoracial-minority groups to believe their work will not be valued or published in those outlets, and refrain from even submitting research to such journals[41].

Finally, inequities at the level of funding agencies further demonstrate how the preference for basic, mechanistic research[25] — to the exclusion of research focused on disparities or inclusive of minoritized populations — helps to explain ethnoracial disparities in grant allocation. For instance, Black scientists submit NIH grant proposals on prevention, intervention and disparity research more frequently than their white counterparts, and these proposals are subsequently discussed less and receive less funding; this inequity arises because grant reviewers prefer research on basic mechanistic processes (that is, research that aligns with the largely quantitative, decontextualized mainstream)[25].

These norms within psychology research (a positivist philosophy; assumptions of universality; reliance on quantitative methods to the exclusion of others; internal experiences and processes as the focal point to the exclusion of context; a focus on dominant populations as the assumed universal experience; and the strict policing and reinforcing of these norms among scientific institutions) interact and support one another. The net effect is that scholarship devoted to diverse and underrepresented populations, as well as that produced by scientists who do not conform to the dominant norms, is excluded from the mainstream and pushed to the scientific fringes (epistemic exclusion)[17] (Fig. 1).

Any scientific endeavour that fails to appreciate the contextual forces influencing the scientific enterprise will be limited in the extent to which its findings adequately capture the experiences of an entire population. For instance, the assumption that scientific rigour negates the need for specialized interest groups — like those devoted to the study of ethnoracial-minority populations[42] — fails to account for how the business-as-usual approach of psychopathology research excludes the very research devoted to understanding such populations. These philosophical traditions in which the HiTOP model has emerged

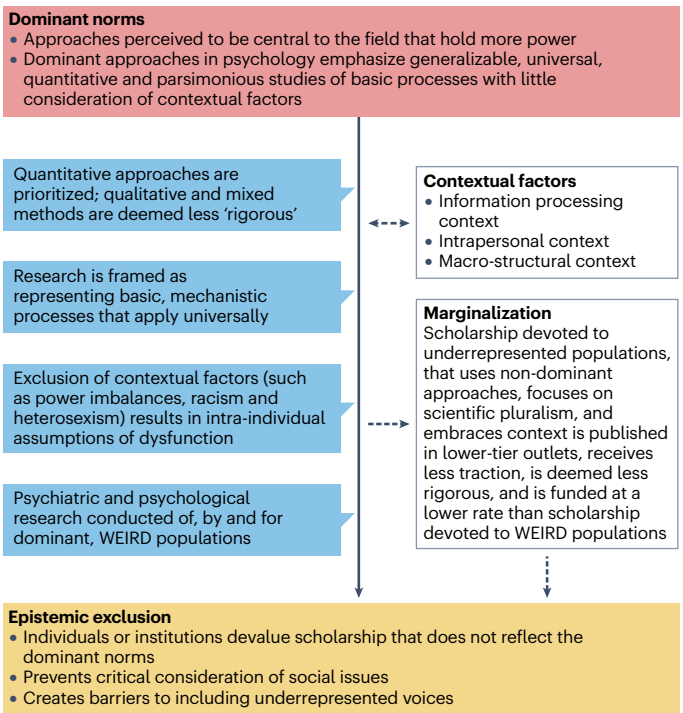

Fig. 1 | Dominant norms and epistemic exclusion. Summary of how the dominant norms in psychopathology research result in epistemic exclusion of scholars and science devoted to diverse and underrepresented populations[18]. This process is influenced by contextual factors[74] and leads to marginalization of scholarship devoted to underrepresented populations. WEIRD, Western, educated, industrialized, rich and democratic.

contextualize the model and reveal factors that probably exert unseen pressures on the work of the consortium.

Philosophy of HiTOP

The approach to modelling psychopathology taken by the HiTOP consortium evolved largely in response to certain limitations of traditional nosologies like the *Diagnostic And Statistical Manual Of Mental Disorders* (DSM)[43] and the *International Classification Of Disorders*[44] (Box 1). Compared to the DSM, the HiTOP model is designed to be more dynamic. That is, the model is altered and expanded as new empirical evidence is generated, rather than requiring potentially lengthy periods between model instantiations[15]. Similar to the DSM, the HiTOP model remains atheoretical in that it avoids imposing theories of aetiology in its approach to understanding psychopathology data[2], although the DSM arguably reflects a largely medicalized model or positivist approach to conceptualizing psychopathology.

The HiTOP consortium approach leverages empirical evidence, largely based on structural studies, to understand how psychological symptoms, signs and traits are interrelated. The HiTOP model represents a phenotypic hierarchy of psychopathology, within which psychiatric dysfunction can be understood across varying levels from the most broadly defined to increasingly specialized units (Fig. 2); different levels of resolution can be relevant to a wide variety of questions and applications. Studies of the comorbidity of psychiatric diagnoses have been particularly fundamental to the HiTOP modelling approach[1,45].

Box 1

Limitations of traditional categorical nosologies

Weaknesses of traditional classification systems include: poor construct validity, failure to account for heterogeneity and discontinuity (see refs. 1,3,45 for an expanded discussion of the strengths and limitations of traditional nosologies).

Poor construct validity

Psychiatric disorders are putatively distinct from one another in traditional nosologies. Disorders exist with clearly defined boundaries. As such, comorbidity should only occur at levels predicted by chance (that is, the joint probability reflecting the two disorders' prevalence). However, comorbidity is the rule rather than the exception. Nearly half of individuals with one disorder will meet diagnostic criteria for another disorder[114,115]. Such rampant comorbidity cuts across disorder groupings (for example, mood versus anxiety disorders, substance-use disorders and personality disorders)[116,117].

Heterogeneity

Diagnostic categories imply a degree of homogeneity within psychiatric disorder categories. Thus, it would be fair to assume that two individuals with the same diagnosis will experience the same core disorder. However, the use of polythetic criterion lists in traditional nosologies — developed to increase diagnostic reliability — means that individuals with the same diagnosis might differ in substantial ways. For example, two individuals who share the same diagnosis of borderline personality disorder might share only a single criterion (for example, chronic feelings of emptiness). Indeed, the need for five polythetic criteria to be met from a list of nine results in 256 different constellations that can result in the same diagnosis of borderline personality disorder[118].

Discontinuity

Psychiatric diagnosis hinges on surpassing some arbitrary criterion count. The implication is that individuals falling short of that count evince relative mental health, and those that surpass it do not. Such discontinuity reifies diagnosis and ignores potentially meaningful information within subthreshold cases, treating such cases as clinically meaningless, which they are not[119–121].

By relying on empirical evidence and a systematic and transparent approach to revisions[15], the HiTOP consortium attempts to reduce the potential for undue influence from any specific individual or individuals, political pressures or financial gatekeeping in understanding the nature of psychopathology. However, it is important to recognize that any scientific consortium, including HiTOP, will be affected by group composition and demographics, decision-making and socio-political processes. Consequently, although the HiTOP model represents an attempt to develop a more quantitative, data-driven hierarchical structure of psychopathology, it is not devoid of socio-historical influences.

The HiTOP consortium has actively created a model that can expand to accommodate a developing research base; therefore, it is in theory poised to incorporate empirical evidence related to diverse, underrepresented and epistemically excluded populations relatively quickly. In addition, because of its atheoretical approach, the HiTOP model can accommodate a level of pluralism that often remains overlooked within mainstream psychopathology research because it does not impose assumptions about the causes of indicators of psychopathology. For instance, it is possible that associations between the various levels within the HiTOP model are differentially related in specific populations, perhaps in response to contextual processes specific to those populations. If new empirical evidence revealed how — for some populations (such as those exposed to stigma owing to their marginalized societal status) — behaviours considered exemplars of a given HiTOP domain could be alternatively understood as a means of coping with stigma, it could theoretically be used to modify the HiTOP model. Additionally, such agnosticism means that a host of other factors (including socio-contextual, genetic and neurologic factors) that might explain indicators within the model could be enveloped within the HiTOP literature and accommodated within the HiTOP model.

However, despite the potential the model has for including psychopathology research pertinent to diverse, underrepresented and epistemically excluded populations, the philosophical underpinnings of HiTOP are similar to those dominant in psychopathology research at large. At this time, the HiTOP model is exclusively based on quantitative data. Indeed, relying on quantitative data is at the core of the HiTOP epistemology[1,3,9]. However, a reliance on exclusively quantitative data might be an impediment to addressing issues related to diversity, equity, inclusion and justice within the HiTOP consortium's efforts. Such an epistemology influences what research is considered to be within the consortium's purview. For example, most HiTOP-related research does not comprehensively investigate nor consider structural factors and their associations or implications. Moreover, quantitative approaches are often decontextualized, and adopting a purely quantitative approach does not always effectively capture the experiences of marginalized populations[24]. Reliance on an exclusively quantitative approach might also convey the message that the HiTOP consortium's efforts do not pertain to scholars whose primary foci are diverse and underrepresented populations.

Similarly, HiTOP research complies with the norm of focusing on intra-individual dysfunction. For example, existing research identifies group differences on various HiTOP model domains (for example, the internalizing and externalizing domains of behavioural problems, such as depressivity and hyperactivity, respectively) among specific populations (such as ethnoracial and sexual-minority individuals)[46–51]. However, in the service of basic, mechanistic understandings, little research has examined the social context that underlies and potentially explains these group differences (for example, how stigma, white supremacy and heteronormativity affect internalizing and externalizing group differences or how the measurement of internalizing and externalizing domains themselves affect observed group differences).

Finally, as of June 2022, the membership of the HiTOP consortium largely reflects those voices most dominant in clinical psychology

and psychiatry research (that is, non-Hispanic white, cisgender, non-disabled men at research-intensive universities within the USA; Box 2). We are not saying that the HiTOP approach is responsible for the makeup of the consortium, nor that the demographic positions of individual researchers dictate their research strategies or foci. We instead present this information to more explicitly highlight some of the context that might affect the HiTOP-relevant literature base. The relative lack of diversity within the HiTOP consortium membership might influence the type of research that has been produced and considered in the development of the model to date.

HiTOP research and diverse populations

Three types of empirical study have examined the generalizability of the HiTOP model or aspects thereof: studies of cross-national generalizability, studies that explicitly compare the HiTOP structure across samples defined by various sociodemographic identities using some variation of measurement invariance analysis, and studies that incorporate social determinants of health in the study of HiTOP domains among minoritized populations.

Cross-national generalizability

Much of the empirical evidence that underpins the HiTOP model is from large-population-based data, thereby supporting broad generalizability of the model. Indeed, a major initial focus of the HiTOP consortium has been the replicability of the model across populations. Only a few studies have considered a relatively large number of countries (and corresponding languages) to determine whether the HiTOP structure of psychopathology is invariant across countries. This body of research is probably small because of the unusual and intensive nature of the relevant data collection (which requires not only adequate funding but an appropriate research infrastructure to support large-scale data collection at the population level) and might be less feasible in some places. Nevertheless, results from these studies generally find HiTOP-congruent structures that are invariant across country and language, at least for the internalizing and externalizing domains.

One study[52] reported on data obtained from the World Health Organization (WHO) Collaborative Study of Psychological Problems in General Health Care[53], and found that the basic configuration of the internalizing and externalizing groupings was relatively invariant across 14 countries (Brazil, Chile, China, France, Germany, Greece, India, Italy, Japan, the Netherlands, Nigeria, Turkey, the UK and the USA). However, the study was limited in its coverage of disorders beyond internalizing (for example, alcohol use was the only externalizing indicator and there were no psychosis indicators). Support for similar internalizing and externalizing structural factors was found using the WHO World Mental Health Survey data[54] from 14 countries, seven of which were classified as 'developing' (Brazil, Colombia, India, Lebanon, Mexico, China and Romania) and seven of which were classified as 'developed' (Belgium, France, Germany, Italy, the Netherlands, Spain and the USA)[55]. Further, this latter study found that pairwise associations between specific disorders were due to their mutual associations with the internalizing and externalizing domains.

Although specific diagnostic indicators varied across sites, another study based on data from the WHO World Mental Health surveys was able to examine diverse mental disorders within ten sites across nine countries that varied in income level (Brazil, Colombia, Colombia-Medillín, Mexico, Spain-Murcia, Northern Ireland, Peru, Poland and Romania)[56]. Findings were in line with a generally invariant set of underlying domains akin to internalizing and externalizing in previous studies. In addition, psychotic experiences tended to be separate from both the internalizing and externalizing domains, although data on psychotic experiences were limited owing to the low prevalence of psychotic disorders and the use of psychotic experiences rather than diagnoses in the modelling data.

Other studies have used large, population-based data from individual countries and found evidence for HiTOP-congruent structures,

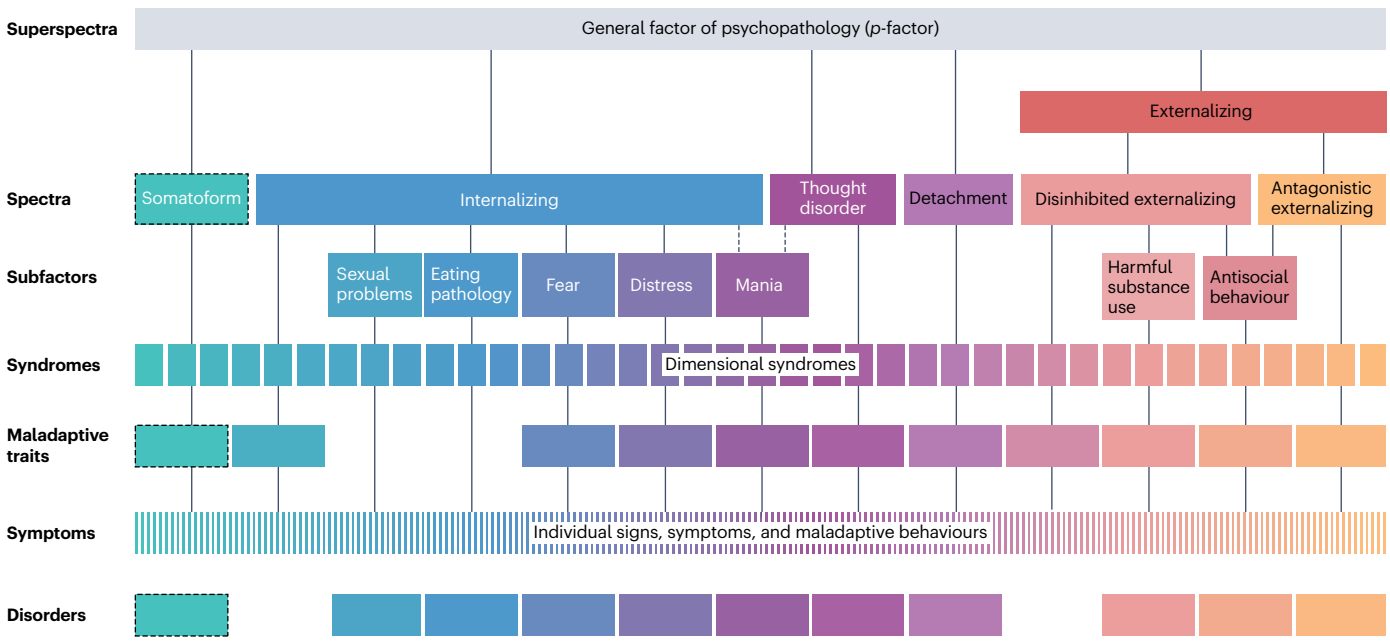

Fig. 2 | The HiTOP model. The HiTOP model represents a phenotypic hierarchy of psychopathology, with increasing specificity in domains at each level from superordinate superspectra to specific disorders. The full model can be viewed at https://osf.io/gds3n.

Box 2

HiTOP consortium membership

In preparation for this Review, we conducted a survey of HiTOP Consortium members in May–June 2022. Criteria for membership in the HiTOP Consortium are: possessing a doctoral degree (PhD, MD or equivalent) and a record of publishing HiTOP-conformant research (that is, research that adopts a transdiagnostic, dimensional approach to modelling psychopathology as opposed to a diagnosis-specific analytic approach). Of the 170 total consortium members, 129 responded to the anonymous survey, in which they were queried about their age, continent of residence, gender identity, sexual orientation, race and/or ethnicity, disability status, academic status (early-, mid- or senior-career), institution type (for example, academic or medical setting) and licensure status. Below are the main findings from the survey.

- Average age: 43.5
- 76% from North America (13% from Europe)
- 65% cisgender men
- 88% heterosexual
- 79% white
- 89% no disability
- 32% senior-career
- 71% research-intensive academic institution
- 51% licensed for clinical practice

primarily the internalizing and externalizing domains. For example, internalizing and externalizing factors were found in data from the 2007 Australian National Survey of Mental Health and Well-Being[57], and internalizing, externalizing, and thought disorder factors — as well as the overarching *p*-factor — were estimated from the Dunedin Multidisciplinary Health and Development Study data[58]. Evidence for internalizing and externalizing factors has also been found in representative data from Norway[59], the Netherlands[60], and the UK[61] and several studies using USA population samples, including the National Epidemiological Survey on Alcohol and Related Conditions[46,51,62,63], the National Comorbidity Survey[64], and the National Survey of American Life[65].

Taken together, the fact that the internalizing and externalizing domains — and, to a lesser extent, the thought disorder domain — have been replicated in datasets spanning multiple countries suggests that these core domains of the HiTOP model represent universal structures. That is, psychiatric disorders and symptoms tend to covary in consistent ways among populations spanning multiple continents. Therefore, there is cross-national evidence for the existence of the internalizing, externalizing and thought disorder domains of the HiTOP model.

Measurement invariance

Measurement invariance aims to determine whether latent variables — in this case the HiTOP domains — are measured equivalently across groups. Whereas cross-national studies examined whether HiTOP domains can be modelled in data from different countries, measurement invariance studies explicitly test the degree to which structures differ based on participants' group memberships. These analyses often go beyond simply modelling the HiTOP domains in different groups by adding increasing constraints on the group-specific models to determine the extent to which the same observed variables reflect the same latent variables in the same way[66,67]. Typically, these approaches involve first estimating the dimensions separately in the groups of interest (configural invariance), then constraining model factor loadings to equality across groups (metric invariance) and finally constraining indicator thresholds or intercepts to equality across groups (scalar or strong invariance). Although strict invariance (constraining indicator residual variances to equality across groups) might be pursued, this is often considered unnecessarily punitive for mean group comparisons. The rationale behind measurement invariance approaches is that comparisons of mean level differences across groups cannot be defensibly achieved without at least scalar or strong invariance[68]. That is, without scalar or strong invariance, any observed mean differences might be due to differences in factor loadings or indicator thresholds or intercepts, rather than to 'true' differences in the latent variable of interest.

Cross-national studies suggest similar covariance patterns among datasets from different countries. By contrast, invariance approaches are fine-tuned for examining specific populations of interest. Thus, simply modelling HiTOP domains in large datasets might obscure important group-related differences in the HiTOP structure. Giving constructs the same names across studies (for example, 'internalizing' and 'externalizing') implies that the same latent variable is being measured each time. However, only a handful of studies have examined measurement invariance of HiTOP domains among diverse populations. These studies found evidence for measurement invariance among groups defined by sociodemographic identity characteristics such as race and ethnicity[46,47], sexual orientation[48], age[49] and the sex assigned at birth[50,51]. For instance, one study[48] found that a model of the internalizing and externalizing domains was invariant across sexual-minority and heterosexual men and women in the National Epidemiological Survey on Alcohol and Related Conditions data[69]. Another study[47] found that a HiTOP-derived model composed of internalizing, externalizing and thought disorder domains was statistically invariant across American individuals of African or European descent from the Philadelphia Neurodevelopmental Cohort[47]. Notably, with the exception of this latter study, all measurement invariance studies cited above preceded the publication of the seminal introductory HiTOP manuscript in 2017[1]. That is, invariance studies were instrumental in the development and justification of the initial HiTOP model, but to date only one study has investigated the invariance of the model subsequent to its publication.

Apart from these formal measurement invariance analyses, one study conducted sub-sample analyses to examine potential differences in loadings across ethnoracial groups in the final estimated model. Results showed minimal to no difference, with the exception that the cross-loading of bipolar I disorder on externalizing was not statistically significant in Black and Hispanic participants[70]. Importantly, all formal measurement invariance and related studies of HiTOP constructs have been conducted using samples obtained in the USA.

Understanding invariance within the HiTOP structure is difficult for several reasons. First, many studies of invariance focus on minoritized populations (for example, sexual-minority or ethnoracial-minority groups). However, understanding the minoritization of any population depends on a contextualized understanding of what these sociodemographic identities represent. For example, ethnoracial categories are not objectively meaningful[71–74], making their use in these sorts of studies idiosyncratic to the contexts from which the data were collected. For example, in the National Epidemiological Survey on

Alcohol and Related Conditions data[69], participants were categorized as 'Hispanic' without consideration of other ethnoracial identities, resulting in a grouping of individuals who might also be Black or white within the same 'Hispanic' class. This categorization approach limits an understanding of group differences because the groups themselves are imprecise from a data integrity level.

Second, the imprecise, often arbitrary boundaries of many sociodemographic categories vary by country. Thus, examining invariance using data from a single context does not necessarily translate to a generalizable finding outside that specific context. Indeed, an individual racialized as Black in the USA might not be racialized in the same way in other countries.

Third, and perhaps most importantly, without a contextualized understanding of social power and privilege, researchers conducting such invariance analyses are liable to employ an essentialist perspective that attributes differences and/or similarities to specific sociodemographic categories rather than considering the historical and social construction of those categories[75,76]. Sociodemographic categories are often assumed to serve as proxies for constructs that might be of greater interest or of greater consequence to psychopathology researchers (such as experiences of racism and sexual-orientation-related stigma and discrimination), yet are often excluded from most quantitative data approaches or, when included, are assumed to operate in independent rather than mutually reciprocal ways[77]. Indeed, scholars and scholarship devoted to inclusion of such contextualization are more likely to include qualitative components in their work[17]. If adjudication of what counts as empirical evidence excludes a research base owing to design features (for example, a preference for quantitative over qualitative approaches) and that specific research base is more often devoted to underrepresented populations, then a selection effect guarantees that a specific focus on diverse, underrepresented and epistemically excluded populations will be largely ignored. Thus, although the HiTOP research to date implies a level of invariance, more research that adequately considers groups and contextual factors is needed. Such research might add additional nuance to existing domains or creation of new domains not yet discovered in past HiTOP research.

In general, the typical approaches to cross-national generalizability and measurement invariance fall under an etic ('outsider') approach to studying psychopathology, wherein concepts developed from the study of one population are applied to others. By contrast, an emic ('insider', using concepts that are indigenous to a particular group) approach to understanding psychopathology would involve understanding psychopathology in specific contexts using concepts developed from the study of the same specific populations of interest. Indeed, cross-cultural research on personality domains has substantial limitations in cross-cultural generalizability, and emic work has been essential for illustrating the importance of understanding personality from indigenous and combined etic–emic perspectives[78–83]. The overlap between the HiTOP model and the Five Factor Model of personality[84,85] suggests that a similar approach might be important for research on psychopathology. One suggestion has been to use etic studies to identify model misfit within different populations, and then to use emic approaches to understand such differences[86].

Social determinants of health

In a hybrid etic–emic approach, some scholars have begun to explore how specific sociocultural processes known to be important for psychiatric functioning among specific populations are associated with HiTOP model domains. These studies often seek to associate psychosocial stressors with HiTOP domains, under the assumption that disparities in HiTOP domains of functioning might be attributable to the deleterious effects of minority stressors[48,63,65,87]. For instance, cross-sectional reports of lifetime sexual-orientation-based discrimination and victimization were positively associated with both the internalizing and externalizing domains[48], and cross-sectional reports of racial discrimination were associated with psychiatric disorders as well as internalizing and externalizing domains in a large, USA-based sample of Black Americans and Caribbean-descended Black individuals[65]. The latter study found few associations with specific disorders once associations with HiTOP domains were accommodated within the model. These studies lend credence to the assertion that minority stressors operate at a transdiagnostic dimensional level, rather than in a disorder-specific manner. Yet, research on associations between minority stressors and psychiatric dysfunction tends to be disorder-specific. Thus, the HiTOP approach to understanding psychopathology might be particularly helpful as a framework for understanding and streamlining co-occurring psychiatric and behaviour dysfunction among minority populations (for example, ref. 88).

One study found differences in latent internalizing and externalizing levels across groups defined by the various intersections of sexual-minority and ethnoracial status in USA-based data[63]. For instance, although all sexual-minority groups showed higher levels of internalizing and externalizing when compared with ethnoracial heterosexual groups, the patterns were more nuanced when compared across ethnoracial groups within sexual-minority populations. For instance, whereas sexual-minority individuals demonstrated higher HiTOP domain levels compared with heterosexual individuals from the same ethnoracial group, patterns differed within sexual-minority groups: Black sexual-minority individuals showed lower internalizing domain levels than white sexual-minority individuals, and there were no group differences between Hispanic and white sexual-minority individuals[63]. Another study found that rejection sensitivity — an important minority stress process for sexual- and gender-minority populations[89] — was associated with the comorbidity of mood and anxiety symptoms, and that there were no associations with specific, discrete disorders after accounting for this transdiagnostic association[87]. Finally, early social stress among at-risk mothers has been associated with internalizing and externalizing domains, but not with any specific disorder[90]. In sum, only a handful of studies have examined processes like discrimination and other forms of stigma and how they relate to HiTOP domains, or have demonstrated how diverse populations cannot be considered a simple monolith in understanding group differences in psychopathology.

Expanding the HiTOP model

In general, the HiTOP-related research undertaken thus far to understand psychopathology among diverse, underrepresented and epistemically excluded populations has overwhelmingly sought to apply the HiTOP model, or aspects thereof, to underrepresented populations. Only a handful of papers have taken an alternative bottom-up approach that uses a contextualized understanding of the sociocultural environment to guide targeted testing and expansion of the HiTOP model. The relative dearth of research on underrepresented and epistemically excluded populations within the HiTOP research canon to date is particularly pertinent as the consortium moves to codifying the HiTOP model within a self-report assessment measure[9–14]. Without appreciating the sociocultural context and using such knowledge to guide targeted testing of indicators within HiTOP domains, any resulting measure or model might be ill-equipped to assess these domains in

an equitable manner. We illustrate this below with specific reference to sexual- and gender-minority as well as racial- or ethnic-minority populations. We use these populations for illustrative purposes but note that there are many other populations for whom similar processes are important. The many populations and ways in which understanding of these diverse populations can be conceptualized and approached highlights the importance of having scholars who focus is on diverse, underrepresented and epistemically excluded populations within the HiTOP consortium. The examples presented below reflect the expertise of several authors on this manuscript (C.R.-S., J.J.L., K.J.J., and N.R.E.) whose research focus includes understanding the mental health of sexual-, gender-, ethnic- and racial-minority populations. Having HiTOP members with expertise in other populations and domains could increase the applicability of the model and help to spearhead a research agenda devoted to understanding psychopathology within and across populations.

Sexual- and gender-minority populations

Previously, scholars have proposed that the HiTOP-consistent ('transdiagnostic') approach to conceptualizing psychopathology (which reframes psychiatric disparities in a more parsimonious manner, unifies disparate, disorder-specific or domain-specific literatures, reduces scientific stigma, and links minority stressors to psychiatric dysfunction) can be particularly effective for understanding the health needs of sexual- and gender-minority populations[88]. However, the utility of the HiTOP model for sexual- and gender-minority populations and any other minoritized populations is incumbent upon the model appropriately reflecting the experiences of these populations.

Specifically, the sociocultural context in which sexual- and gender-minority individuals exist might complicate the assessment and conceptualization of several domains within the HiTOP model. For instance, owing to their stigmatized status, sexual- and gender-minority individuals experience and anticipate rejection[89,91] at higher levels than their cisgender and heterosexual counterparts. Experiences of rejection among sexual- and gender-minority individuals are associated with outcomes such as insecure relationship attachment[92,93], unassertive interpersonal functioning[94], compulsive sexual behaviour[95], and increased harmful substance use[96]. Notably, these outcomes traditionally align with the symptoms or traits of detachment (intimacy avoidance, suspiciousness, social withdrawal and unassertiveness) and disinhibited externalizing domains (Fig. 3a). However, these behaviours might also be rooted in societal heterosexism and cisnormativity and develop as adaptive ways of contending with structural and interpersonal stigma. For example, social withdrawal and suspiciousness might be expected among sexual- and gender-minority individuals, particularly those with increased exposure to overt forms of discrimination. Similarly, intimacy avoidance might be associated with concerns about rejection as well as internalization of societal messages about the immorality of same-sex sexual behaviour. Thus, differential associations between symptoms and traits might be observed among sexual- and gender-minority individuals compared with cisgender heterosexual individuals. For example, although social withdrawal and unassertiveness might be strongly associated with other symptoms of detachment (such as restricted affectivity and coldness) among members of majority population groups, social withdrawal and unassertiveness might show stronger associations with symptoms within the internalizing domain (such as social anxiety) among sexual- and gender-minority individuals. Further, these differential associations could be a function of exposure to minority stressors that vary within sexual- and gender-minority groups, rather than resulting from group membership itself. Thus, group-based invariance approaches are not by themselves sufficient to investigate this topic.

Similarly, harmful substance use[97–100] and externalizing behaviour[48,63] is higher among sexual- and gender-minority individuals compared with cisgender heterosexual individuals. These findings align at the surface because variance from harmful substance use dominated indicators of the externalizing domain, particularly in early models. However, substance use among sexual- and gender-minority populations might not always reflect impulsivity, sensation seeking, and disinhibition as is assumed of indicators of the externalizing domain. Venues in which substance use is relatively normative have traditionally been 'safe spaces' for sexual- and gender-minority individuals[101–103]. Consequently, environments in which some sexual- and gender-minority individuals might find themselves are associated with increased normative and harmful substance use[104]. Thus, substance use among some sexual- and gender-minority individuals might reflect an intra-individual propensity to act in impulsive and disinhibited ways — consistent with the HiTOP conceptualization of the disinhibited externalizing spectrum (Fig. 3b). Alternatively, this association might be moderated by minority stress experiences like discrimination and rejection, or as a function of different substance-use norms based on sexual- and gender-minority-specific contexts. Indeed, one study found very weak and mostly nonexistent associations between substance use in sexual contexts and the disinhibited externalizing domain among sexual-minority men (with the exception of methamphetamine use)[105], a finding that differs from previous research using general population samples.

Racial-minority populations

The importance of considering the context that defines the experiences of individuals from underrepresented groups is also illustrated by considering how racial- and/or ethnic-minority status might differentially affect the assessment of externalizing psychopathology. The externalizing domain within the HiTOP model refers to symptoms and traits that reflect general deconstrained behaviour and personality style, encompassing both impulsive and aggressive tendencies. Further, the externalizing domain consists of two more circumscribed sub-domains: antagonistic externalizing (expressions of disagreeableness and aggression) and disinhibited externalizing (expressions of impulsivity and non-planfulness). Rule-breaking, unlawful and antisocial behaviours are considered to be behavioural indicators of the antagonistic externalizing domain. However, engaging in more rule-breaking behaviours (breaking the law, being arrested or getting in trouble with the law) does not occur solely owing to psychological functioning within an individual (an intra-individual propensity to engage in rule-violating behaviours).

For example, it is well established that more criminal behaviour is committed than detected[106]. However, unique policing patterns in the USA compared to other Western countries affects the rate of detection of crime for specific groups[107,108]. Specifically, racial and ethnic minorities and lower-income communities are overpoliced, especially those of Black Americans[109–111]. Moreover, Black Americans (and other racial and/or ethnic minorities in the USA) have their behaviour more closely monitored than white Americans, perhaps owing to the country's white supremacist history and ongoing racism. Thus, Black people and people of colour in the USA are more likely to encounter police intervention and therefore have higher rates of detected crime, even when there is no difference in the incidence of criminality relative to

other racial or ethnic groups. These factors, on average, raise the rate with which some items that index the externalizing domain would be endorsed (such as getting arrested or being in trouble with the law), but the reason for endorsing these items would be entirely unrelated to the 'essence' of antagonistic externalizing that HiTOP seeks to measure.

Put another way, in an item response theory framework, indicators of the antagonistic externalizing spectrum might show differential item functioning based on the racial and/or ethnic group to which respondents belong. For Black individuals and other people of colour, the level of antagonistic externalizing necessary to endorse several indicators might be substantially lower than that for white individuals. For example, the socio-historical context of racism in policing might affect the associations between a specific indicator (being arrested) and the antagonistic externalizing domain. Consequently, the latent

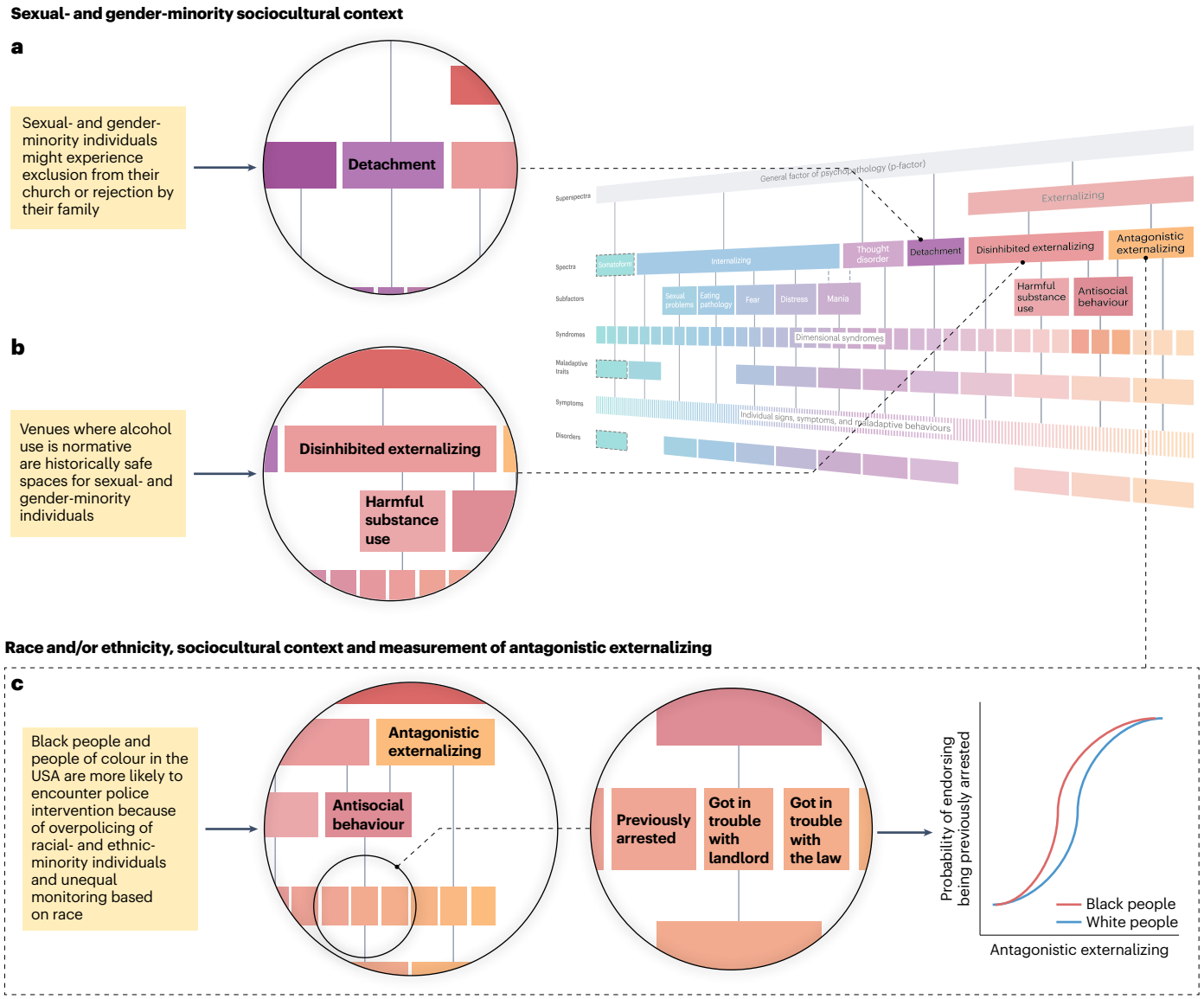

Fig. 3 | Understanding sociocultural context relevant to minoritized groups within HiTOP. a,**b**, Heterosexism and cisnormativity create a social climate rife with stressors for sexual- and gender-minority individuals. The way sexual- and gender-minority individuals contend with these structural stressors can affect the behaviours, symptoms and domains within the HiTOP model. **a**, Stigma and rejection might make outcomes that are considered indicators of the detachment and disinhibited externalizing domains, such as social withdrawal, more likely. **b**, Norms surrounding substance use and historical characteristics of safe spaces for sexual- and gender-minority populations might affect the extent to which substance use among sexual- and gender-minority individuals reflects an intra-individual propensity to act in impulsive and disinhibited ways, consistent with disinhibited externalizing. **c**, Historical and ongoing racism within the USA has implications for understanding and assessing behaviours indicative of intra-individual antagonistic externalizing. For example, detection of criminality as well as interactions with law enforcement are differentially experienced on the basis of race. This socio-historical context of racism in policing affects associations between a specific indicator (being arrested) and the antagonistic externalizing domain. Consequently, quantitative analyses might reveal differences in the latent antagonistic externalizing level necessary for 50% probability endorsement of the item 'I have been arrested' between Black versus white people in the USA.

antagonistic externalizing level necessary for 50% probability endorsement of the item "I have been arrested" would be lower for Black versus white people in the USA (Fig. 3c).

Together, these examples illustrate how an understanding and appreciation of the structural and social determinants of health that affect minoritized populations can inform targeted testing and potential expansion of the HiTOP model. In addition, they highlight the importance of attending to context. Although the HiTOP model remains agnostic to aetiology, it has neglected to include the exploration of structural context within its remit, which might lead to an assumption that psychopathology resides within the individual. By engaging in targeted testing of differential functioning of model parameters based on contextualized understanding of structural and social determinants of health, HiTOP could spearhead the creation of a nuanced and pluralized structure of psychopathology that applies to diverse, understudied and epistemically excluded populations. However, model testing can only go so far because it often follows conceptualization, research protocol development and data collection. Thus, including expertise from diverse backgrounds from inception is necessary for the success of any model of psychopathology.

Box 3

Case study

A fundamental understanding of context and its impact on the outcomes used as indicators of psychopathology necessitates the inclusion of scholars with the expertise to advise and assist with such targeted testing and subsequent refinement of HiTOP assessment instruments. This is illustrated by the item generation process[9] for the HiTOP self-report measure related to externalizing[14]. One domain to be assessed under the externalizing rubric was sexually compulsive behaviour, which is characterized by repetitive and intense preoccupations with sexual fantasies, urges and behaviours that are distressing to the individual and/or result in psychosocial impairment[122]. However, measures of sexually compulsive behaviour often include items that could differentially index the underlying construct depending on the sexual orientation of the respondent. For instance, some measures include items about interest in engaging in anal sex as indicators of sexual compulsivity[123]. Others index sexual compulsivity using items that assess difficulty in controlling sexual thoughts and/or urges[124–126], or include attempts at resisting and changing sexual behaviours as indicators of the latent construct[125]. The inclusion of these items could inadvertently introduce differential item functioning into the HiTOP externalizing domain. Because anal sex is normative in certain sexual-minority populations, controlling sexual thoughts might be related to internalized stigma of heteronormative ideals, and efforts to change sexual behaviour might be systematically related to sexual-orientation-based stigma, such items might be more readily endorsed by sexual-minority populations, regardless of actual latent levels of sexual compulsivity. The research of C.R.-S., the clinical focus on sexual- and gender-minority populations, and affiliation with the HiTOP consortium, allowed us to discuss this issue with stakeholders involved in the development of the externalizing item pool. Together, they were able to create an item pool that hopefully should minimally index confounding domains that could contaminate the assessment of sexually compulsive behaviour among sexual-minority populations (see ref. 127 for a summary of similar issues in relation to the intention to include compulsive sexual behaviour disorder in the newest iteration (11th edition) of the *International Classification Of Disorders*).

Summary and future directions

Empirical research across countries supports the generalizability of several core domains in the HiTOP model — specifically, the internalizing, externalizing and thought disorder domains. That is, psychiatric disorder diagnoses or symptoms co-occur in similar ways in samples from different countries. Researching the cross-cultural generalizability of the HiTOP structure has been an important consortium focus since HiTOP's inception. Other research has found evidence for measurement invariance of a small number of fundamental portions of the HiTOP model, based on sociodemographic group membership. Finally, a handful of studies have examined how specific social determinants of health (such as racial discrimination and sexual-orientation-based discrimination) associate with HiTOP domains, finding that stigma operates in higher-order, transdiagnostic domains rather than in a disorder-specific manner.

The HiTOP model and consortium have developed within a zeitgeist that deprioritizes an explicit focus on diverse, underrepresented and epistemically excluded populations. However, the philosophy of the HiTOP approach is amenable to prioritizing an understanding of these populations to achieve the consortium's overarching goal of articulating a fully empirical classification of psychopathology[3]. Multicultural perspectives are needed in the continued work of the HiTOP consortium[112]. Importantly, the focus on issues related to diversity, equity, inclusion and justice needs to be a core consideration in all the functions of the consortium, in all its workgroups, and in the executive committee, rather than being relegated to a single workgroup.

First, increasing expertise related to underrepresented populations at the consortium level is imperative. The membership of the HiTOP consortium largely reflects identities most dominant within clinical psychology and psychiatry at large (Box 2). Increasing diversity at the HiTOP table is not an exercise in bean counting. To articulate a fully empirical model of psychopathology, the consortium needs diverse scientific viewpoints. Solely focusing on demographic percentages will not achieve that goal. Instead, to appropriately diversify the HiTOP model, the consortium needs input and scholarship from scientists with specific and diverse forms of expertise.

A diverse membership should not solely be relegated to workgroups whose explicit focus is underrepresented groups; the consortium needs diverse scholars and those whose work pertains to epistemically excluded populations within each workgroup of the consortium as well as among the executive committee. Indeed, having scholars with expertise in specific marginalized populations within the measurement workgroup helped to reduce bias in the measurement of compulsive sexual behaviour in the HiTOP self-report assessment[14] (Box 3).

Including scholars with diverse backgrounds and skillsets does not happen by chance. It involves actively reflecting on the knowledge gaps within the consortium membership, increasing the attractiveness of the HiTOP approach to scholars who work from different philosophical backgrounds, and active recruitment and retention. At present, consortium membership requires a "record of publishing HiTOP-conformant research"[113]. If scholars who focus on underrepresented

groups see little utility in the HiTOP model as it currently stands, then they are unlikely to meet this publishing requirement. The consortium might best strategically expand its membership requirements to make scholars from these backgrounds eligible for membership and to make its membership attractive to them.

Second, simply applying HiTOP models to underrepresented groups is insufficient. A representative science must be built from the ground up (that is, including emic approaches). For example, although measurement invariance analyses offer some support for the generalizability of the HiTOP model, this approach might fail to capture important determinants of health or nuances in the model specific to individual subpopulations. Indeed, invariance in the HiTOP model between racial or ethnic groups cannot be taken as evidence that the causes of psychopathology are necessarily the same between these groups[47]. It will be important to use measurement invariance analyses to determine the suitability of items in the HiTOP self-report measure across groups. Nonetheless, invariance occurs more at the back end of data collection and analysis. Consideration of diverse, underrepresented and epistemically excluded populations as well as the structural determinants of health important to these populations must occur at earlier stages in the research enterprise.

Owing to its agnosticism regarding etiology, the HiTOP model is advantageously positioned to incorporate a more pluralistic way of conceptualizing and approaching psychopathology than most mainstream approaches. Beyond invariance-type analyses, the consortium could also actively measure and examine social and structural determinants of health — important for understanding the mental health needs of minoritized populations — and spearhead research that examines how such processes complicate the HiTOP model. We envision a model with metaphorical lenses, where each 'lens' provides a 'hue' that illustrates how specific domains and interrelations across domains are influenced by social processes like those highlighted in Fig. 3.

Finally, the business-as-usual operation of clinical psychological and psychiatric science (the preference for quantitative approaches; a positivist outlook focused on intra-individual, mechanistic processes; and the exclusion of non-dominant groups from the literature) stymies understanding of the psychopathology of diverse and underrepresented populations; this can be improved by appreciating intersectionality theory and its importance in improving clinical psychological and psychiatric science[17,18,24]. Interlocking systems of power minoritize entire swathes of psychological research. As contemporary models of psychopathology aim to improve upon the limitations of traditional systems, it is imperative that the field should understand how these systems insidiously creep into seemingly objective scientific processes. If the HiTOP consortium can leverage this understanding to incorporate a level of pluralism into its classification approach, it has the potential to transform the wider fields of psychopathology and psychiatry research by demonstrating how seriously contending with these issues does not impede science but instead improves it.

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Competing interests

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