Psychometric properties of the Personality Inventory for DSM-5 Brief Form in Chinese undergraduate students and clinical patients

Panwen Zhang
Second Xiangya Hospital

Zirong Ouyang
hunan biological and electromechanical polytechnic

Shulin Fang
Second Xiangya Hospital

Jiayue He
Second Xiangya Hospital

Lejia Fan
Second Xiangya Hospital

Xingwei Luo
Second Xiangya Hospital

Jianghua Zhang
Central South University

Yan Xiong
Central South University

Fusheng Luo
Central South University

Xiaosheng Wang
Central South University Xiangya School of Medicine

Shuqiao Yao
Second Xiangya Hospital

Xiang Wang ( wangxiang0916@csu.edu.cn )
Medical Psychological Center, the Second Xiangya Hospital, Central South University
https://orcid.org/0000-0001-9258-2017

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Abstract

Background: The Personality Inventory for DSM-5 Brief Form (PID-5-BF) is a 25-item measuring tool evaluating maladaptive personality traits for the diagnosis of personality disorders (PDs). As a promising scale, its impressive psychometric properties have been verified in some countries, however, there have no studies about the utility of PID-5-BF in Chinese settings. The current study aimed to explore the maladaptive personality factor model which was culturally adapted in China and examine psychometric properties of the Personality Inventory for DSM-5 Brief Form among Chinese undergraduate students and clinical patients.

Methods: 7155 undergraduate students and 451 clinical patients completed the Chinese version of PID-5-BF. 228 students were chosen randomly for test-retest reliability at a 4-week interval. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted to discover the most suitable construct in Chinese, measurement invariance (MI), internal consistency, and external validity were also calculated.

Results: An exploratory six-factor model was supported more suitable in both samples (Undergraduate sample: CFI = 0.905, TLI = 0.888, RMSEA = 0.044, SRMR = 0.039; Clinical sample: CFI = 0.904, TLI = 0.886, RMSEA = 0.047, SRMR = 0.060), adding a new factor “Interpersonal Relationships”. Measurement invariance across non-clinical and clinical sample was established (configural, weak, strong MI, and partial strict MI). Aside from acceptable internal consistency (Undergraduate sample: alpha=0.84, MIC=0.21; Clinical sample: alpha=0.86, MIC=0.19) and test-retest reliability (0.73), the association with 220-item PID-5 was significant (r = 0.93, p < 0.01), and six PDs measured by Personality diagnostic questionnaire-4+ (PDQ-4+) were correlated with expected domains of PID-5-BF.

Conclusions: The PID-5-BF is a convenient and useful screening tool for personality disorders with a novel six-factor model in Chinese settings, with the main difference for the Negative Affect domain.

Background

Personality disorders (PDs) are common psychiatric conditions that are disruptive to everyday functioning. Because PDs are often misdiagnosed or missed entirely, reliable and valid clinical diagnostic tools for PDs are needed [1]. In light of the numerous weaknesses of the traditional PD taxonomic diagnostic system, including a high comorbidity rate, arbitrary cutoff scores, and substantial heterogeneity within PDs in Section III of the DSM-5 [2], the APA (2013) proposed an Alternative Model of Personality Disorder (AMPD) diagnosis, wherein 25 maladaptive personality trait facets are organized into five domains (Criterion B) after measuring personality functioning (Criterion A) [3]. The AMPD provides theoretical trait domains across six specified PDs, thus converting PD diagnosis from a categorical to a dimensional scheme.

The Personality Inventory for DSM-5 (PID-5) is a 220-item self-report measurement that was developed specifically to evaluate hierarchically organized personality traits in accordance with the AMPD. The
reliability and validity of the PID-5 have been confirmed in multiple studies, which have yielded internal consistency values above 0.8 for most domains [4-7]. The five broad domains affirmed in prior studies [8,9] have been described as comparable to maladaptive variants of the Big-Five Model [10], which would be expected given that the development of the associated dimensional model of personality pathology was informed by the normal personality taxonomy [11]. Although the PID-5 has satisfactory psychometric properties, its utility is limited due to its having a large number of items, and thus its taking substantial time to complete [12]. With the aim of screening for PDs quickly and accurately, the PID-5 Brief Form (PID-5-BF) was developed by extracting core items from the five domains (Negative Affect, Detachment, Antagonism, Disinhibition, and Psychoticism) of the PID-5 [13]. Correlation coefficients between the five PID-5-BF domains and the original PID-5 domains have been reported to be very good, with Bach et al. (2016) reporting a mean correlation coefficient value of 0.90[14], and Debast et al. (2017) reporting correlation coefficients in the range of 0.81 – 0.87[15].

PID-5-BF results provide an overall assessment of degree of personality maladjustment and point to potential PDs [16]. The PID-5-BF has been shown to be reliable and valid in a number of countries in Europe [14-18], North America [19-21], and Asia [22]. In all but two cases, internal consistency coefficients above 0.8 were obtained; internal consistency coefficients for Belgium [15] and Denmark [14] were between 0.66 and 0.78. The PID-5-BF has been shown to have satisfactory discriminant validity (effect size of mean domain level = 0.46, p < .05) between individuals with and without PDs [14]. In terms of criterion validity, each PD measured by Personality Diagnostic Questionnaire-4(PDQ-4) was associated with and predicted by theoretical PID-5-BF domains. Regarding internalizing and externalizing criteria, the PID-5-BF Negative Affect domain subscore is a robust predictor of Inventory for Depression and Anxiety Symptoms-2 scores. Meanwhile, the PID-5-BF Disinhibition and Antagonism domain subscores are specifically predictive of Externalizing Spectrum Inventory scale scores. Somewhat unexpectedly, PID-5-BF Psychoticism domain subscores were found to be significantly predictive of scores for the aforementioned three scales [20]. PID-5-BF domain subscores and total scores correlated significantly with Personality Assessment Screener scores [21].

Although the PID-5 domains have been understood as putative maladaptive variants of Big-Five Model dimensions, the appropriateness of the Big-Five Model differs across cultures. For example, a six-factor model has been shown to be more suitable than a five-factor model in Chinese populations, while still fitting data from multiracial samples across Asia, Europe, and North America [23-25]. The sixth factor has been suggested to reflect “Interpersonal Relatedness”, which encompasses the traditional Chinese concepts of relationship orientation (Ren Qing; i.e. reciprocity of favors, affections, etc.), Harmony (e.g. lack of conflict, balance), and Face (as in “saving face” or reputation). A seven-factor model was also proposed [26] and confirmed in a sample of Chinese undergraduate students [27]. The Big-Five Model was found to have a poor fit with an Indian sample [28]. Similarly, the five-factor model of the PID-5-BF did not achieve an adequate fit in a study of Filipino college students [22]. In consideration of cultural dissociations of personality constructs, it is also of interest to note that the replicability of the Openness domain of the NEO Personality Inventory was also found to be poor in Asian countries in a cross-cultural study that included 24 cultures [29](De Fruyt et al., 2009).
Given that five-factor models of the PID-5-BF have been supported principally in studies with Western samples, it is likely that cultural differences may underlie differing factor structure findings in the literature. Accordingly, the most suitable factor structure of the PID-5-BF in Chinese respondents remains to be clarified. Measurement invariance (MI) studies of the PID-5-BF should be conducted to determine whether factor structure differs between populations constituted by individuals of different cultures [30,31]. Although MI of the PID-5 has been examined across cultures, sexes, and across clinical and nonclinical samples [32-34], the MI of the PID-5-BF is unknown.

The current study was the first to examine the psychometric properties of the Chinese version of the PID-5-BF. The aims of this study were threefold. First, we set out to determine the most suitable factor structure of the PID-5-BF in a Chinese population sample. Second, we assessed MI of the Chinese version of PID-5-BF across normal students and clinical patient samples, which is important for generalization of the PID-5-BF in both research and clinical settings. Third, to investigate criterion-related validity, we analyzed how well PID-5-BF scores correlate with scores obtained on the 220-item PID-5 and PDQ-4+.

**Methods**

**Participants**

The normal sample consisted of 7,985 university students recruited from two Chinese universities in Hunan Province from 2015-2017. After omitting subjects with missing data values, we retained a final normal sample of 7,155 subjects (3,713 male, 51.9%; and 3,436 female, 48.0%) with a mean age of 18.26 [standard deviation (SD), 1.33; range 18-23] years.

The clinical sample was collected from 2018-2020, including 451 outpatients (205 men, 45.5%; and 246 women, 54.5%), with a mean age of 24.62 (SD, 8.49; range, 18–57) years, who had been referred to the psychological clinic in hospital for assessment and treatment. Each patient was diagnosed based on the Structured Clinical Interview for DSM-IV system by two experienced psychiatrists (WX, LXW). The distribution of diagnoses in the clinical sample were as follows: PD, 43.2%; major depressive disorder, 22.6%; anxiety disorder, 4.9%; bipolar disorder, 7.1%; obsessive-compulsive disorder, 4.9%; schizophrenia, 3.1%; and other mental disorders, 14.2%.

All study procedures were approved by the Ethics Committee. All participants signed an informed consent.

**Instruments**

*Chinese PID-5 and PID-5-BF*
The full-length PID-5 [35] is a 220-item self-report scale developed in the USA to index 25 lower-order trait facets (Cronbach's $\alpha$, 0.72–0.96) organized into five higher-order trait domains of personality pathology (Cronbach's $\alpha$, 0.84–0.96) [35]. We invited two psychologists to translate the PID-5 scale from American English into Chinese; and then it was translated back into English by a bilingual teacher, with repeated revisions to ensure translation accuracy. The PID-5-BF [36] was developed by extracting 25 items from the original PID-5, representing 21 of the 25 trait facets (facets not included: Restricted Affectivity, Rigid Perfectionism, Submissiveness, and Suspiciousness). Items are rated on a 0–3 Likert-type scale, with higher scores representing greater dysfunction. Each of the five higher-order domains is represented by five items (Negative Affect: Items 8, 9, 10, 11, and 15; Detachment: Items 4, 13, 14, 16, and 18; Antagonism: Items 17, 19, 20, 22, and 25; Disinhibition: Items 1, 2, 3, 5, and 6; and Psychoticism: Items 7, 12, 21, 23, and 24).

**PDQ-4+**

The PDQ-4+ [37] is a self-report PD assessment scale based on the DSM-4. Items are answered as “yes” (scored as 1) or “no” (scored as 0). The Chinese version of the PDQ-4+ [38] used in the current study contains 107 items constituting 12 PD-type subscales. The PDQ-4+ has been used reliably in PD studies in China [39,40], with Cronbach's $\alpha$ values ranging from 0.49 (Passive-Aggressive) to 0.72 (Depressive).

**Model testing procedures**

In the normal sample, 3,985 students finished the 220-item PID-5, and 7,155 students completed the PID-5-BF and PDQ-4+. For the clinical sample, we obtained 451 valid PID-5-BF, 395 valid PID-5, and 231 valid PDQ-4+ questionnaires. For evaluation of test-retest reliability, 228 normal sample participants (93 male, 135 female) were chosen randomly for a PID-5-BF re-test taken 4 weeks after the initial test. Construct validity of the Chinese PID-5-BF was assessed with exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) after randomly (roughly) halving the normal sample randomly into an EFA subsample ($N = 3,633$) and a CFA subsample ($N = 3,522$). CFA was conducted to test the theoretical model suggested to be the best fitting model in the EFA.

MI tests across population included four nested models. Model 1 (configural invariance) tested the factor structure of latent variables across our two population samples with all parameters freely estimated. Model 2 (weak invariance) was based on the configural results with factor loadings equalized across groups. Next, Model 3 (strong invariance) had consistency of variable intercepts; achieving this model indicates that latent factor scores have the same meaning across groups, and thus that group comparisons are tenable. Model 4 (strict invariance) requires equalized error variance on the basis of the previous three models [41], which is rarely achieved [42].

**Data analysis**
Data analysis was performed in IBM SPSS Statistics 23.0 and Mplus 7.4. To examine construct validity, we first conducted EFA to identify the most suitable factor model of the PID-5-BF. Oblique rotation was used to allow correlation among factors. Each item with a factor loading $\geq 0.3$ was accepted as a factor component [43]. For EFA and CFA, model fit indices applied included the comparative fit index (CFI), the Tucker-Lewis index (TLI), the standard root mean square residual (SRMR), and the root mean square error of approximation (RMSEA) with a 90% confidence interval (CI). Acceptable fit values were: CFI $\geq 0.90$, TLI $\geq 0.90$, SRMR $\leq 0.08$, and RMSEA $\leq 0.08$ [44]. Model modifications were made on the basis of item correlations and MI index values.

MI was estimated based on three indices, namely $\Delta$CFI, $\Delta$TLI, and $\Delta$RMSEA, wherein $\Delta$ represents the difference between two adjacent models. Invariance was verified when $\Delta$CFI and $\Delta$TLI were $\leq 0.01$ and $\Delta$RMSEA was $<0.015$ [45]. In cases where these criteria were not met, the largest-value modification indices were selected to determine the parameters of which item(s) should be released to be free across groups iteratively until the $\Delta$CFI was $\leq 0.01$, demonstrating potential partial invariance [32].

Internal consistency was determined by calculating Cronbach's $\alpha$ and mean inter-item correlation (MIC) values. Cronbach's $\alpha > 0.8$ and $> 0.9$ signified acceptable and good reliability, respectively; a MIC $> 0.15$ was considered acceptable [46]. Test-retest reliability was estimated by calculating a Pearson's correlation coefficient ($r$). To examine criterion validity, Pearson's $r$ index values were also calculated between the PID-5-BF and the original PID-5, as well as between the PID-5-BF and the PDQ-4+ (representing the six DSM-4 PDs retained in DSM-5, Section III). Pearson $r$ values $>0.30$ and $>0.50$ indicated medium and large effect sizes, respectively[47].

Results

Descriptive statistics

The mean (SD) PID-5-BF total score obtained for the full university student sample (N = 7,155) was 16.4 (8.20), with females having a significantly greater ($t = -6.80, p < 0.01$) mean score, at 17.10 (7.96), than males, at 15.79 (8.32). The mean (SD) PID-5-BF total score obtained for the clinical sample (N = 451) was 29.78 (10.70), with females again showing a significantly greater ($t = -4.37, p < 0.01$) mean score, at 31.75 (10.98), than males, at 27.41 (9.86). The mean obtained for the clinical sample was significantly greater ($t = 26.04, p < 0.01$) than that obtained for undergraduate student sample. The mean (SD) PID-5-BF total score obtained for the subsample used in the EFA, at 16.29 (8.24)(N = 3,633), was statistically similar ($t = -1.34, p = 0.18$) to that obtained for the subsample used in the CFA, at 16.55 (8.11)(N = 3,522).

EFA and CFA

EFA supported an exploratory five-factor model and an exploratory six-factor model. The factor designations of the items are compared across these two exploratory models and Krueger et al.'s (2013) previously reported five-factor model [36] in Table 1. In our exploratory five-factor model, five items (8, 9,
11, 15, and 20) did not load into any factor; item 10 was the only item to reach a 0.3 loading weight in the Negative Affect domain, and it loaded with item 19, which had belonged to the Antagonism factor in the previously published model. Our exploratory six-factor model had higher fit indices (CFI = 0.969, TLI = 0.944) than the exploratory five-factor model (CFI = 0.952, TLI = 0.922), with fewer items failing to load on any factor (items 8 and 11). A new factor named Interpersonal Relationships was added to the original five factors. The factor loadings of each item in the exploratory six-factor model are reported in Table 2.

We chose to pursue analysis of our exploratory six-factor model because it had better model fit indices and fewer items that failed to load than our exploratory five-factor model and because of the significant differences in the Negative Affect domain between our exploratory five-factor model and the theoretical five-factor model. As shown in Table 3, we obtained significantly greater fit indices for our exploratory six-factor model than for the theoretical five-factor model in both our undergraduate student sample and clinical sample.

**MI across populations**

As shown in Table 4, we established configural, weak, and strong MI across the normal and clinical samples. However, the acceptable index criteria were not met for strict MI. We allowed the residual variances of items with the largest modification indices to be freely estimated until the △CFI of the last model was ≤ 0.01. Parameter constraints of items 15, 4, 14, 18, 17, 20, 7, 12, 24 and 5 were released in this process. Subsequently, partial strict MI of our modified six-factor model was supported. Hence, ultimately, our modified six-factor PID-5-BF model achieved configural MI, weak MI, strong MI, and partial strict MI across our normal and clinical samples.

**Reliability**

In the normal sample, we obtained a Cronbach’s α of 0.84, a MIC of 0.21 for the PID-5-BF total scale, and domain MICs in the range of 0.29–0.46. Domain subscores correlated significantly with total scores (r = 0.38–0.80, all p < 0.01). With respect to test-retest reliability over a 4-week interval, we obtained a Pearson correlation coefficient of 0.73 for the total scale, with domain correlation coefficients in the range of 0.50–0.67.

For the clinical sample, we obtained a Cronbach’s α of 0.86, a MIC of 0.19 for the total scale, and domain MICs in the range of 0.27–0.58. Similar to our results with the normal sample, we observed significant correlations between the domain subscores and the PID-5-BF total score (r = 0.26–0.78).

**Criterion validity**

PID-5-BF total scores correlated with scores obtained for the original 220-item PID-5 in our normal population participants (N = 3985, r = 0.93, p < 0.01). Correlation coefficients for each domain were in the
range of 0.64–0.86 in the undergraduate student normal sample and in the range of 0.69–0.91 in the clinical patient sample. As shown in Table 5, the Interpersonal Relationships domain showed the greatest correlation coefficient with the Negative Affect domain in both samples. Finally, as shown in Table 6, PID-5-BF domain scores correlated significantly with the six PD dimensions in Section III of the DSM-5 (schizotypal, antisocial, borderline, narcissistic, avoidant, and obsessive-compulsive).

**Discussion**

Contrary to most previous studies of the PID-5-BF in other countries, in this study, we found that a six-factor model was more suitable than the theoretical five-factor model for the PID-5-BF in our Chinese sample. Following modifications, the Chinese six-factor model of PID-5-BF achieved configural MI, weak MI, strong MI, and partial strict MI across our normal and clinical samples. In agreement with prior studies [14,20], we found that the PID-5-BF was highly correlated with the original 220-item PID-5, and the domains generally correlated with the six PDs retained in Section III of the DSM-5. We obtained acceptable Cronbach's $\alpha$ and MIC values for the PID-5-BF [46], revealing a good internal consistency of PID-5-BF, similar to prior studies [16,17,20]. Furthermore, our finding of good test-retest reliability over a 4-week interval is in agreement with prior work showing similarly good test-retest reliability of the PID-5-BF over a 2-week interval in a sample of high school students [16].

**Factor structure**

Although a number of prior studies conducted in Western-culture populations have supported a five-factor model for the PID-5-BF [14,15,16,19,20], our results supported a six-factor model better than the theoretical five-factor model derived from the literature. Interestingly, a prior study conducted with Filipino college students also showed a relatively poor fit of the theoretical five-factor model for the PID-5-BF [22]. Thus, we speculate that the discrepancy may reflect differences in the way people from Western versus Eastern cultures understand personality constructs and thus interpret items of the PID-5-BF.

Four of the factors in our exploratory six-factor model were consistent with the theoretical five-factor structure. Only the Negative Affect domain failed to align, and items 10 (fear being alone) and 19 (I crave attention) were placed in the newly added factor called Interpersonal Relationships. According to traditional personality theories in Western cultures, which focus on internal characteristics of the individual [48], loneliness is regarded as a source of distress related to experiencing a lack of empathy. On the contrary, in Eastern cultures, which are generally more collectivist, individuals are often considered to be inherently closely connected with others [49]. Accordingly, loneliness may be viewed as an isolated state due to poor interpersonal skills. Item 19, which is associated with the Antagonism domain of the original PID-5-BF, refers to behaviors that put the individual at odds with others, including an exaggerated sense of self-importance and an expectation of special treatment [10]. However, in a collectivist society, one's sense of belonging is an important aspect of his or her personality constitution [49]. Consequently, item 19 is likely to be understood as one's desire to fit into a certain group and to communicate with
others. Prior studies have explored the influences of collectivist versus individualist cultures on personality [50-52]. In summary, cultural differences in how one understands and interprets Items 10 and 19 may affect the factor loading of these two items.

The unique structure of the DSM-5 personality trait model in Chinese respondents, compared to respondents from most other examined countries, may be related to cultural differences in general personality models [35,53]. Although the five-factor model has been widely used globally, it may not be fully applicable in a variety of cultural contexts due to its Western-centric derivation. Consistent with this supposition, the five-factor model was not well-fitted when the NEO Personality Inventory was examined in the Philippines [54], Korea [55], and Japan [56]. Hence, it appears that the Big-Five Model does not fully explain personality traits in collectivist society contexts [23]. Prior studies have proposed a six-factor hypothesis of Chinese personality traits, with the addition of Interpersonal Relationships [25]. The importance of this sixth dimension for Chinese personality analysis has been affirmed in Chinese Personality Assessment Inventory standardization studies [24]. Therefore, although many western personality tests are reasonably reliable and valid when applied to Chinese samples, there are some cultural deviations to be considered [25].

**MI**

To the best of our knowledge, this study is the first to explore MI of the PID-5-BF. Establishment of MI provides evidence of a consistent underlying structure across groups and thus enables group means to be compared [30]. When performing nested MI modeling, as was done here with configural, weak, strong, and strict MI, MI must be established sequentially from lower- to higher-level MI analyses [57]. We were able to achieve MI fully with respect to factor structure (configural MI), metric (weak MI), and intercept (strong MI) equivalences for the PID-5-BF in both samples. Strict invariance was partially satisfied.

Because our modification index analyses led us to release constraints on Items 15, 4, 14, 18, 17, 20, 7, 12, 24 and 5 to better achieve strict invariance, it can be deduced that the residual variances of these items were not equivalent across our two sample groups. Notwithstanding, upon achieving strong MI, we were able to conclude that our finding of higher PID-5-BF scores in our clinical sample, compared to our normal sample, could be considered a reliable finding. Moreover, these data affirm a satisfactory discriminant validity of the PID-5-BF for differentiating between nonclinical and clinical individuals.

**External validity and clinical value**

Although the 220-item PID-5 has many merits for personality diagnosis—such as close relations with clinical symptoms, the ability to be combined with various psychotherapy methods, and good stability over time [12]—its length hinders its clinical utility. Pires et al. (2018) examined the psychometric properties of the 220-item (original), 100-item (short form), and 25-item (brief form) PID-5 versions in a sample of Portuguese university students and concluded that any of the three could be used to assess
maladaptive personality traits reliably and validly [18]. Bach et al. (2016) compared the three forms in a Danish population and showed that the three scales were highly similar with respect to internal consistency, factor structure, discriminant validity, and correlation with DSM-4 PD dimensions [14]. The present findings of very strong correlation coefficients between the PID-5-BF and the 220-item PID-5 in both of our samples indicate that in addition to saving time, reducing the burden upon participants, and being generally more clinic friendly, the PID-5-BF maintains the validity of the original instrument to a remarkable degree.

Moreover, the six factors of the PID-5-BF in our six-factor model showed good alignment with the six PDs in Section III of the DSM-5. Each PD correlated directly and specifically with its expected domain, with the exception of obsessive-compulsive personality disorder, which demonstrated good continuity from the DSM-4 to the DSM-5. Our unexpected finding of the Psychoticism domain showing strong correlations with most of the PDs in our normal sample may due to college students being sensitive to abnormal behaviors, thereby limiting the specificity of Psychoticism. In summary, the PID-5-BF retained satisfactory psychometric properties, despite its extensive omission of items relative to the 220-item PID-5, affirming its suitability as a preliminary clinical PD screening tool.

The PID-5-BF can be used to differentiate between psychologically healthy and troubled respondents, at least preliminarily. Bach et al. (2016) reported that the PID-5-BF has very good discriminant validity between psychiatric outpatients and community-dwelling individuals [14], consistent with our findings of significantly higher PID-5-BF scores in our clinical patients than in our normal sample of undergraduate students. Clinicians can administer the PID-5-BF to acquire a rough estimation of one’s personality functioning, laying the foundation of further treatment planning, and then judge the need for additional assessments. Although the PID-5-BF may not provide unique clinical information regarding specific symptoms, it can describe personality traits through the assessment of dimensions, embodying differences in degree rather than in category, contributing to individualized therapy development.

Limitations and future directions

The present study had some noteworthy limitations. First, the retested sample and clinical population were relatively small due to practical limitations. Second, the clinical sample was heterogeneous, including patients diagnosed with various psychological disorders. Third, the current study was cross-sectional, and cross-sectional studies cannot demonstrate predictive validity with the robustness of longitudinal studies. Hence, there is a need for larger longitudinal and clinical-sample studies of the PID-5-BF, particularly with samples constituted by patients with PDs.

Finally, the current study explored a novel six-factor model for the PID-5-BF in Chinese samples, in which the Negative Affect domain in the original five-factor model was divided into Negative Affect and Interpersonal Relationships factors. This Chinese six-factor model was supported by previous studies on Big Five personality traits in Chinese samples[24,25]. However, the novel factor structure limited the possibility to compare with or generalize to some advanced researches using the original PID-5-BF
operationalization. For instance, recently the combination of DSM-5 and ICD-11 in the diagnosis of personality disorders has aroused increasing attention[58-64]. Researchers developed some novel algorithms to assess ICD-11 personality domains from the five-factor structure and relevant sub-scores of PID-5[63,64]. It's worth noting that in 2018 Oltmanns et al developed a new instrument named the personality inventory for ICD-11(piCD) to assess five trait dimensions of ICD-11 [65], which indicated that combination of PID-5-BF and piCD for personality disorder study would become a more direct and reasonable way to explore the relationship between these two diagnostic systems in the Chinese sample.

On the other hand, because dimensions represent continua from normal to abnormal, actionable score ranges need to be established based on ample empirical data collected in clinical practice rather than developed from theoretical hypotheses. Further correlational analyses between the PID-5-BF and other psychological scales are also needed. MI of the PID-5-BF should also be further examined across genders, age bands, and cultures, particularly in Asia and the Pacific Islands.

**Conclusion**

Psychometric properties of the Chinese version of PID-5-BF were partially supported as the factor of Negative Affect was not replicated in its entirety. It was divided into two domains and we named the novel domain Interpersonal Relationships. The Chinese six-factor model was confirmed to have better psychometric properties in both our undergraduate students and clinical samples. In general, the PID-5-BF is suitable for assessing personality traits and clinical screening for PDs quickly.

**List Of Abbreviations**

PID-5-BF, Personality Inventory for DSM-5 Brief Form; PD, personality disorder; EFA, exploratory factor analysis; CFA, confirmatory factor analysis; MI, measurement invariance; PDQ-4+, Personality diagnostic questionnaire-4+.

**Declarations**

**Ethics approval and consent to participate**

This study was approved by the ethics committee of Second Xiangya Hospital, Central South University. All participants were over 18 years old and had written informed consent.

**Consent for publication**

Not applicable.

**Availability of data and materials**

The datasets generated and analysed during the current study are not publicly available due to no permission from participants to share anonymized participant data publicly but are available from the
corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

XW and YS supervised the study. PZ and ZO performed the data analysis and wrote the paper, SF, JH, LF and XL contributed to the data collection. JZ, YX, FL and XW provided resources of sample. All authors revised and approved the final manuscript.

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**Tables**

**Table 1. Item comparison among three models.**

| Model                  | Items associated with each factor, F1–6 |
|------------------------|----------------------------------------|
|                        | F1          | F2          | F3          | F4          | F5          | F6          |
| Theoretical five-factor| 8, 9, 10, 11, 15 | 4, 13, 14, 16, 18 | 17, 19, 20, 22, 25 | 1, 2, 3, 5, 6 | 7, 12, 21, 23, 24 | -          |
| Exploratory five-factor| -           | 4, 13, 14, 16, 18 | 17, 22, 25 | 1, 2, 3, 5, 6 | 7, 12, 21, 23, 24 | 10, 19     |
| Exploratory six-factor | 9, 15       | 4, 13, 14, 16, 18 | 17, 20, 22, 25 | 1, 2, 3, 5, 6 | 7, 12, 21, 23, 24 | 10, 19     |

*Note: Factor loading for the exploratory six-factor model (N = 3,633).*
| Item                                                                 | Factor |
|---------------------------------------------------------------------|--------|
| 9. I get emotional easily, often for very little reason.             | 0.70   |
|                                                                    | 0.05   |
|                                                                    | 0.00   |
|                                                                    | -0.07  |
|                                                                    | 0.12   |
|                                                                    | 0.02   |
| 15. I get irritated easily by all sorts of things.                  | 0.50   |
|                                                                    | 0.00   |
|                                                                    | 0.23   |
|                                                                    | 0.10   |
|                                                                    | -0.03  |
|                                                                    | 0.02   |
| 10. I fear being alone in life more than anything else.             | 0.01   |
|                                                                    | 0.61   |
|                                                                    | -0.02  |
|                                                                    | -0.01  |
|                                                                    | -0.02  |
|                                                                    | 0.02   |
| 19. I crave attention.                                              | 0.06   |
|                                                                    | 0.47   |
|                                                                    | -0.11  |
|                                                                    | 0.09   |
|                                                                    | 0.01   |
|                                                                    | -0.00  |
| 4. I often feel like nothing I do really matters.                   | -0.05  |
|                                                                    | 0.06   |
|                                                                    | 0.44   |
|                                                                    | 0.01   |
|                                                                    | 0.01   |
|                                                                    | 0.17   |
| 13. I steer clear of romantic relationships.                        | 0.04   |
|                                                                    | -0.11  |
|                                                                    | 0.36   |
|                                                                    | -0.10  |
|                                                                    | 0.21   |
|                                                                    | -0.01  |
| 14. I’m not interested in making friends.                           | 0.06   |
|                                                                    | -0.12  |
|                                                                    | 0.58   |
|                                                                    | 0.07   |
|                                                                    | 0.01   |
|                                                                    | 0.00   |
| 16. I don’t like to get too close to people.                        | 0.04   |
|                                                                    | -0.08  |
|                                                                    | 0.43   |
|                                                                    | 0.03   |
|                                                                    | 0.01   |
|                                                                    | -0.10  |
| 18. I rarely get enthusiastic about anything.                       | -0.02  |
|                                                                    | 0.03   |
|                                                                    | 0.59   |
|                                                                    | -0.01  |
|                                                                    | 0.12   |
|                                                                    | 0.02   |
| 17. It’s no big deal if I hurt other peoples’ feelings.             | 0.04   |
|                                                                    | 0.01   |
|                                                                    | 0.28   |
|                                                                    | 0.43   |
|                                                                    | -0.12  |
|                                                                    | 0.07   |
| 20. I often have to deal with people who are less important than me.| 0.08   |
|                                                                    | 0.14   |
|                                                                    | 0.06   |
|                                                                    | 0.30   |
|                                                                    | 0.23   |
|                                                                    | -0.06  |
| 22. I use people to get what I want.                                | 0.01   |
|                                                                    | 0.02   |
|                                                                    | 0.05   |
|                                                                    | 0.61   |
|                                                                    | 0.03   |
|                                                                    | 0.10   |
| 25. It is easy for me to take advantage of others.                  | -0.05  |
|                                                                    | 0.00   |
|                                                                    | -0.02  |
|                                                                    | 0.65   |
|                                                                    | 0.22   |
|                                                                    | -0.02  |
| 7. My thoughts often don’t make sense to others.                   | 0.04   |
|                                                                    | -0.06  |
|                                                                    | 0.07   |
|                                                                    | 0.01   |
|                                                                    | 0.45   |
|                                                                    | 0.17   |
| 12. I have seen things that weren’t really there.                  | 0.00   |
|                                                                    | 0.00   |
|                                                                    | 0.06   |
|                                                                    | 0.16   |
|                                                                    | 0.42   |
|                                                                    | -0.01  |
| 21. I often have thoughts that make sense to me but that other people say are strange. | -0.02 | -0.05 | -0.08 | 0.14 | 0.61 | 0.08 |
| 23. I often “zone out” and then suddenly come to and realize that a lot of time has passed. | 0.04 | 0.14 | 0.03 | -0.14 | 0.52 | 0.10 |
| 24. Things around me often feel unreal, or more real than usual.    | -0.00  |
|                                                                    | 0.10   |
|                                                                    | 0.05   |
|                                                                    | 0.02   |
|                                                                    | 0.63   |
|                                                                    | -0.03  |
| 1. People would describe me as reckless.                            | 0.15   |
|                                                                    | -0.05  |
|                                                                    | -0.15  |
|                                                                    | 0.06   |
|                                                                    | -0.03  |
|                                                                    | 0.55   |
| 2. I feel like I act totally on impulse.                            | 0.15   |
|                                                                    | -0.01  |
|                                                                    | -0.01  |
|                                                                    | 0.01   |
|                                                                    | 0.02   |
|                                                                    | 0.56   |
| 3. Even though I know better, I can’t stop making rash decisions.  | 0.07   |
|                                                                    | 0.07   |
|                                                                    | 0.05   |
|                                                                    | -0.01  |
|                                                                    | 0.20   |
|                                                                    | 0.37   |
| 5. Others see me as irresponsible.                                  | -0.02  |
|                                                                    | -0.00  |
|                                                                    | 0.23   |
|                                                                    | 0.07   |
|                                                                    | 0.07   |
|                                                                    | 0.35   |
| 6. I’m not good at planning ahead.                                  | -0.07  |
|                                                                    | 0.12   |
|                                                                    | 0.17   |
|                                                                    | -0.14  |
|                                                                    | 0.00   |
|                                                                    | 0.46   |
| 8. I worry about almost everything.                                 | 0.17   |
|                                                                    | 0.19   |
|                                                                    | 0.22   |
|                                                                    | 0.14   |
|                                                                    | 0.04   |
|                                                                    | 0.06   |
| 11. I get stuck on one way of doing things, even when it’s clear it won’t work. | 0.06 | 0.16 | 0.24 | 0.05 | 0.12 | 0.21 |

Note. NA, Negative Affect; IR, Interpersonal Relationships; De, Detachment; An, Antagonism; Ps, Psychoticism; Di, Disinhibition. Bold represents the largest factor loading in each item as well as >0.30.

Table 3. Goodness of fit index values for the compared models.
| Model          | CFI  | TLI  | SRMR | RMSEA | RMSEA 90%CI |
|----------------|------|------|------|-------|-------------|
|                | LO90 | HI90 |      |       |             |
| Normal sample (N = 3,522) |      |      |      |       |             |
| TFF            | 0.887| 0.872| 0.044| 0.046 | 0.044/0.048 |
| ESF            | 0.905| 0.888| 0.039| 0.044 | 0.042/0.046 |
| Clinical sample (N = 451) |      |      |      |       |             |
| TFF            | 0.868| 0.848| 0.061| 0.053 | 0.048/0.059 |
| ESF            | 0.904| 0.886| 0.060| 0.047 | 0.041/0.054 |

*Note.* TFF, theoretical five-factor model; ESF, exploratory six-factor model; CFI, comparative fit index, TLI, Tucker-Lewis index; SRMR, standard root mean square residual; RMSEA, root-mean-square error of approximation; LO90/HI90, lower/upper 90% confidence interval of the RMSEA.

### Table 4. Fit indexes of the PID-5-BF for MI across population.

| Model          | S-Bx2   | df  | CFI  | TLI  | RMSEA | △CFI | △TLI | BIC             | △RMSEA |
|----------------|---------|-----|------|------|-------|------|------|------------------|--------|
| Configural     | 3013.479*| 420 | 0.923| 0.907| 0.040 | —    | —    | 323186.073       | —      |
| Weak           | 3196.737*| 437 | 0.918| 0.905| 0.041 | -0.005| -0.002| 323230.393       | —      |
| Strong         | 3480.394*| 454 | 0.910| 0.900| 0.042 | -0.008| -0.005| 323383.756       | 0.001  |
| Strict         | 5377.472*| 477 | 0.855| 0.846| 0.052 | -0.055| -0.054| 325314.743       | 0.010  |
| Part.Strict    | 3817.237*| 467 | 0.901| 0.892| 0.043 | -0.009| -0.008| 323635.095       | 0.001  |

*Note.* Part.Strict, partial strict invariance by releasing the residuals of items with largest modification indices; the S-Bχ² = Satorra-Bentler scaled χ²; df, degrees of freedom; TLI, Tucker-Lewis index; CFI, comparative fit index; RMSEA, root-mean-square error of approximation; BIC, Bayesian information criterion.

### Table 5. Correlations between the PID-5-BF and full-length PID-5.
| PID-5-BF domains | 220-item PID-5 domains |
|------------------|------------------------|
|                  | NA  De  An  Ps  Di  TS |
| Normal sample (N = 3,985) | |
| NA               | 0.64** 0.35** 0.33** 0.40** 0.52** 0.58** |
| IR               | 0.58** 0.03  0.32** 0.26** 0.28** 0.40** |
| De               | 0.37** 0.86** 0.30** 0.47** 0.43** 0.62** |
| An               | 0.37** 0.40** 0.75** 0.53** 0.43** 0.65** |
| Ps               | 0.57** 0.49** 0.46** 0.85** 0.54** 0.77** |
| Di               | 0.47** 0.32** 0.27** 0.40** 0.82** 0.57** |
| TS               | 0.75** 0.67** 0.60** 0.77** 0.79** 0.93** |
| Clinical sample (N = 395) | |
| NA               | 0.69** 0.31** 0.17** 0.30** 0.53** 0.55** |
| IR               | 0.54** -0.05** 0.29** 0.23** 0.26** 0.33** |
| De               | 0.40** 0.91** 0.12** 0.43** 0.49** 0.65** |
| An               | 0.21** 0.30** 0.73** 0.35** 0.27** 0.52** |
| Ps               | 0.58** 0.50** 0.37** 0.88** 0.55** 0.78** |
| Di               | 0.51** 0.34** 0.20** 0.44** 0.84** 0.62** |
| TS               | 0.76** 0.71** 0.46** 0.74** 0.81** 0.94** |

**Note.** NA, Negative Affect; IR, Interpersonal Relationships; De, Detachment; An, Antagonism; Ps, Psychoticism; Di=, Disinhibition; TS, Total Score. Bold presents the highest correlation coefficient in each row.

**Correlation is significant at the 0.01 level (2-tailed).**

Table 6. Correlations between PID-5-BF domains and the six DSM-4 PDs retained in Section III of the DSM-5 and measured by PDQ-4+. 
| PID-5-BF domains | DSM-4 PDs in Section III of the DSM-5 |
|------------------|--------------------------------------|
|                  | STPD | ASPD | BPD   | NPD   | AVPD  | OCPD  |
| Normal sample (N = 7,155) |      |      |       |       |       |       |
| TS               | 0.35** | 0.28** | 0.53** | 0.39** | 0.48** | 0.35** |
| NA               | 0.20** | 0.18** | 0.43** | 0.27** | 0.33** | 0.25** |
| IR               | 0.13** | 0.12** | 0.23** | 0.29** | 0.26** | 0.19** |
| De               | 0.24** | 0.05** | 0.31** | 0.17** | 0.36** | 0.24** |
| An               | 0.29** | 0.26** | 0.27** | 0.33** | 0.23** | 0.21** |
| Ps               | 0.39** | 0.22** | 0.44** | 0.34** | 0.37** | 0.33** |
| Di               | 0.13** | 0.28** | 0.40** | 0.22** | 0.32** | 0.16** |
| Clinical sample (N = 231) |      |      |       |       |       |       |
| TS               | 0.44** | 0.40** | 0.66** | 0.28** | 0.43** | 0.21** |
| NA               | 0.24** | 0.19** | 0.43** | 0.14** | 0.35** | 0.21** |
| IR               | 0.11** | 0.06** | 0.25** | 0.30** | 0.24** | 0.13** |
| De               | 0.22** | 0.10** | 0.43** | 0.02** | 0.31** | 0.12** |
| An               | 0.23** | 0.36** | 0.23** | 0.32** | 0.07** | 0.06** |
| Ps               | 0.46** | 0.30** | 0.49** | 0.24** | 0.22** | 0.23** |
| Di               | 0.20** | 0.41** | 0.46** | 0.12** | 0.34** | -0.00** |

Note. NA, Negative Affect; IR, Interpersonal Relationships; De, Detachment; An, Antagonism; Ps, Psychoticism; Di, Disinhibition; TS, Total Score; STPD, schizotypal personality disorder; ASPD, antisocial personality disorder; BPD, borderline personality disorder; NPD, narcissistic personality disorder; AVPD, avoidant personality disorder; OCPD, obsessive-compulsive personality disorder.

Bold means suggested domains of each personality disorder in DSM-5;

**Correlation is significant at the 0.01 level (2-tailed)