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Item Response Theory Analysis, Reliability and Construct Validity of the Personality Inventory for ICD-11 (PiCD) in Italian Community Dwelling Adult Participants

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To assess the psychometric properties of the Personality Inventory for *ICD-11* (PiCD, where *ICD-11* is the *International Classification of Diseases, 11th Revision*), a sample of Italian community-dwelling adult participants ($N = 1,122$) was administered the PiCD, the Five-Factor Model Rating Form, the Big Five Inventory, the Personality Inventory for *DSM-5* Short Form (where *DSM-5* is the *Diagnostic and Statistical Manual of Mental Disorders, fifth edition*), and the Measure of Disordered Personality Functioning. Our findings supported the unidimensionality hypothesis for the PiCD Negative Affectivity, Detachment, and Dissocial scale items, whereas adequate fit indices were observed for the bifactor model of the PiCD Disinhibition and Anankastic item joint polychoric correlation matrix. The PiCD scales showed adequate internal consistency, test-retest reliability ($n = 262$), and meaningful relationships with five-factor model domains and their maladaptive variants. A four-factor model of the joint correlation matrix of the PiCD, Personality Inventory for *DSM-5* Short Form, and the five-factor model composite score was provided with adequate fit. All PiCD scales were significantly associated with the impairment in personality functioning.

Public Significance Statement

The purpose of the present study was to provide cross-cultural evidence for the reliability and validity of the Personality Inventory for *ICD-11* (PiCD). Our findings supported internal consistency and test-retest reliabilities, convergent-discriminant validities and factor structures of the PiCD in a moderately large sample of community-dwelling Italian adults.

Keywords: Personality Inventory for *ICD-11*, dimensional models of personality disorders, five-factor model, Personality Inventory for *DSM-5* Short Form, cross-cultural validity


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Evidence indicates that personality disorder (PD) categories in use since the third edition of *Diagnostic and Statistical Manual of Mental Disorders (DSM-III; American Psychiatric Association, 1980)* are plagued by a number of problems, such as arbitrary diagnostic thresholds, extensive comorbidity, temporal instability and insufficient construct validity (Widiger & Trull, 2007). In the 15 years between the completion of the fourth edition (*DSM-IV*) and the establishment of the work group to revise PDs in the fifth edition (*DSM-5*), a number of studies (e.g., Clark, 2007; Costa & McCrae, 1990; Harkness, McNulty, & Ben-Porath, 1995; Livesley, 2006; Widiger & Trull, 2007) supported the usefulness of a di-

mensional approach (Oltmanns & Widiger, 2018; Zachar, Krueger, & Kendler, 2016). Thus, an alternative model of personality disorders (AMPD) containing personality functioning and personality trait dimensions and six diagnostic categories model was printed in *DSM-5* Section III (American Psychiatric Association, 2013). Notably, the AMPD included a five-domain dimensional trait model, consisting of negative affectivity, detachment, antagonism, disinhibition, and psychoticism (American Psychiatric Association, 2013; Krueger & Markon, 2014).

Similarly, the World Health Organization's 11th revision of the *International Classification of Diseases (ICD-11)* proposed a dimensional trait model (Tyler, Reed, & Crawford, 2015; Widiger & Oltmanns, 2016), providing a true paradigm shift in the classification of PDs. Indeed, the proposed *ICD-11* model instructs the user to select one of three different diagnostic codes according to PD severity (mild, moderate, and severe), along with specification of five trait dimensions (negative affective, detachment, dissociality, disinhibition, and anankastic), that may be observed or rated by clinicians or informants (e.g., Bach et al., 2017).

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Interestingly, four of the five *ICD-11* domains were aligned, at least conceptually, with four of the five *DSM-5* Section III domains (Mulder, Horwood, Tyrer, Carter, & Joyce, 2016). More specifically, *ICD-11* negative affective, detachment, dissocial, and disinhibition were thought to align with *DSM-5* Section III negative affectivity, detachment, antagonistic, and disinhibition, respectively. However, the *ICD-11* dimensions were not entirely equivalent to the *DSM-5* proposals; indeed, the *ICD-11* dimensional trait model did not include a domain of schizotypal thinking and perception (referred to as psychoticism in *DSM-5* Section III) and, in turn, included an anankastic (or compulsivity) dimension that was not included in the final *DSM-5* proposal (American Psychiatric Association, 2013). The absence of *DSM-5* psychoticism from the *ICD-11* proposal was consistent though with the classification of schizotypal PD as a variant of schizophrenia rather than as a PD within *ICD-11*; rather, although *DSM-5* Section III trait model did not include an anankastic dimension, compulsivity was somewhat represented by the facet of rigid perfectionism (e.g., Bach et al., 2017; Oltmanns & Widiger, 2018; Widiger & Oltmanns, 2016).

The Personality Inventory for *ICD-11* (PiCD)

A significant difference between *DSM-5* and *ICD-11* is that the *DSM-5* working group members and consultants pursued the creation of an official measure for the maladaptive personality trait model, the Personality Inventory for *DSM-5* (PID-5; Krueger, Derringer, Markon, Watson, & Skodol, 2012). The availability of an assessment measure facilitated a substantial amount of research on the dimensional trait proposal for *DSM-5* to be published (Bagby, 2013; Krueger & Markon, 2014). Rather, this was not the case for *ICD-11* working group and there has been relatively little research on the dimensional trait proposal for the *ICD-11* (Oltmanns & Widiger, 2018). To promote research on the *ICD-11* dimensions as well as the “*DSM-5* to *ICD-11* cross-walk” (Bach et al., 2017), Oltmanns and Widiger (2018) developed the Personality Inventory for *ICD-11* (PiCD), a 60-item self-report measure of the *ICD-11* PDs trait model. An initial set of 130 draft items were written by the authors to develop scales for the five domains proposed for *ICD-11* (i.e., negative affective, detachment, dissocial, disinhibition, and anankastic) as described by the *ICD-11* working group (e.g., Mulder et al., 2016; Tyrer et al., 2011, Tyrer et al., 2015). Item selection and scale construction proceeded through three initial data collections assessing potential item performance (Clark & Watson, 1995; Oltmanns & Widiger, 2018); then, two studies were conducted for scale validation. First, the PiCD was evaluated in a sample ($N = 259$) of participants with respect to measures of general personality (i.e., the Eysenck Personality Questionnaire—Revised and the Five-Dimensional Personality Test). Then, the PiCD was evaluated in an independent sample ($N = 285$) of participants who were also administered two measures that are closely aligned with the *DSM-5* dimensional trait model. Finally, Oltmanns and Widiger (2018) provided an item-level factor analysis of the 60 PiCD items ($N = 285 + 259$) and found support for the expected four-structure of the PiCD items, where the anankastic traits are considered to be opposite to traits of disinhibition (e.g., Widiger & Simonsen, 2005).

The Present Study

Despite its encouraging psychometric properties and usefulness, to our knowledge, no independent replication of the original findings on the PiCD has been conducted, particularly in a cross-cultural (or at least cross-language) perspective. Evaluating the psychometric properties of the PiCD in a different cultural context (i.e., southern Europe) may be particularly important considering that the ICD is the authoritative classification for the diagnosis of disease (including mental disorders) for the 194 Member States of the World Health Organization and it is thought to be used worldwide.

Against this background, we administered the PiCD in a moderately large sample of Italian adult participants ($N = 1,122$) who volunteered to take part in the study, first, to evaluate the unidimensionality the PiCD scales by fitting a confirmatory factor analysis model of the individual PiCD scales. Notably, Oltmanns, and Widiger (2018) found support for an exploratory structural equation modeling (Marsh, Morin, Parker, & Kaur, 2014); specifically, 93% of the PiCD items obtained their primary loading on their domain Oltmanns and Widiger (2018). Nevertheless, to the best of our knowledge, no previous study tested the unidimensionality of the individual PiCD scales.

Second, we administered the PiCD to assess the internal consistency reliability of its scales, and the PiCD scale 2-week test-retest reliability in a subsample of participants ($n = 262$) who agreed to take part in the longitudinal part of the study. In the present study, we computed both test-retest r and Green's (2003) test-retest α coefficient, which allows to assess the test-retest reliability of the PiCD scales controlling for both transient error and item specific error correlation over time (Green, 2003). In line with Oltmanns and Widiger's (2018) findings, the internal consistency reliability estimates of the PiCD dimensions were expected to be adequate. Although no test-retest reliability data on the PiCD are currently available, based on previous findings on the temporal stability of measures of maladaptive personality domains (e.g., Pires, Sousa Ferreira, Gonçalves, Henriques-Calado, & Paulino, 2017) we expected that the five PiCD scale scores were provided with adequate short-term test-retest reliability.

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Third, we administered the PiCD to evaluate the relationships between the PiCD scales and five-factor model (FFM) traits, and dysfunctional personality traits, as they were operationalized in the Personality Inventory for *DSM-5* Short Form (PID-5-SF; Maples et al., 2015; Somma, Krueger, Markon, Borroni, & Fossati, 2018). To obtain reliable scores of the FFM traits that were not based on a single FFM measures, and to reduce the impact of method effects on the associations between the FFM personality domain measures and the PiCD domain scale scores, a Five-Factor Model Personality Index (FFMPI) which represents the composite score of the Big Five Inventory (BFI; John & Srivastava, 1999) and the Five-Factor Model Rating Form (FFMRF; Mullins-Sweatt, Jamerson, Samuel, Olson, & Widiger, 2006) scores was computed. Based on Oltmanns and Widiger's (2018) findings as well as on previous reports on the convergent-discriminant correlation between general personality traits and dysfunctional personality dimensions (e.g., Crego & Widiger, 2016), the PiCD Negative Affective scale was expected to show a positive relationship with FFMPI Neuroticism (N) scale, whereas Detachment, Dissocial, and Disinhibition scales were expected to show negative convergent validity with the

FFMPI Extraversion (E), Agreeableness (A), and Conscientiousness (C) scales, respectively. Similarly, the five PiCD domain scales (namely, Negative Affect, Detachment, Dissocial, Disinhibition, and Anankastic dimensions) were expected to show convergent validity with four PID-5 scales (namely, PID-5-SF Negative Affectivity and PiCD Negative Affective, PID-5-SF Detachment and PiCD Detachment, PID-5-SF Antagonism and PiCD Dissocial, and PID-5-SF Disinhibition with both PiCD Disinhibition [+], and Anankastic [-] dimensions), respectively. Rather, no convergent validity was a priori hypothesized between the PID-5-SF Psychoticism domain scale and any of the PiCD scales, because schizotypal PD was not included among PDs in the *ICD-11*.

Fourth, we administered the PiCD to confirm and extend Oltmanns and Widiger's (2018) model of the PiCD, which hypothesizes that the five PiCD domain scale map onto four latent dimensions, which are thought to be common to the *ICD-11* dysfunctional personality domains and the *DSM-5* AMPD Criterion B dysfunctional personality domains with the corresponding FFM general personality traits. In the present study, we performed dimensionality analysis of the correlation matrix of the PiCD scale scores, FFMPI scores, and PID-5-SF domain scale scores. If quasi-inferential parallel analysis provided evidence for a four-factor structure of the joint correlation matrix of normative dimensions (i.e., FFMPI scores), *ICD-11* dimensions (i.e., PiCD scores), and *DSM-5* AMPD domains (PID-5-SF domain scores), an unweighted least square (ULS) exploratory factor model (EFA) was fitted and its goodness-of-fit evaluated. Based on Oltmanns and Widiger's (2018) model of the PiCD, PiCD Negative Affective scale, PID-5-SF Negative Affectivity domain scale, and the FFMPI Neuroticism composite scores were expected to load on the same latent dimensions, PiCD and PID-5-SF Detachment scales were hypothesized to represent the positive polarity of a second factor, whose FFMPI Extraversion was hypothesized to represent its negative polarity. Considering the third factor, it was expected to be defined by PiCD Dissocial scale (+), PID-5-SF Antagonism domain scale (+), and FFMPI Agreeableness (-) scores; finally, the fourth factor was hypothesized to be characterized by a positive factor loading of the PiCD Anankastic scale and FFMPI Conscientiousness composite score, and by substantial negative loadings of the PiCD and PID-5-SF Disinhibition scales.

Finally, we administered the PiCD to extend Oltmanns and Widiger's (2018) results on the nomological network validity of PiCD by assessing the relationships between the PiCD dimensions and a measure of general impairment in personality functioning. Indeed, in the *ICD-11*, it has been proposed to classify PDs according to severity and personality dimensions (e.g., Tyrer et al., 2015). Thus, in the present study, we relied on the Italian translation of the Measure of Disordered Personality Functioning (MDPF; Parker et al., 2004). The MDPF was chosen because previous reports showed that it may be reliably and validly used to assess impairment in self-effectiveness and empathy among Italian community-dwelling adults (Fossati, Borroni, Somma, Markon, & Krueger, 2017). These constructs (namely, noncoping and noncooperativeness) are akin to the social dysfunction described in the *ICD-11* proposal (e.g., Olajide et al., 2018; Tyrer et al., 2015). Based on these considerations, we expected to observe significant and positive relationships between the PiCD scales and measures of general impairment in personality functioning, as they were operationalized in the MDPF Noncoping and Noncooperativeness scales.

Method

Participants

As a whole, 1,203 Italian community-dwelling adults volunteered to take part in the study; however, 81 participants (6.7%) did not provide complete data on the PiCD or any other measure. A detailed description of missing values is provided in the [online supplemental materials](#); however, Little's missing-completely-at-random test showed that missing values were completely at random, $\chi^2(1637) = 1,728.08, p > .05$. The final sample was composed of 1,122 Italian community-dwelling adult participants. Two hundred fifty-three participants (22.5%) were male and 867 (77.3%) were female, whereas two participants (0.2%) refused to disclose their gender. Participants' mean age was 31.94 years, $SD = 12.44$ years, range 18–80 years. Seven hundred sixty-four participants (68.1%) were unmarried, 294 (26.2) were married, 53 (4.7%) were divorced, and 10 (0.9%) were widow/widower, whereas one participant (0.1%) refused to disclose his or her civil status. One hundred four participants (9.3%) had junior high school degree, 584 (52.0%) had high school degree, 363 (32.4%) had university degree, 68 (6.1%) had graduate school degree, and three participants (0.3%) refused to report their educational level.

A subgroup of 262 participants (23.4%) agreed to participate in the PiCD 2-week test-retest reliability study. Forty-one participants (15.6%) were male and 220 (84.0%) were female; one participant (0.4%) refused to disclose his or her gender; participants' mean age was 30.60 years, $SD = 11.47$ years. A detailed description of the retest sample is provided in the [online supplemental materials](#).

Procedures

In the present study, all measures were administered to participants in their Italian translations. Participants responded to advertisements requesting potential volunteers for psychological research on the university web from summer 2018 to winter 2018. All participants were at least 18 years old at the time the study was carried out and were treated in accordance with the ethical principles of psychologists and code of conduct. Participants completed the study online using Google Forms platform; participants volunteered to take part in the study receiving no economic incentive or academic credit for their participation. To be included in the sample, participants had to document that they were adult (i.e., 18 years of age or older) and agree to online written informed consent in which the study was extensively described. Each participant included in the sample was asked to choose an alphanumeric ID code to allow the possibility to pair test-retest data. For each participant, questionnaires were administered in random order. A detailed description of measures translation procedures is provided in the [online supplemental materials](#).

Measures

The Cronbach's alpha values for the PiCD, FFMPI, PID-5 domain scales are reported in [Tables 1, 3, and 4](#), respectively.

Personality Inventory for *ICD-11* (PiCD; Oltmanns & Widiger, 2018). The PiCD is a 60-item, Likert-type self-report questionnaire that was explicitly designed to measure the five

Table 1

The Personality Inventory for ICD-11 Scales: Descriptive Statistics, Internal Consistency Reliability (i.e., Cronbach's α Coefficient) Estimates, and Scale Intercorrelations (N = 1,122)

Personality Inventory for ICD-11 subscale	M	SD	α	MIC	Scale intercorrelations (i.e., Pearson r values)					
					1	2	3	4	5	
1. Negative affective (12 items)	35.99	8.52	.84	.30	—					
2. Detachment (12 items)	27.05	8.90	.85	.32	.33	—				
3. Dissocial (12 items)	22.84	7.02	.78	.23	.22	.26	—			
4. Disinhibition (12 items)	24.17	6.94	.80	.25	.39	.26	.39	—		
5. Anankastic (12 items)	37.20	6.86	.77	.21	.16	.20	.10	-.40	—	

Note. ICD-11 = *International Classification of Diseases, 11th Revision*; MIC = mean interitem correlation; — = statistic not computed. The nominal significance level (i.e., $p < .05$) of Pearson r coefficients was corrected according to the Bonferroni procedure for multiple comparisons and set at $p < .005$. Pearson r values $> |.081|$ are significant at $p < .005$. **Bold highlights large effect size correlations ($r > .50$; Cohen, 1988).**

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broad domains of PDs that were included in the ICD-11, namely, negative affective, detachment, dissocial, disinhibition, and anankastic (Mulder et al., 2016). Each PiCD item is rated on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*); each PiCD domain scale includes 12 items.

Five-Factor Model Personality Index (FFMPI). The FFMPI represents the composite score of the FFMRF and BFI scale scores. Previous data showed that the Italian translation of the FFMRF is provided with adequate reliability and validity (Fossati, Widiger, Borroni, Maffei, & Somma, 2017). In the present study, the Cronbach's alpha values for the FFMRF N, E, A, C, and O scales were .73 (mean interitem correlation [MIC] = .32), .77 (MIC = .36), .68 (MIC = .26), .80 (MIC = .40), and .69 (MIC = .27), respectively. Fossati, Borroni, Marchione, and Maffei (2011) provided reliability and validity data for the Italian translation of the BFI. In the present study, the BFI N, E, A, C, and O scales showed Cronbach's alpha values of .86 (MIC = .43), .86 (MIC = .43), .75 (MIC = .25), .83 (MIC = .35), and .84 (MIC = .35). To obtain the FFMPI scale scores, for each FFM personality domain, the corresponding FFMRF and BFI scale scores were transformed to z scores, summed, and averaged. Thus, the FFMPI provides scores for N, E, A, C, and O scales, respectively. A detailed description of the development of the FFMPI is provided in the online supplemental materials.

Personality Inventory for DSM-5. Short Form (PID-5-SF; Maples et al., 2015). The PID-5-SF represents a 100-item version of the PID-5 (Krueger et al., 2012) to score the DSM-5 domains and facets, which was obtained through the use of item response theory methods. The PID-5-SF resulted in nearly identical reliability and validity and similar nomological networks with the PID-5 (Maples et al., 2015). Recently, Somma and colleagues (2018) provided data on the psychometric properties of the Italian translation of the PID-5-SF. In the present study, the median Cronbach's alpha value for the PID-5 trait scales was .83, $SD = .07$ (median MIC = .55, $SD = .10$), minimum Cronbach's $\alpha = .64$ (PID-5 Irresponsibility scale; MIC = .30), maximum Cronbach's $\alpha = .90$ (PID-5 Attention Seeking scale; MIC = .69).

Measure of Disordered Personality Functioning (MDPF; Parker et al., 2004). The MDPF is a 20-item, Likert-type self-report questionnaire designed to assess two broad dimensions of personality dysfunction, namely, Noncoping and Noncooperativeness. The final version of the MDPF was validated in both non-clinical samples and clinical samples (Parker et al., 2004) and is

considered a reliable and valid self-report measure of personality dysfunction (Ro & Clark, 2013). Fossati and colleagues (2017) reported the psychometric properties of the Italian translation of the MDPF in Italian community-dwelling adults. In the present study, Cronbach's alpha values were .83 (MIC = .33) and .85 (MIC = .36) for the MDPF Noncooperativeness and Noncoping scales, respectively.

Results

Unidimensionality of the PiCD Scales: Factor Analysis Results

When the unidimensional model for the 12 items that were included in each PiCD scale was tested using weighted least square mean and variance adjusted (WLSMV) confirmatory factor analyses of the PiCD item polychoric correlation matrices, adequate goodness-of-fit index values (Hu & Bentler, 1999) were observed for the PiCD Negative Affective, $\chi^2(54) = 449.14$, $p < .001$, root mean square error of approximation (RMSEA) = .081, 90% confidence interval (CI) [.073, .09], Tucker-Lewis index (TLI) = 0.956, comparative fit index (CFI) = .964, Detachment, $\chi^2(54) = 533.36$, $p < .001$, RMSEA = .089, 90% CI [.080, .097], TLI = 0.949, CFI = .958, and Dissocial scales, $\chi^2(54) = 639.13$, $p < .001$, RMSEA = .098, 90% CI [.089, .11], TLI = 0.901, CFI = .919. In contrast, WLSMV factor analysis goodness-of-fit index values did not seem to support the unidimensionality hypothesis for the PiCD Disinhibition, $\chi^2(54) = 1,126.28$, $p < .001$, RMSEA = .133, 90% CI [.125, .141], TLI = 0.848, CFI = .876, and Anankastic scale items, $\chi^2(54) = 1029.34$, $p < .001$, RMSEA = .127, 90% CI [.119, .135], TLI = 0.815, CFI = .848.

Because Oltmanns and Widiger (2018) considered PiCD Disinhibition and Anankastic as opposite poles of a single domain, we tested an exploratory bifactor representation of the PiCD Disinhibition and Anankastic scale items (Reise, Moore, Sabb, Brown, & London, 2013). This bifactor model (Zinbarg, Revelle, & Yovel, 2007) had one general factor and two orthogonal specific factors (i.e., disinhibition and anankastic), and WLSMV exploratory structural equation modeling with bigeomin orthogonal rotation was used to estimate their parameters. The following fit index values were observed for the PiCD Disinhibition and Anankastic

items, $WLSMV\chi^2(207) = 1,517.62, p < .001, RMSEA = .075, 90\% CI [.072, .079], TLI = 0.92, CFI = .90$.¹

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PiCD Internal Consistency Reliability and 2-Week Test-Retest Reliability

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The descriptive statistics, internal consistency reliabilities, and intercorrelations for the PiCD scales are listed in Table 1. The PiCD scale 2-week test-retest study ($N = 262$) results are summarized in Table 2; for each set of test-retest comparisons, the nominal significance level (i.e., $p < .05$) was corrected according to the Bonferroni procedure and set at $p < .01$. In the present study, test-retest r values ranged from .81 (Anankastic) to .89 (Negative Affectivity and Detachment), whereas Green's (2003) test-retest α coefficient ranged from .69 (Anankastic) to .82 (Negative Affectivity and Detachment).

PiCD Convergent-Discriminant Validity

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Stratified α coefficient (Nunnally & Bernstein, 1994) was used to evaluate the internal consistency reliability of the FFMPI scale composite scores. The convergent-discriminant validity correlations (i.e., Pearson r coefficients) between the PiCD scales and the FFMPI scales are listed in Table 3. The PiCD Detachment, Dissocial, and Disinhibition scales were expected to show negative convergent validity r coefficient values with the FFMPI E, A, and C scales, respectively, because they were thought to represent their corresponding negative extremes. In our study, all convergent validity coefficients ranged from .481 (Dissocial and Agreeableness) to .811 (Negative Affectivity and Neuroticism), and could be considered at least of moderate size by conventional standards (Cohen, 1988). In the present study, Steiger's (1980) z tests were used to compare convergent validity r coefficients with discriminant correlation coefficients. All convergent validity r coefficients were significantly larger than the corresponding discriminant validity r coefficients, minimum Steiger's $|z| = 11.22$, maximum Steiger's $|z| = 31.51$, all $ps < .001$. The median effect size r coefficient for the Steiger's z test value was .58, $SD = .17$, min. effect size $r = .421$, max effect size $r = .1901$.

The correlations (i.e., Pearson r coefficients) between the PiCD scales and the PID-5-SF domain scales are summarized in Table 4. In the present study, on average the PID-5-SF domain scales were moderately intercorrelated, median $r = .46, SD = .10$, min. $r = .30$ (PID-5-SF Detachment and Antagonism scales), max. $r = .58$ (PID-5-SF Disinhibition and Psychoticism scales), all $ps < .001$. The five PiCD domain scales were expected to show convergent validity with four PID-5 scales (namely, Negative Affectivity, Detachment, Antagonism, and Disinhibition); the PiCD Anankastic domain scale was expected to have a negative and significant relationship with the PID-5 Disinhibition scale. No convergent validity was a priori hypothesized between the PID-5-SF Psychoticism domain scale and any of the PiCD scales, because schizotypal PD was not included among PDs in the ICD-11. The nominal significance level (i.e., $p < .05$) of Pearson r coefficients was corrected according to the Bonferroni procedure for multiple comparisons and set at $p < .002$. Pearson r values $> .1091$ were significant at $p < .0011$. All convergent validity r coefficients were signifi-

cantly larger than the corresponding discriminant validity r coefficients, min. Steiger's $|z| = 9.03$, max. Steiger's $|z| = 30.15$, all $ps < .001$. The median effect size r coefficient for the Steiger's z -test value was .52, $SD = .09$, minimum effect size $r = .1301$, maximum effect size $r = .1651$.

On average, the PID-5-SF scales (i.e., Anxiousness, Emotional Lability, Hostility, Perseveration, Restricted Affectivity, Separation Insecurity, and Submissiveness) that were designed to measure the DSM-5 AMPD Negative Affectivity domain traits showed a nonnegligible association with the PiCD Negative Affective domain scale, median $r = .57$. Similar considerations held for the associations between the PID-5-SF scales (i.e., Anhedonia, Depressivity, Intimacy Avoidance, Suspiciousness, and Withdrawal) measuring the DSM-5 AMPD Detachment traits and the PiCD Detachment scale, median $r = .49$, the PID-5 SF scales (i.e., Attention Seeking, Callousness, Deceitfulness, Grandiosity, and Manipulativeness) measuring the DSM-5 AMPD Antagonism traits and the PiCD Dissocial scale, median $r = .53$, and the PID-5-SF scales (i.e., Distractibility, Impulsivity, Rigid Perfectionism, Risk Taking, and Irresponsibility) measuring the DSM-5 AMPD Disinhibition traits and the PiCD Disinhibition scale, median $r = .50$. Considering the PID-5-SF scales measuring Disinhibition traits, only the Rigid Perfectionism scale showed a positive correlation with the PiCD Anankastic scale, $r = .43, p < .001$; rather, all the other PID-5-SF scales that were designed to measure traits of the DSM-5 Disinhibition domain showed negative relationships with the PiCD Anankastic scale, with Pearson r values ranging from $-.43$ (PID-5-SF Impulsivity scale) to $-.10$, all $ps < .001$, median $r = -.11, SD = .16$.

PiCD, FFMPI, and PID-5 Joint Analysis

The PiCD, FFMPI, and PID-5 domain scale joint correlation matrix is listed in Table S3 in the online supplemental materials. The dimensionality analysis results of the PiCD, FFMPI, and PID-5 domain scale joint correlation matrix are summarized in Table 5. Parallel analysis was based on 1,000 random correlation matrices that were obtained by random permutations of the original data (Buja & Eyuboglu, 1992). The value of the Kaiser-Meyer-Olkin statistic of sampling adequacy was .80. When we fitted an exploratory unweighted least square four-factor model of the PiCD, FFMPI, and PID-5 domain scale joint correlation matrix, it explained 73.0% of the variance. Factor loadings based on oblique Geomin rotation, communality estimates and goodness-of-fit statistics for the exploratory unweighted least square four-factor model are listed in Table 6; 92.0% ($n = 23$) of the observed variables showed communality estimates greater than .50, showing that the four-factor model

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¹ The goodness-of-fit of a full-information confirmatory factor analysis of the PiCD items based on item-to-scale assignment was adequate. In our study, the full-information five-factor confirmatory model showed a highly significant value for the M_2^* statistic (i.e. a test statistic that can be used in the assessment of model fit in applications of item response theory when the items are polytomous; Cai & Hansen, 2013), $M_2^*(1520) = 8,858.90, p < .001$; however, its associated $RMSEA_2$ value suggested acceptable fit, $RMSEA_2 = .066$ (90% CI [.064, .067]). A detailed description of the confirmatory factor analysis results of the PiCD items is available upon request from the corresponding author.

Table 2

Personality Inventory for ICD-11 Scale 2-Week Test–Retest Results: Mean-Level Consistency, Test–Retest Correlation (i.e., Pearson *r* Coefficient), and Green’s Alpha Coefficient for Test–Retest Data (*N* = 262)

Personality Inventory for ICD-11 subscale	Time 1			Time 2			<i>t</i> (261)	<i>d</i>	<i>r</i>	$\alpha_{X_1X_2}$
	<i>M</i>	<i>SD</i>	α	<i>M</i>	<i>SD</i>	α				
Negative affective	35.94	9.21	.86	35.54	9.32	.88	1.49	.09	.89***	.82
Detachment	26.49	9.06	.86	26.87	9.38	.88	-1.43	-.09	.89***	.82
Dissocial	22.82	6.89	.77	21.83	7.08	.81	4.11***	.25	.84***	.72
Disinhibition	23.58	6.38	.79	23.48	6.43	.81	.44	.03	.82***	.73
Anankastic	37.26	6.78	.77	37.92	7.00	.80	-2.48	-.15	.81***	.69

Note. ICD-11 = International Classification of Diseases, 11th Revision; $\alpha_{X_1X_2}$ = Green’s (2003) coefficient alpha for test–retest data. The nominal significance level (i.e., *p* < .05) of paired-sample *t* tests and Pearson *r* coefficients was corrected according to the Bonferroni procedure for multiple comparisons and set at *p* < .01. Bold highlights large effect size correlations (*r* > 1.50; Cohen, 1988) and standardized mean differences (*d* > 1.80; Cohen, 1988).

*** *p* < .001.

showed more than one half of their variance. The 90% CI for RMSEA was .036, .052.

Relationships Between PiCD Dimensions and General Impairment in Personality Functioning

In the present study, the MDPF Noncoping scale (*M* = 10.08, *SD* = 5.28) showed Pearson *r* values of .63, *p* < .001, .47, *p* < .001, .14, *p* < .001, .48, *p* < .001, and -.09, *p* < .01, with the PiCD Negative Affective, Detachment, Dissocial, Disinhibition, and Anankastic scales, respectively. The correlations (i.e., Pearson *r* coefficient values) between the MDPF Noncooperativeness scale (*M* = 6.82, *SD* = 4.09) and the PiCD Negative Affective, Detachment, Dissocial, Disinhibition, and Anankastic scales were .18, *p* < .001, .42, *p* < .001, .35, *p* < .001, .28, *p* < .001, and -.09, *p* < .01, respectively. However, because the PiCD Disinhibition scale showed a negative, significant association with the PiCD Anankastic scale, while showing significant relationships with both MDPF Noncoping and Noncooperativeness scale, it may have biased the associations between the PiCD Anankastic scale and the two MDPF scales. When we reanalyzed the relationship between the PiCD Anankastic scale and the MDPF Noncoping scale controlling for the effect of the PiCD Disinhibition scale, the partial *r* value was .12, *p* < .001, whereas the partial *r* value for the

relationship between the PiCD Anankastic scale and the MDPF Noncooperativeness scale controlling for the effect of the PiCD Disinhibition scale was .04, *p* > .10.

Discussion

As a whole, our findings seemed to suggest that the Italian translation of the PiCD represents a reliable and construct-valid measure of the ICD-11 domains, at least when it was administered to Italian community-dwelling adult participants. Confirming and extending previous reports on the U.S. original version of the PiCD (Oltmanns & Widiger, 2018), our study provided data on the cross-cultural replicability of the PiCD measurement properties. In turn, cross-cultural stability represents a major target in the development of ICD-11 measures because the ICD-11 has been developed by the World Health Organization to represent the official world classification system for all diseases, including PDs, which may be potentially used in every country worldwide (Bach et al., 2017). Interestingly, in our study the PiCD nicely fitted a network of nomological relationships with sound measures of both FFM general personality domains and DSM-5 AMPD dysfunctional personality domains; in this respect, the PiCD may represent a helpful tool to harmonize the ICD-11 and the DSM-5 and to provide ICD-11 to DSM-5 cross-walk (Bach et al., 2017).

Table 3

The Personality Inventory for ICD-11 Scales: Correlations (i.e., Pearson *r* Values) With the Five-Factor Personality Model Index Scores (*N* = 1,122)

Five-Factor Model Personality Index subscales	<i>M</i>	<i>SD</i>	Stratified α	Personality Inventory for ICD-11 scale <i>r</i> values				
				NA	DT	DL	DN	AN
Neuroticism	.00	.89	.85	.81	.30	.15	.38	-.03
Extraversion	.00	.91	.89	-.34	-.73	.04	-.09	-.12
Agreeableness	.00	.94	.90	-.15	-.37	-.48	-.20	.03
Conscientiousness	.00	.90	.83	-.28	-.22	-.08	-.63	.44
Openness to Experience	.00	.94	.89	-.01	-.21	.07	.06	-.03

Note. ICD-11 = International Classification of Diseases, 11th Revision; NA = Negative Affective; DT = Detachment; DL = Dissocial; DN = Disinhibition; AN = Anankastic. For each Five Factor Index subscale, the stratified α coefficient was computed using sums of standardized scores of the Big Five Inventory and Five-Factor Model Rating Form corresponding scale. The expected convergent validity (i.e., Pearson *r*) coefficients between the Personality Inventory for ICD-11 scales and the Five-Factor Model Personality Index scales are underlined. The nominal significance level (i.e., *p* < .05) of Pearson *r* coefficients was corrected according to the Bonferroni procedure for multiple comparisons and set at *p* < .002. Pearson *r* values > 1.091 are significant at *p* < .002. Bold highlights large effect size correlations (*r* > 1.50; Cohen, 1988).

Table 4

The Personality Inventory for ICD-11 Scales: Correlations (i.e., Pearson r) Coefficients With the Personality Inventory for DSM-5 Short Form Domain Scales ($N = 1,122$)

Personality Inventory for ICD-11 subscales	Personality Inventory for DSM-5 domain scales				
	Negative affectivity	Detachment	Antagonism	Disinhibition	Psychoticism
Negative affective	.76	.42	.22	.46	.45
Detachment	.17	.72	.18	.26	.33
Dissocial	.15	.34	.67	.39	.46
Disinhibition	.30	.32	.29	.73	.42
Anankastic	.11	.09	.09	-.30	.00
<i>M</i>	1.31	.64	.50	.76	.66
<i>SD</i>	.67	.55	.49	.50	.57
α	.89	.89	.88	.86	.88
MIC	.41	.40	.38	.33	.38

Note. ICD-11 = International Classification of Diseases, 11th Revision; DSM-5 = Diagnostic and Statistical Manual of Mental Disorders, fifth edition; MIC = mean interitem correlation. The nominal significance level (i.e., $p < .05$) of Pearson r coefficients was corrected according to the Bonferroni procedure for multiple comparisons and set at $p < .002$. Pearson r values $> |.09|$ are significant at $p < .002$. Bold highlights large effect size correlations ($r > |.50|$; Cohen, 1988). Convergent validity (i.e., Pearson r) coefficients are underlined; the Personality Inventory for ICD-11 Anankastic scale was expected to show a negative relationship with the Personality Inventory for DSM-5 Short Form Disinhibition domain scale. No convergent validity was a priori hypothesized between the Personality Inventory for DSM-5 Psychoticism domain scale and any of the Personality Inventory for ICD-11 scales, because schizotypal personality disorder is not included among personality disorders in the ICD-11.

Dimensionality of PiCD Scales

Extending Oltmanns and Widiger's (2018) seminal findings, our data supported the unidimensionality hypothesis for the PiCD Negative Affectivity, Detachment, and Dissocial scale items, whereas adequate fit index values were observed for the bifactor model of the PiCD Disinhibition and Anankastic item joint polychoric correlation matrix. Thus, our results seemed to suggest that the PiCD Disinhibition and Anankastic item scores could reflect multidimensionality caused by clusters of items with similar content, as well as the effect of a general factor running among the items (Rodriguez, Reise, & Haviland, 2016). These findings are particularly interesting because the PiCD Disinhibition and Anankastic scales were considered by Oltmanns and Widiger (2018) to be representing opposite poles of a single domain. Indeed, consistent with the ICD-11 proposal (Mulder et al., 2016), as well as with previous observations (Skodol, 2012; Widiger & Simonsen, 2005),

our findings supported the hypothesis of the alignment between Disinhibited and low FFM conscientiousness as well as between Anankastic and high conscientiousness.

PiCD Internal Consistency Reliability and 2-Week Test-Retest Reliability

Confirming and extending Oltmanns and Widiger's (2018) seminal findings, in our study all the PiCD scales showed adequate internal consistency reliability estimates (i.e., Cronbach's alpha coefficient values), while presenting MIC values that were all in the .15–.50 range, which is considered to suggest adequate internal consistency (Clark & Watson, 1995). Extending previous reports on the PiCD scale reliability (Oltmanns & Widiger, 2018), 2-week test-retest r values were greater than .80, suggesting that the five PiCD scale scores were provided also with adequate short-term test-retest reliability. Extending previous reports on the PiCD

Table 5

Dimensionality Analysis of the Personality Inventory for ICD-11, Personality Inventory for DSM-5 Short Form, and Five-Factor Model Personality Index Scale Correlation (i.e., Pearson r Coefficient) Matrix: Bayesian Information Criterion and Parallel Analysis Results ($N = 1,122$)

Dimensions	Bayesian information criterion	Parallel analysis ($n = 1,000$ randomly permuted correlation matrices)		
		Real data eigenvalues	Random data eigenvalues	
			<i>M</i>	95th Percentile
1	3,404.068	5.274	1.216	1.262
2	2,231.181	2.130	1.170	1.204
3	1,442.066	1.829	1.134	1.162
4	688.722 ^a	1.722 ^a	1.102	1.125
5	699.200	.885	1.073	1.096
6	774.960	.632	1.047	1.068

Note. ICD-11 = International Classification of Diseases, 11th Revision; DSM-5 = Diagnostic and Statistical Manual of Mental Disorders, fifth edition. Parallel analysis was based on 1,000 random matrices that were obtained by random permutations of the original data.

^a Advised number of dimensions.

Table 6
Personality Inventory for ICD-11 (PiCD), Personality Inventory for DSM-5 (PID-5) Short Form, and Five-Factor Model Personality Index (FFMPI) Scale Joint Unweighted Least Square Exploratory Factor Analysis Results: Oblique Geomin-Rotated Factor Loading Matrix and Goodness-of-Fit Statistics (N = 1,122)

Scale	F1	F2	F3	F4	h^2
Negative affective (PiCD)	.87	.07	.02	.02	.80
Detachment (PiCD)	-.01	.81	.17	.06	.73
Dissocial (PiCD)	-.06	.00	.89	.06	.76
Disinhibition (PiCD)	.07	.02	.34	-.69	.72
Anankastic (PiCD)	.28	.12	.05	.74	.51
Negative affectivity (PID-5)	.93	-.13	.01	.02	.78
Detachment (PID-5)	.13	.61	.29	-.03	.63
Antagonism (PID-5)	.04	-.02	.76	.03	.59
Disinhibition (PID-5)	.26	.01	.40	-.58	.78
Psychoticism (PID-5)	.38	-.02	.49	-.08	.52
Neuroticism (FFMPI)	.77	.11	-.04	-.12	.73
Extraversion (FFMPI)	-.06	-.90	.20	-.01	.82
Agreeableness (FFMPI)	.20	-.40	-.47	.02	.38
Conscientiousness (FFMPI)	.04	-.24	-.01	.76	.66
Openness to experience (FFMPI)	.18	-.46	.15	.02	.19
Factor correlation matrix					
F1	—				
F2	.38	—			
F3	.29	.20	—		
F4	-.31	-.13	-.14	—	

Note. ICD-11 = International Classification of Diseases, 11th Revision; DSM-5 = Diagnostic and Statistical Manual of Mental Disorders, fifth edition; F = Factor. Model fit statistics: $\chi^2(51) = 162.01^{***}$; root mean square error of approximation = .044; Tucker-Lewis index = .984; comparative fit index = .992; standardized root mean square residual = .037. Bold highlights factor loading values $\geq .40$; italic highlights factor loading values greater than .30, but smaller than .40; for each rotated factor, the factor loadings of the variables that were hypothesized to represent factor marker variables are underlined.

*** $p < .001$.

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scale reliability, these data suggested that the PiCD scale scores are robust to transient error effects, even when controlling test-retest reliability estimates for specific error correlations between test and retest (Green, 2003).

PiCD Convergent-Discriminant Validity

Oltmanns and Widiger (2018) demonstrated that the original US version of the PiCD nicely fitted a system of expected relationships with several measures of normative personality traits. Confirming and extending these findings, in our study the five PiCD scales showed substantial and unique relationships with reliable and construct-valid measures of the FFM general domains of personality (i.e., the FFMPI scale scores) that were a priori hypothesized to represent the adaptive variant of the corresponding PiCD/ICD-11 dimensions (Widiger & Oltmanns, 2016). To stress further the relevance of these convergences between selected PiCD scale scores and specific FFMPI domain scores for understanding the continuities between FFM general personality traits and ICD-11 dysfunctional personality domains, it should be observed that in our study all convergent validity r coefficients were significantly and substantially larger than the corresponding discriminant validity r coefficients.

Consistent with Oltmanns and Widiger's (2018) results, in our study large effect size correlations (i.e., $r > .50$; Cohen, 1988) were observed for the predicted convergent validity associations between the PiCD scale scores and the PID-5-SF domain scale

scores. Interestingly, in our study the PID-5-SF Psychoticism domain scale—that is, a measure of psychosis-proneness dysfunctional personality domain based on the DSM-5 AMPD (Krueger et al., 2012) – showed nontrivial, positive, and significant relationships with the PiCD Negative Affective, Detachment, Dissocial, and Disinhibition domain scales. Although other explanations may be possible, we feel that these findings were somewhat consistent with FFM research data showing that psychosis-proneness and severity of psychotic symptoms may be associated with high N (i.e., high PiCD Negative Affective scale scores), low E (i.e., high PiCD Detachment scale scores), low A (i.e., high PiCD Dissocial scale scores), and low C (i.e., high PiCD Detachment scale scores), at least among participants with a diagnosis of schizophrenia, participants with schizophrenia spectrum PD, or siblings of subjects with schizophrenia diagnosis (Boyette et al., 2013; Camisa et al., 2005; Gurrera, Nestor, & O'Donnell, 2000).

PiCD, FFMPI, and PID-5 Joint Analysis

Consistent with Oltmanns and Widiger's (2018) model of the PiCD, which hypothesizes that the five PiCD domain scale map onto four latent dimensions, which are thought to align the ICD-11 dysfunctional personality domains—as well as the DSM-5 AMPD Criterion B dysfunctional personality domains—with the corresponding FFM general personality traits, our dimensionality analysis results provided evidence for a four-factor structure of the joint correlation matrix of the PiCD scale scores, FFMPI scores,

and PID-5-SF domain scale scores. Confirming and extending Oltmanns and Widiger's (2018) findings, our ULS EFA results showed that the four-factor model of the joint correlation matrix was provided with adequate fit index values, with each PiCD scale, as well as PID-5-SF and FFMPI composite score, showing its largest factor loading on the latent dimension (i.e., factor) which it was expected to load on.

Consistent with Widiger and Oltmanns's (2016) model, in our study the PiCD Negative Affective scale, PID-5-SF Negative Affectivity domain scale, and the FFMPI Neuroticism composite scores seemed to represent the FFM neuroticism general personality trait. Interestingly, with the exception of the PID-5 Psychoticism domain scale, no other observed variable showed non-negligible secondary factor loadings (i.e., standardized factor loading values $>.30$) on the first factor. It should be observed that the PiCD did not include a psychosis-proneness scale, thus it was not surprising to observe that non-negligible factor loadings of the PID-5-SF Psychoticism scale spread over Factor 1 and Factor 3. Although other explanations may be possible, we feel that these substantial, positive loadings of the PID-5-SF Psychoticism scale may reflect the association between psychosis-proneness, and high neuroticism (i.e., Factor 1) and low agreeableness (i.e., Factor 3) that were previously reported in the literature (Boyette et al., 2013; Camisa et al., 2005; Gurrera et al., 2000).

Confirming and extending previous factor analytic findings on the PiCD (Oltmanns & Widiger, 2018), our results seemed to indicate that four broad dimensions connecting adaptive personality feature to their maladaptive counterparts explained the covariation of the PiCD scales with the PID-5-SF domain scales, on the one hand, and with the FFMPI composite scores, on the other hand. We feel that our ULS EFA findings are highly consistent with Bach and colleagues' (2017) attempts at creating bridges between measures of the *ICD-11* and *DSM-5* AMPD Criterion B domains, respectively, while rooting firmly these dysfunctional domains in the FFM framework.

Relationships Between PiCD Dimensions and General Impairment in Personality Functioning

Lending further support to the evidence that the PiCD scales measure dysfunctional personality dimensions (Oltmanns & Widiger, 2018), our results showed several significant relationships between the PiCD scales and measures of general impairment in personality functioning (i.e., the MDPF Noncoping and Noncooperativeness scales). The PiCD Negative Affective, Detachment, Dissocial, and Disinhibition scales showed direct relationships with poor self-effectiveness, poor self-directedness, and self-defeating attitude (i.e., MDPF Noncoping scale; Parker et al., 2004); in particular, large or moderate-to-large effect size r values were observed for the PiCD Negative Affective, Detachment, and Disinhibition domain scales. Interestingly, after removing the "suppressor" role of the PiCD Disinhibition scale, a significant and positive (albeit modest) relationship between the PiCD Anankastic scale and the MDPF Noncoping scale was observed ($r = .12, p < .001$). This finding was consistent with the hypothesis that the *ICD-11* Anankastic domain is likely to represent a maladaptive variant of high conscientiousness (e.g., Widiger & Mullins-Sweatt, 2009). Similar considerations held for the relationships between MDPF Noncooperativeness scale (i.e., poor empathy with a reduced

capacity to understand other people's point of view and poor desire for closeness), although the relationship between PiCD Anankastic domain and MDPF Noncooperativeness scale remained nonsignificant even after controlling the effect of PiCD Disinhibition scale. Moreover, PiCD Dissocial dimension showed its greatest, albeit moderate, association with MDPF Noncooperativeness scale. Notably, PiCD Detachment and, to a lesser extent, PiCD Negative Affective domain, showed their largest association with the general impairment on personality functioning, with median r values for the associations with MDPF scales of .45 and .43, respectively. These findings are consistent with previous meta-analytic data documenting that PDs are meaningfully related to the domain of neuroticism (e.g., Samuel & Widiger, 2008; Saulsman & Page, 2004) and extraversion (e.g., Ozer & Benet-Martinez, 2006).

Limitations

Of course, the results of the present study should be considered in the light of several limitations. Although we relied on a moderately large sample of community-dwelling participants, they were not randomly selected; thus, our sample was more akin to a convenient study group than to a random sample of participants that was actually representative of the Italian population of adult subjects. Although studying clinically relevant personality traits in nonclinical samples may be legitimate (e.g., Lenzenweger, 2008), our data should not be uncritically extended to clinical/forensic populations.

In the present study, we relied only on self-report measures. Although the large majority of the research on the *DSM-5* dysfunctional personality domains has itself relied on self-report inventories (e.g., Al-Dajani, Gralnick, & Bagby, 2016), it would be important for future research concerning the PiCD to also consider its relationship across methods of assessment (e.g., McCrae, 2018). In the present study, we relied exclusively on the MDPF as a measure of severity of impairment in personality functioning. Although, Olajide and colleagues (2018) have recently developed the Standardized Assessment of Severity of Personality Disorder, reliable measures for facilitating assessment of severity according to *ICD-11* criteria are still sparse (Olajide et al., 2018) and they were not validated into Italian language. Moreover, it should be observed that the MDPF item and scale contents cover adequately the interpersonal and social dysfunction included in the *ICD-11* criteria for PD severity assessment, with the only exception for harm to self or others. Thus, before accepting our conclusions, future studies should investigate if the pattern of associations between the PiCD scale scores and the Standardized Assessment of Severity of Personality Disorder scores overlaps with the system of relationships that the PiCD scale scores showed in the present study with the MDPF scale scores.

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