The Personality Inventory for ICD-11: Investigating Reliability, Structural and Concurrent
Validity, and Method Variance

Michael Carnovale

University of Toronto Scarborough

Martin Sellbom

University of Otago

R. Michael Bagby

University of Toronto

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Author Note

Michael Carnovale, Graduate Department of Psychological Clinical Science, University of Toronto Scarborough, Toronto, Canada; Martin Sellbom, Department of Psychology, University of Otago, Dunedin, New Zealand; R. Michael Bagby, Departments of Psychology and Psychiatry, University of Toronto; Graduate Department of Psychological Clinical Science, University of Toronto Scarborough.

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Correspondence concerning this article should be addressed to R. Michael Bagby, Department of Psychology, University of Toronto, 1265 Military Trail, Toronto, Ontario M1C 1A4, Canada. E-mail: rmichael.bagby@utoronto.ca

Abstract

The eleventh edition of the International Classification of Diseases and Related Health Problems (ICD-11), recently approved by the World Health Organization, contains a new diagnostic approach for personality disorders. This approach partly involves the consideration of five dimensional trait domain qualifiers – Negative Affectivity, Detachment, Dissocial, Disinhibition, and Anankastia. Oltmanns and Widiger (2018) recently developed a self-report measure, the Personality Inventory for ICD-11 (PiCD), to assess the five domains; however, further examination of the psychometric properties of the PiCD is warranted due to its limited research base. The present study aimed to further examine the reliability, structural and concurrent validity, and method variance of the PiCD in an ethnically-diverse undergraduate sample ($N = 518$), who were also administered the Minnesota Multiphasic Personality Inventory–2–Restructured Form (MMPI-2-RF). First, results suggested that the PiCD domain scales exhibited adequate internal consistency reliability via coefficient categorical omega (range = .77 - .87). Next, exploratory structural equation modeling results suggested support for a four-factor solution, with the fourth factor thought to represent a bipolar continuum of Anankastia to Disinhibition severity. Random-intercept factor analysis results suggested a small amount of variance in items (4.88%) attributable to idiosyncratic scale usage. Lastly, relations between PiCD domains and MMPI-2-RF scales (PSY-5 and Higher-Order scales) provided support for the validity of the Negative Affectivity, Detachment, and Dissocial domains, though relatively less support for Disinhibition and Anankastia. Further examination of other psychometric properties and the nomological network of the PiCD is recommended.

Keywords: ICD-11; Minnesota Multiphasic Personality Inventory; Personality Disorders; Personality Inventory for ICD-11; Psychometrics

The Personality Inventory for ICD-11: Investigating reliability, structural and concurrent validity, and method variance

The World Health Organization (WHO) recently updated and published the eleventh edition of the International Classification of Diseases and Related Health Problems (ICD-11; WHO, 2018), which includes descriptions and diagnostic codes of mental and behavioural disorders for use in healthcare settings, and for mortality and morbidity statistics around the world. In May of 2019, the World Health Assembly formally approved the ICD-11, with implementation planned for 2022. One substantial change from the ICD-10 to the ICD-11 involved the classification/diagnosis of personality disorders (PDs). Whereas the ICD-10 contained a classification/diagnostic scheme for eight categorical PDs that had evidence of extensive comorbidity and infrequent diagnoses (Reed et al., 2019), the proposed PD model in the ICD-11 resulted in a fundamental shift towards a more dimensional approach to PDs – consistent with existing empirical evidence on the nature and assessment of these disorders (Hopwood et al., 2018; Tyrer, Mulder, Kim, & Crawford, 2019). More specifically, the ICD-11 PD classification/diagnostic scheme involves three major components (Reed et al., 2019; WHO, 2018). First, a clinician determines whether a patient meets criteria for ‘general’ personality disorder (i.e., dysfunction in aspects of the self and/or interpersonal dysfunction; persistence across time and situations; distress; resulting maladaptive cognitions, emotions, and behaviours), as opposed to whether a patient meets criteria for a specific categorical PD type. Second, after meeting criteria for general personality disorder, a clinician can further diagnose the degree of impairment associated with this diagnosis – either ‘mild’ personality disorder, ‘moderate’, or ‘severe’ personality disorder, with the degrees of impairment differing based on the severity and pervasiveness of the above criteria. Third, a clinician can add one or more of five dimensional

trait domain qualifiers to the above diagnosis to describe the prominent features of maladaptive personality in a given patient in more detail (i.e., the trait domains are not further diagnostic categories). The five trait domains are: (a) Negative Affectivity (e.g., manifestation of a wide variety of disproportionate negative emotions; poor emotion regulation; self-loathing; anxiety; irritability, etc.), (b) Detachment (e.g., emotional and interpersonal distance; social withdrawal; anhedonia, etc.), (c) Dissociality (e.g., disregard for the rights and feelings of others; self-centeredness; lack of empathy; manipulation, etc.), (d) Disinhibition (e.g., act impulsively without concern of outcomes; irresponsibility; distractibility, etc.), and (e) Anankastia (e.g., focus on control and regulation of own/other's behaviour to a rigid standard; perfectionism; emotional and behavioural constraint; perseveration, etc.) (Mulder, Horwood, Tyrer, Carter, & Joyce, 2016; WHO, 2018).

In order to aid in the assessment of the ICD-11 PD model criteria, several studies to date have been conducted (see Mulder & Tyrer, 2019; Tyrer et al., 2019). For example, the Standardized Assessment of Severity of Personality Disorder (SASPD) was developed as a self-report screening measure for mild or moderate personality disorder, and has preliminary evidence of adequate reliability and validity (Bach & Anderson, 2018; Olajide et al., 2018). Olajide et al. (2018) note, however, that the available data in their study were not feasible to determine cut-off scores for the classification of severe personality disorder. The assessment of the trait domains of the ICD-11 PD model has received relatively more attention. Bach, Sellbom, Kongerslev, Simonsen, Krueger, and Mulder (2017) developed scoring algorithms for the ICD-11 trait domains based on facet subscales from the Personality Inventory for DSM-5 (PID-5). The reliability and validity of this PID-5 scoring algorithm has been subsequently examined and

supported in other studies (Bach, Sellbom, Skjernov, & Simonsen, 2017; Lotfi, Bach, Amini, & Simonsen, 2018; Lugo et al., 2019; Sellbom, Solomon-Krakus, Bach, & Bagby, 2019).

Oltmanns and Widiger (2018) recently developed a self-report measure, called the Personality Inventory for ICD-11 (PiCD), from the ground-up (i.e., creating a novel item bank, as opposed to derivations from existing instruments). The PiCD is designed to assess the five trait domains of the ICD-11 PD model. The PiCD is relatively short - containing 60 items (i.e., 12 items per trait domain), and has some preliminary evidence for its reliability and validity. Preliminary evidence has suggested adequate reliability of the PiCD domain scales, and adequate convergent and discriminant validity of the PiCD domain scales with other maladaptive personality scales (Crego & Widiger, 2019; McCabe & Widiger, 2019; Oltmanns & Widiger, 2018; Oltmanns & Widiger, 2019a; Somma, Gialdi, & Fossati, 2019). In terms of structural validity, results from item-level Exploratory Structural Equation Modeling suggest a four-factor structure (i.e., Disinhibition and Anankastia items both load strongly onto the same factor), rather than a five-factor structure (i.e., Disinhibition and Anankastia items do not strongly load onto two separate factors) (Bach, Christensen, Kongerslev, Sellbom, & Simonsen, 2019; Mulder et al., 2016; Oltmanns & Widiger, 2018). Although these studies have provided preliminary support for the PiCD, there are a number of gaps in the literature regarding the PiCD's psychometric evidence that could be addressed with further research, which can in turn potentially further support the use of the PiCD for the assessment of ICD-11 trait domains in research and in clinical practice.

Present Study

The aims of the current study were to further examine the internal consistency reliability, the structural validity, and the broader construct validity of the PiCD domains in a large,

ethnically diverse sample. First, previous studies to date that have used the PiCD have estimated the reliability of its domains using coefficient alpha, which tends to underestimate the reliability of a scale and has certain restrictive assumptions (Miller, 1995; Revelle & Condon, 2019). We, in turn, estimated the internal consistency of PiCD domain scores using the model-based coefficient omega (specifically, categorical omega due to Likert-scale items; Green & Yang, 2009), which represents the proportion of total variance in scores that can be attributed to a model-based source of variance (e.g., a latent variable). We compared our estimated values of coefficient omega, coefficient alpha, and mean interitem correlations to the estimates of reliability in the previously outlined studies that have used the PiCD.

Second, only one study to date has examined the structural validity of the self-report version of the PiCD (Oltmanns & Widiger, 2018) – therefore, it would be informative to determine the robustness and generalizability of these factor analytic results in an independent sample. We were also interested in clarifying whether a four-factor or five-factor model provides support for the structure of the PiCD, because while the measure contains five separate score-able domain scales, Oltmanns and Widiger (2018) found support for a four-factor structure with a fourth factor representing both Disinhibition and Anankastia. To this end, we attempted to replicate the analyses initially conducted by Oltmanns and Widiger (2018) using four-factor and five-factor item-level Exploratory Structural Equation Models (ESEMs). Based on results and conclusions by Oltmanns & Widiger (2018) described above, we expected to find support for the four-factor solution in terms of substantive resulting factors, adequate model fit, and high pattern matrix congruence coefficients with the original validation study (i.e., $\geq .90$).

Third, we were also interested in examining the proportion of total variance in PiCD item scores that may be attributed to systematic error variance/method variance – for example,

acquiescence bias (i.e., consistent agreeing or disagreeing with items regardless of content; Jackson & Messick, 1958). Acquiescence bias can affect estimates of scale reliability, factor structure, and criterion validity (e.g., Rammstedt & Farmer, 2013; Soto, John, Gosling, & Potter, 2008). To estimate method variance, we used random-intercept factor analysis (Aicholzer, 2014; Maydeu-Olivares & Coffman, 2006), which models an orthogonal method factor that is thought to represent “the idiosyncratic use of the response scale” (Maydeu-Olivares & Coffman, 2006, p. 348) by a participant. As a comparison, method variance has also been examined in the PID-5 (McCrae, 2018).

Finally, although the convergent and discriminant validity of the PiCD domains has been examined with respect to certain personality pathology measures (e.g., the PID-5, the Computerized Adaptive Test for Personality Disorders-Static Form, the Schedule for Nonadaptive and Adaptive Personality, and the Dimensional Assessment of Personality Pathology-Basic Questionnaire; Crego & Widiger, 2019; McCabe & Widiger, 2019; Oltmanns & Widiger, 2018), this form of validity has not been examined with respect to another widely-used personality pathology scale – the Personality Psychopathology-Five (PSY-5) from the Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF). The PSY-5 predates and has influenced many contemporary models of personality pathology, including the Alternative Model for Personality Disorders in the DSM-5, and has a large amount of evidence supporting its reliability, validity, and clinical utility (Harkness, Finn, McNulty, & Shields, 2012). Hypotheses regarding convergent and discriminant validity of PiCD domains were derived from other research examining relations between the PSY-5 and personality pathology measures with conceptually similar domains (e.g., the PID-5; Anderson et al., 2013). For convergent validity, we expected strong relations between the following scales: (a) PiCD Negative Affective and

PSY-5 Negative Emotionality/Neuroticism (positive r), (b) PiCD Detachment and PSY-5 Introversion/Low Positive Emotionality (positive r), (c) PiCD Dissocial and PSY-5 Aggressiveness (positive r), (d) PiCD Disinhibition and PSY-5 Disconstraint (positive r), and (e) PiCD Anankastia and PSY-5 Disconstraint (negative r). For discriminant validity, we expected that the absolute values of the correlations between PiCD domains and conceptually dissimilar PSY-5 scales would be relatively smaller in magnitude than the convergent validity correlations. We did not have any specific hypotheses regarding PSY-5 Psychoticism, but we assumed that correlations between PiCD domains and PSY-5 Psychoticism would be smaller than convergent validity correlations.

The MMPI-2-RF contains three higher-order scales reflecting general domains of psychopathology – Emotional/Internalizing Dysfunction, Behavioural/Externalizing Dysfunction, and Thought Disorder Dysfunction. Consistent with recent evidence and models of psychopathology (e.g., the Hierarchical Taxonomy of Psychopathology, Kotov et al., 2017) which emphasize the joint structure of personality pathology and traditional clinical symptoms, we were interested in determining whether PiCD domains have conceptually consistent relations with these higher-order domains, in order to examine the nomological network of the PiCD (Cronbach & Meehl, 1955). We hypothesized that PiCD Negative Affect would be positively and strongly related to MMPI-2-RF Emotional/Internalizing, and that PiCD Dissocial, Disinhibition, and Anankastia would be positively (negatively for Anankastia) and strongly related to Behavioural/Externalizing Dysfunction. No predictions were made regarding PiCD Detachment (due to mixed evidence of its placement in the joint structure of psychopathology; Kotov et al., 2017), or MMPI-2-RF Thought Dysfunction – these analyses can be considered exploratory.

Method

Participants

The present sample consisted of 518 student participants (366 females, 152 males; 70.66% female) from a large, primarily English-speaking Canadian university, recruited via an online research portal maintained by the Department of Psychology. The mean age of the sample was 19.26 years ($SD = 3.05$, range = 18 – 51); the mean years of education was 13.32 years ($SD = 1.51$, range = 12 – 26, 13 missing responses). The racial-ethnic composition of this sample was as follows: 26.45% East Asian, 21.43% South Asian, 17.37% South East Asian, 10.42% White Canadian, 6.18% Mixed Background, 5.60% Middle Eastern, 5.03% Black Canadian, 2.90% Indian Caribbean, 1.35% ‘Other’; 12 participants did not report their race or ethnicity. All of the participants provided written informed consent and were debriefed after participation; they received either course credit or monetary compensation. The university research ethics board approved the study protocol.

Measures

Personality Inventory for ICD-11 (PiCD). The PiCD (Oltmanns & Widiger, 2018) is a 60-item self-report measure designed to assess the five trait domains in the ICD-11 personality disorder diagnostic guidelines (World Health Organization, 2018). Each domain contains twelve items rated on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*), and the five domains are as follows: Negative Affective (e.g., “I am usually an anxious person”), Detachment (e.g., “I prefer to stay away from other people”), Dissocial (e.g., “My anger has gotten me into fights”), Disinhibition (e.g., “I am not a very responsible person”), and Anankastia (e.g., “I spend a large amount of time organizing and making arrangements”). A sum score or a mean score for each domain can be calculated using the respective items for that domain – in the present study,

mean scores were used. Descriptive statistics (i.e., mean, standard deviation, skewness, and kurtosis) and reliability estimates (i.e., coefficient alpha, mean interitem correlation, and coefficient categorical omega) for domain scores are displayed in Table 1.

Minnesota Multiphasic Personality Inventory-2 Restructured Form (MMPI-2-RF).

The MMPI-2-RF (Ben-Porath & Tellegen, 2008/2011) is a 338-item, self-report omnibus measure designed to assess a wide variety of psychopathology and personality constructs. As explained above, in the present study, the following groups of scales were used as dependent variables: (a) PSY-5 scales (Aggressiveness, Psychoticism, Disconstraint, Negative Emotionality/Neuroticism, and Introversion/Low Positive Emotionality), and (b) Higher-Order scales (Emotional/Internalizing Dysfunction, Thought Dysfunction, and Behavioural/Externalizing Dysfunction). Descriptive statistics (i.e., mean, standard deviation, skewness, and kurtosis) and coefficient alpha for the subscales used in the current study are displayed in the online supplement Table S1.

Statistical Analyses

In order to replicate and clarify the internal structure/structural validity of the PiCD, four-factor and five-factor exploratory structural equation models (ESEMs; Asparouhov & Muthén, 2009; Hopwood & Donnellan, 2010; Marsh, Morin, Parker, & Kaur, 2014) were estimated – as was done in the initial validation paper by Oltmanns and Widiger (2018). In each model, the weighted least squares mean and variance adjusted (WLSMV) robust estimator was estimated on the polychoric correlation matrix due to the items having an ordinal rating scale, and to account for potential non-normality and outliers in the observed variables. Following Oltmanns and Widiger (2018), we used the oblique Geomin rotation for our ESEMs. Full-information maximum likelihood estimation was used to account for negligible amounts of missing values in

items (i.e., < 10 missing values per item). To evaluate the models, absolute model fit was examined using the following robust fit indices: the model chi-square test statistic, the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the root mean square error of approximation (RMSEA) with a 90% confidence interval (CI), and the standardized root mean square residual (SRMR). The following conventional cut-offs were used to qualitatively evaluate the models (c.f., Greiff & Heene, 2017; Marsh, Hau, & Wen, 2004): CFI and TLI values $\geq .90$, and RMSEA and SRMR values $\leq .08$ were representative of acceptable model fit; CFI and TLI values $\geq .95$, and RMSEA and SRMR values $\leq .05$ were representative of good model fit.

To model method variance, we estimated four-factor and five-factor random-intercept ESEMs (Aicholzer, 2014; Maydeu-Olivares & Coffman, 2006). Random-intercept factor analysis involves modeling substantive factors (i.e., in the present case, four and five oblique factors corresponding to PiCD domains) and an orthogonal method factor that loads onto each item. Specifically, in this model, unstandardized item loadings on the method factor are fixed to one, with the assumption that idiosyncratic scale use is relatively consistent across items. After estimation, the following parameters are considered: (a) the variance of the random-intercept factor, in which a significant amount of variance suggests rejection of no individual differences in idiosyncratic scale use; (b) the proportion of total variance in each item accounted for by the random-intercept factor; and (c) the factor intercorrelations. To calculate (b), the standardized factor loadings are squared – therefore, maximum likelihood estimation must be used for proper interpretation (as factor loadings are linear regressions as opposed to probit regressions in WLSMV estimation). Robust maximum likelihood estimation with targeted factor loadings (i.e., item cross-loadings estimated to close to zero as possible) was used for these analyses.

To examine the construct validity of the observed PiCD domain scores, we calculated zero-order Pearson's correlation coefficients between each PiCD domain, and Spearman's rank correlation coefficients (due to some skewness/kurtosis) between each PiCD domain and each MMPI-2-RF subscale of interest, respectively. With the present sample size, a sensitivity power analysis revealed that, at $\alpha = .05$, $.01$, and $.001$, we had 80% statistical power to detect correlations $\geq |.123|$, $\geq |.149|$, and $\geq |.180|$, respectively. We also conducted a series of multiple regression models (with HC3 heteroscedasticity-robust standard errors) that included each separate MMPI-2-RF scale as a dependent variable, and the five PiCD domains as independent variables in each model.

ESEM models were estimated using *Mplus* 8.1 (Muthén & Muthén, 2018). All other statistical analyses were conducted using RStudio (version 1.1.463; RStudio, 2016) for R statistical software (version 3.5.2; R Core Team, 2018), with particular help from the following R packages: *psych* (version 1.8.12; Revelle, 2019), *MplusAutomation* (version 0.7-3; Hallquist & Wiley, 2018), *jtools* (version 2.0.0; Long, 2019), *lavaan* (version 0.6-3; Rosseel, 2012), and *semTools* (version 0.5-1; Jorgensen, Pornprasertmanit, Schoemann, & Rosseel, 2018).

Results¹

The internal consistency reliability estimates for the PiCD domains were adequate (see Table 1); all coefficient categorical omega values were greater than $.75$, suggesting that more than 75% of the variance in observed PiCD domain scores can be accounted for by their respective latent variable (i.e., in unidimensional measurement models). In comparison to the reliability estimates in previous studies using the PiCD (i.e., Crego & Widiger, 2019; Oltmanns

¹ Data and R syntax/output to reproduce results can be found at <https://osf.io/yn2fp/>.

& Widiger, 2018; Oltmanns & Widiger, 2019a; Oltmanns & Widiger, 2019b) our coefficient alpha values were somewhat lower. Specifically, the mean coefficient alpha value for the PiCD domains in the current study was .78, whereas the mean coefficient alpha value across the previous studies was .87. As expected, coefficient categorical omega values were higher than coefficient alpha values. Overall, the reliability estimates were adequate, thus further supporting the internal consistency reliability of the PiCD domains reported in previous studies.

Intercorrelations between observed PiCD domain scores are displayed in Table 2.

Descriptively, the largest absolute correlation was between Disinhibition and Anankastia scores, $r = -.409$, 95% CI $[-.478, -.334]$, $p < .001$; the smallest absolute correlation was between Dissocial and Anankastia scores, $r = -.020$, 95% CI $[-.106, .067]$, $p = .654$. The median absolute value of the intercorrelations was .204 (mean = .220), thus suggesting that the domains are slightly related but relatively separate constructs.

Structural and Convergent/Discriminant Validity

Robust fit indices for the four-factor target ESEM model suggested somewhat adequate model fit: $\chi^2 = 2951.123$, $df = 1536$, $p < .001$; CFI = .870; TLI = .851; RMSEA = .042, 90% CI $[.040, .044]$; and SRMR = .050. The CFI and TLI values for this model were slightly below conventional cut-off values, while the RMSEA and SRMR values were consistent with good model fit. For the five-factor target ESEM model, robust fit indices also suggested somewhat adequate model fit: $\chi^2 = 2587.737$, $df = 1480$, $p < .001$; CFI = .899; TLI = .879; RMSEA = .038, 90% CI $[.036, .040]$; and SRMR = .044. Similar to the four-factor model, the CFI and TLI values were below conventional cut-off values, while the RMSEA and SRMR values were consistent with good model fit. Notably, our CFI and RMSEA values for both models were descriptively better than what was found in the original validation paper by Oltmanns and Widiger (2018),

where their CFI value was .779 and their RMSEA value was .065. As both the four-factor and five-factor model had similar values for fit indices, it was important to examine the factor loadings for both solutions to assist in substantive interpretations for model comparison.²

Standardized factor loadings (λ s) and factor intercorrelations for the four-factor ESEM model are displayed in Table 3. For the Negative Affective factor: (a) the median absolute λ for Negative Affective items was .600, (b) 11/12 items had medium to large λ s, and (c) 2/12 Detachment items, 1/12 Dissocial items, and 3/12 Disinhibition items had medium cross-loadings. For the Detachment factor: (a) the median absolute λ for Detachment items was .518, (b) 10/12 items had medium to large λ s, and (c) 6/12 Dissocial items (median $\lambda = .212$), 2/12 Disinhibition items, and 2/12 Anankastia items had medium cross-loadings. For the Dissocial factor: (a) the median absolute λ for Dissocial items was .466, (b) 11/12 Dissocial items had medium to large λ s, and (c) 2/12 Detachment items, and 2/12 Anankastia items had medium cross-loadings. For the Disinhibition/Anankastia factor: (a) the median absolute λ for Disinhibition and Anankastia items was .499, (b) 19/24 items had medium to large λ s, and (c) no other items had substantial cross-loadings.

Standardized factor loadings for the five-factor ESEM model are displayed in Table S2 in the supplemental materials. For the Negative Affective factor: (a) the median absolute λ for Negative Affective items was .643, (b) 11/12 items had medium-large λ s, and (c) 1/12 Detachment item, 2/12 Dissocial items, and 3/12 Disinhibition items had medium cross-loadings. For the Detachment factor: (a) the median absolute λ for Detachment items was .511, (b) 10/12

² The polychoric correlation matrix, standard errors of loadings, item thresholds, and Mplus syntax can be found in the R output at <https://osf.io/ekwv6/>.

items had medium-large λ s, and (c) 1/12 Dissocial items had medium cross-loadings. The third factor seemed to have a mix of medium-large loadings from Dissocial items (median $\lambda = .434$) and Disinhibition items (median $\lambda = .306$), with 11/12 Dissocial items having medium-large λ s and 7/12 Disinhibition items having medium λ s. Additionally, there were two Detachment items with medium cross-loadings. The fourth factor had a mix of medium-large loadings from Disinhibition items (median $\lambda = .168$) and Anankastia items (median $\lambda = .414$), with 4/12 Disinhibition items and 8/12 Anankastia items having medium-large λ s. There were no substantial cross-loadings on this factor. The fifth factor was similar to the fourth factor, in that it involved a mix of medium-large λ s with Disinhibition items (median $\lambda = .180$) and Anankastia items (median $\lambda = .181$). 5/12 Disinhibition items and 5/12 Anankastia items had medium-large λ s on this factor, and two Dissocial items had medium cross-loadings.

In general, the substantive interpretations of the factors from the four-factor solution were relatively simpler, and therefore preferred over the five-factor solution. Tucker's congruence coefficients between the four-factor pattern loading matrix in our study and the loading matrix in Oltmanns and Widiger (2018) were calculated: (a) .97 for Negative Affectivity, (b) .93 for Detachment, (c) .94 for Dissocial, and (d) .94 for Disinhibition/Anankastia.

Random-intercept ESEM results were similar between the four-factor solution and the five-factor solution – therefore, the four-factor solution is focused on for parsimony.³ The four-factor random-intercept ESEM fit the data somewhat poorly, based on the CFI and TLI (but not

³ In the five-factor model, the random-intercept factor also had significant variance ($\phi = .052$, $SE = .007$, $p < .001$), and the median amount of variance explained in items by this factor was 4.35% (range = 3.13% to 6.50%).

the RMSEA and SRMR): $\chi^2 = 3150.903$, $df = 1535$, $p < .001$; CFI = .783; TLI = .750; RMSEA = .045, 90% CI [.043, .047]; and SRMR = .047. Compared to a model without the random-intercept though, a regular four-factor ESEM with robust maximum likelihood estimation with target rotation fit the data significantly worse than the four-factor random-intercept model, $\Delta\chi^2(1) = 14.841$, $p < .001$. The variance of the random-intercept factor was significant, $\phi = .059$, $SE = .010$, $p < .001$, suggesting a small degree of individual differences in idiosyncratic responding to the PiCD items. The standardized factor loadings and factor intercorrelations for the four-factor solution are displayed in Table S3 in the supplemental materials. Squaring the standardized factor loadings for the random-intercept factor resulted in a median value of 4.88% variance explained in PiCD items by the random-intercept factor (range = 3.57% to 7.18%), suggesting that only a very small amount of the total variance in PiCD items can be explained by idiosyncratic responding by participants.

Zero-order Spearman's rank correlation coefficients between observed PiCD domain scores and MMPI-2-RF scale scores are presented in Table 4. As well, regression coefficients and coefficients of determination from the multiple regression models are presented in Table 4.

PSY-5 relations. Convergent validity coefficients were mostly of medium-large effect sizes (median $r = .46$), with the exception of PiCD Anankastia, and discriminant validity coefficients were mostly of small effect sizes (median $r = .09$) with some exceptions. Results for PiCD Negative Affective and Detachment, overall, were consistent with good convergent validity and discriminant validity. PiCD Dissocial had good convergent validity with PSY-5 Aggressiveness, but also had a similarly valued correlation with PSY-5 Disconstraint, $r_{\text{diff}} = .03$,

95% CI [-.05, .10].⁴ PiCD Disinhibition had adequate convergent validity with PSY-5 Disconstraint, but had a similarly valued correlation with PSY-5 Negative Emotionality, $r_{\text{diff}} = .03$, 95% CI [-.15, .08], and PSY-5 Psychoticism, $r_{\text{diff}} = -.01$, 95% CI [-.10, .11]. PiCD Anankastia had relatively small convergent validity with PSY-5 Disconstraint. It should be noted, however, that PSY-5 Psychoticism is positively related with each PiCD domain, which may be lack of discriminant validity for PSY-5 Psychoticism (which was also found for PID-5 Psychoticism; Oltmanns & Widiger, 2018). With respect to the multiple regression models, PiCD domains accounted for a range of 24% (PSY-5 Disconstraint) to 58% (PSY-5 Negative Emotionality) of variance in PSY-5 scale scores.

MMPI-2-RF Higher-Order scale relations. Consistent with hypotheses, PiCD Negative Affective was strongly related to Emotional/Internalizing Dysfunction, while also being moderately related to Behavioural/Externalizing Dysfunction. Also consistent with hypotheses, PiCD Dissocial and PiCD Disinhibition were positively related with Behavioural/Externalizing Dysfunction, although PiCD Disinhibition was also moderately related to Emotional/Internalizing Dysfunction. PiCD Anankastia, however, was only weakly negatively related to Behavioural/Externalizing Dysfunction. In terms of exploratory relations, it was found that PiCD Detachment was moderately related to Emotional/Internalizing Dysfunction. Thought Disorder Dysfunction, on the other hand, was found to be moderately related to PiCD Negative Affective, PiCD Dissocial, and PiCD Disinhibition. With respect to the multiple regression

⁴ Differences between respective correlations were calculated with 1000 bootstrapped samples, and 95% CIs on these differences were calculated using the percentile method.

models, PiCD domains accounted for a range of 27% (Thought Disorder Dysfunction) to 64% (Emotional/Internalizing Dysfunction) of variance in MMPI-2-RF Higher-Order scale scores.

Discussion

In the present study we sought to replicate and examine further the reliability and the validity of the PiCD in a large, ethnically-diverse undergraduate sample. Each domain of the PiCD was estimated to have adequate internal consistency reliability, as indexed by coefficient categorical omega, coefficient alpha, and mean interitem correlation coefficients. To clarify the structural validity of the PiCD, four-factor and five-factor ESEMs were estimated and both models had somewhat adequate fit, with respect to conventional cut-off criteria. The four-factor solution, however, was more interpretable than the five-factor model based on respective medium-large factor loadings and relatively smaller cross-loadings. The four-factor solution had three factors consistent with Negative Affective, Detachment, and Dissocial severity, and a fourth factor consistent with a bipolar continuum of Anakastia/Disinhibition severity. This four-factor loading pattern matrix was highly similar to the loadings from Oltmanns and Widiger (2018). The five-factor solution was more difficult to interpret, with the third factor from this model corresponding to a mix of Dissocial and Disinhibition items, and the fourth and fifth factors corresponding to a mix of different Disinhibition and Anakastia items. In comparison, a five-factor model was supported in the PID-5-based scoring of the ICD-11 trait domains (Sellbom et al., 2019), where the five factors were interpreted to align with the five trait domains. This discrepancy is not much a problem from a descriptivist perspective towards the factors (i.e., the factors represent useful summaries of respective scale data), but pragmatically, which solution is 'better' would depend on relative predictive utility of the four factors in the PiCD compared to the five factors in the PID-5 ICD-11 scoring. Regardless, one strength of our

analyses was that they were conducted at the item-level, which is arguably a stronger test of the structure of a given measure and can possibly better identify sources of model misspecification (as opposed to using subscale sum/mean scores as indicators of higher-order factors; Marsh, Lüdtke, Nagengast, Morin, & von Davier, 2013). One caveat with item-level factor analysis is that if the indicators in the model have less reliability (i.e., low factor loadings), fit index values may be biased, especially with many indicators (Shi, Lee, & Maydeu-Olivares, 2019). With valid methods, however, detailed item-level analyses may be informative if applied to other personality pathology measures, such as the PID-5. Results from the random-intercept ESEMs suggested that the total variance in PiCD items is not substantially accounted for by idiosyncratic responding. In other words, results suggested that there was a small amount of systematic method variance in the PiCD, and most of the reliable variance in PiCD items was attributed to proposed substantive factors.

Associations between specific MMPI-2-RF scales (personality pathology and higher-order psychopathology domains) and observed PiCD domain scores were examined. On average, all of the five PiCD domains accounted for a moderate amount of variance (median $R^2 = .30$) in MMPI-2-RF scales within the multiple regression models. In terms of convergent and discriminant validity, PiCD Negative Affective, Detachment, Dissocial, and Disinhibition had evidence of adequate convergent validity with PSY-5 and Higher-Order scales – PiCD Anankastia, on the other hand, had weak negative relations with PSY-5 Disconstraint and Behavioural/Externalizing Dysfunction. One possible explanation for the former weak negative relation is that, despite having strong coverage of maladaptive low Conscientiousness, PSY-5 Disconstraint has evidence of relatively weaker coverage of maladaptive high Conscientiousness (e.g., Trull, Ueda, Costa, & McCrae, 1995), as opposed to PiCD Anankastia having limited

coverage. This is further supported by results in the original validation study of the PiCD, where PiCD Anankastia had relatively stronger negative relations with PID-5 Disinhibition and CAT-PD-SF Disconstraint (Oltmanns & Widiger, 2018). Results related to discriminant validity were mostly consistent with hypotheses, although PiCD Disinhibition was similarly related to both PSY-5 Disconstraint, Negative Emotionality, and Psychoticism. Our results were also mostly consistent with relations between PID-5-based ICD-11 scales and PSY-5 scores (Sellbom et al., 2019), although Dissocial, Disinhibition, and Anankastia are more strongly related to PSY-5 Negative Emotionality with the PID-5 scoring.

Taking these results together, one possible and parsimonious way forward to increase the structural and external validity of the PiCD would be to take the best items (i.e., in terms of psychometric properties) from the PiCD Disinhibition and Anankastia domains and then combine them into one domain representing a single bipolar continuum, similar to Oltmanns and Widiger's (2018) suggestion of reducing the five domain ICD-11 trait model to a four domain model and the conceptualization of Anankastia by Mulder et al. (2016). Specifically, high scores would represent the Disinhibition end of the continuum, while low scores would represent the Anankastia end of the continuum. At a measurement level, however, this may be relatively confusing as the other scales are representative of unipolar constructs. Another possibility is that more research simply needs to be done in order to clarify these aspects of these domains (e.g., Anankastia may have evidence of incremental validity in predicting scores not found in the present study).

Limitations and Future Directions

Although the present sample size was relatively large, the sample was composed of only undergraduate university students, potentially limiting the generalizability of the present results

to other types of samples (e.g., clinical or community samples). In this regard, it is important to replicate the present results, and examine other psychometric aspects of the PiCD (including the ones described below) in both clinical and community samples.

It would also be important to examine whether the PiCD has evidence of measurement invariance (i.e., whether observed scores between groups are representative of the same latent variable) across a variety of examinee characteristics (e.g., sex, ethnicity, and age) (Marsh et al., 2014; Millsap & Olivera-Aguilar, 2012). Next, every measure used in the present study was based on self-reports, and therefore the relations between scale scores were likely inflated due to shared method variance (Campbell & Fiske, 1959), in which the use of different methods may result in slightly different convergent and discriminant validity results. The recently developed informant version of the PiCD (Bach et al., 2019) could be used in order to leverage the advantages of multisource assessment (e.g., separating trait and method variance; more information regarding a target's personality pathology across different contexts; Campbell & Fiske, 1959) and investigate questions related to self-other agreement (e.g., Samuel, Suzuki, Bucher, & Griffin, 2018; Sleep, Lamkin, Lynam, Campbell, & Miller, 2018).

Although the measure has a small number of items (60) relative to the PID-5 (220), it may still be useful to develop a short-form version of the PiCD for potential use in ecological momentary assessment/intensive longitudinal data studies (e.g., Roche, 2018; Wright & Simms, 2016), or for use in a treatment context (e.g., tracking a patient's level of personality pathology across therapy). Additionally, it would be informative to study the test-retest reliability of the PiCD over different theoretically-driven time lags in order to examine rank-order stability and the potential presence of transient error (see Somma et al., 2019; Chmielewski & Watson, 2009). We also believe it may be important for future studies to compare the PiCD, the PID-5, and other

personality measures in terms of similar (or differential) predictive ability (i.e., to address potential jingle-jangle fallacies), or the incremental validity of the PiCD over other personality pathology measures, considering the conceptual overlap between domains of these existing measures. Indeed, in the original validation study, PiCD Negative Affective, Detachment, Dissocial, and Disinhibition domain score had a median convergent correlation of $r = .80$ with PID-5 Negative Affect, Detachment, Antagonism, and Disinhibition domain scores, respectively (Oltmanns & Widiger, 2018). In terms of clinical utility, we believe that normative data for the PiCD should be collected in order to increase its potential for clinical use, and we believe that future research must examine how the PiCD may be integrated with the assessment of the general personality disorder severity gradient (i.e., mild, moderate, or severe personality disorder) in the ICD-11 PD model. Lastly, an increase in precision of theoretical predictions regarding the nomological network of the PiCD (and other established personality pathology measures) may be informative, in that theories/definitions of given constructs could be further corroborated (or falsified) (Meehl, 1999).

Overall, the PiCD is a relatively new measure with some preliminary evidence for its reliability and validity, although more research must be done in various samples to further evaluate its validity.

References

- Aichholzer, J. (2014). Random intercept EFA of personality scales. *Journal of Research in Personality*, (53), 1–4.
- Anderson, J. L., Sellbom, M., Bagby, R. M., Quilty, L. C., Veltri, C. O. C., Markon, K. E., & Krueger, R. F. (2013). On the Convergence Between PSY-5 Domains and PID-5 Domains and Facets: Implications for Assessment of DSM-5 Personality Traits. *Assessment*, 20(3), 286–294. <https://doi.org/10.1177/1073191112471141>
- Asparouhov, T., & Muthén, B. (2009). Exploratory structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, 16(3), 397-438.
- Bach, B., & Anderson, J. L. (2018). Patient-Reported ICD-11 Personality Disorder Severity and DSM-5 Level of Personality Functioning. *Journal of Personality Disorders*, 1–19. https://doi.org/10.1521/pedi_2018_32_393
- Bach, B., Christensen, S., Kongerslev, M. T., Sellbom, M., & Simonsen, E. (2019). Structure of clinician-reported ICD-11 personality disorder trait qualifiers. *Psychological Assessment*. Advance online publication.
- Bach, B., Sellbom, M., Kongerslev, M., Simonsen, E., Krueger, R. F., & Mulder, R. (2017). Deriving ICD-11 personality disorder domains from dsm-5 traits: initial attempt to harmonize two diagnostic systems. *Acta Psychiatrica Scandinavica*, 136(1), 108–117. <https://doi.org/10.1111/acps.12748>
- Bach, B., Sellbom, M., Skjernov, M., & Simonsen, E. (2018). ICD-11 and DSM-5 personality trait domains capture categorical personality disorders: Finding a common ground. *Australian & New Zealand Journal of Psychiatry*, 52(5), 425–434. <https://doi.org/10.1177/0004867417727867>

- Ben-Porath, Y. S., & Tellegen, A. (2008/2011). *MMPI-2-RF manual for administration scoring and interpretation*. Minneapolis, MN: University of Minnesota Press.
- Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, 56(2), 81-105.
- Chmielewski, M., & Watson, D. (2009). What is being assessed and why it matters: the impact of transient error on trait research. *Journal of Personality and Social Psychology*, 97(1), 186–202. <https://doi.org/10.1037/a0015618>
- Crego, C., & Widiger, T. A. (2019). The convergent, discriminant, and structural relationship of the DAPP-BQ and SNAP with the ICD-11, DSM-5, and FFM trait models. *Psychological Assessment*. Advance online publication.
- Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin*, 52(4), 281-302.
- Green, S. B., & Yang, Y. (2009). Reliability of Summed Item Scores Using Structural Equation Modeling: An Alternative to Coefficient Alpha. *Psychometrika*, 74(1), 155–167. <https://doi.org/10.1007/s11336-008-9099-3>
- Greiff, S., & Heene, M. (2017). Why Psychological Assessment Needs to Start Worrying About Model Fit. *European Journal of Psychological Assessment*, 33(5), 313–317. <https://doi.org/10.1027/1015-5759/a000450>
- Hallquist, M. N., & Wiley, J. F. (2018). MplusAutomation: An R Package for Facilitating Large-Scale Latent Variable Analyses in Mplus. *Structural Equation Modeling: A Multidisciplinary Journal*, 25(4), 621–638. <https://doi.org/10.1080/10705511.2017.1402334>

- Harkness, A. R., Finn, J. A., McNulty, J. L., & Shields, S. M. (2012). The Personality Psychopathology-Five (PSY-5): Recent constructive replication and assessment literature review. *Psychological Assessment*, 24(2), 432–443. <https://doi.org/10.1037/a0025830>
- Hopwood, C. J., & Donnellan, M. B. (2010). How Should the Internal Structure of Personality Inventories Be Evaluated? *Personality and Social Psychology Review*, 14(3), 332–346. <https://doi.org/10.1177/1088868310361240>
- Hopwood, C. J., Kotov, R., Krueger, R. F., Watson, D., Widiger, T. A., Althoff, R. R., ... Zimmermann, J. (2018). The time has come for dimensional personality disorder diagnosis. *Personality and Mental Health*, 12(1), 82–86. <https://doi.org/10.1002/pmh.1408>
- Jackson, D. N., & Messick, S. (1958). Content and style in personality assessment. *Psychological Bulletin*, 55(4), 243–252. <https://doi.org/10.1037/h0045996>
- Kotov, R., Krueger, R. F., Watson, D., Achenbach, T. M., Althoff, R. R., Bagby, R. M., ... Zimmerman, M. (2017). The Hierarchical Taxonomy of Psychopathology (HiTOP): A dimensional alternative to traditional nosologies. *Journal of Abnormal Psychology*, 126(4), 454–477. <https://doi.org/10.1037/abn0000258>
- Long, J. A. (2018). Jtools: Analysis and presentation of social scientific data (R package version 1.1.1) [Software]. Available from <https://cran.r-project.org/package=jtools>
- Lotfi, M., Bach, B., Amini, M., & Simonsen, E. (2018). Structure of DSM-5 and ICD-11 personality domains in Iranian community sample. *Personality and Mental Health*, 12(2), 155–169. <https://doi.org/10.1002/pmh.1409>
- Lugo, V., Oliveira, S. E. S. de, Hessel, C. R., Monteiro, R. T., Pasche, N. L., Pavan, G., ... Spanemberg, L. (2019). Evaluation of DSM-5 and ICD-11 personality traits using the

- Personality Inventory for DSM-5 (PID-5) in a Brazilian sample of psychiatric inpatients. *Personality and Mental Health*, 13(1), 24–39. <https://doi.org/10.1002/pmh.1436>
- Marsh, H. W., Hau, K.-T., & Wen, Z. (2004). In Search of Golden Rules: Comment on Hypothesis-Testing Approaches to Setting Cutoff Values for Fit Indexes and Dangers in Overgeneralizing Hu and Bentler's (1999) Findings. *Structural Equation Modeling: A Multidisciplinary Journal*, 11(3), 320–341. https://doi.org/10.1207/s15328007sem1103_2
- Marsh, H. W., Lüdtke, O., Nagengast, B., Morin, A. J. S., & von Davier, M. (2013). Why item parcels are (almost) never appropriate: Two wrongs do not make a right—Camouflaging misspecification with item parcels in CFA models. *Psychological Methods*, 18(3), 257–284. <https://doi.org/10.1037/a0032773>
- Marsh, H. W., Morin, A. J. S., Parker, P. D., & Kaur, G. (2014). Exploratory Structural Equation Modeling: An Integration of the Best Features of Exploratory and Confirmatory Factor Analysis. *Annual Review of Clinical Psychology*, 10(1), 85–110. <https://doi.org/10.1146/annurev-clinpsy-032813-153700>
- Maydeu-Olivares, A., & Coffman, D. L. (2006). Random intercept item factor analysis. *Psychological Methods*, 11(4), 344–362. <https://doi.org/10.1037/1082-989X.11.4.344>
- McCabe, G. A., & Widiger, T. A. (2019). A Comprehensive Comparison of the ICD-11 and DSM-5 Section III Personality Disorder Models. *Psychological Assessment*. Advance online publication.
- McCrae, R. R. (2018). Method biases in single-source personality assessments. *Psychological Assessment*, 30(9), 1160–1173.

- Meehl, P. E. (1990). Appraising and amending theories: The strategy of Lakatosian defense and two principles that warrant it. *Psychological Inquiry*, 1(2), 108-141.
- Miller, M. B. (1995). Coefficient alpha: A basic introduction from the perspectives of classical test theory and structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, 2(3), 255–273. <https://doi.org/10.1080/10705519509540013>
- Millsap, R. E., & Olivera-Aguilar, M. (2012). Investigating measurement invariance using confirmatory factor analysis. In R. H. Hoyle (Ed.), *Handbook of Structural Equation Modeling* (pp. 380-392). New York, NY: Guilford.
- Mulder, R. T., Horwood, J., Tyrer, P., Carter, J., & Joyce, P. R. (2016). Validating the proposed ICD-11 domains. *Personality and Mental Health*, 10(2), 84–95.
<https://doi.org/10.1002/pmh.1336>
- Mulder, R., & Tyrer, P. (2019). Diagnosis and classification of personality disorders: novel approaches. *Current Opinion in Psychiatry*, 32(1), 27-31.
<https://doi.org/10.1097/YCO.0000000000000461>
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus user's guide* (8th ed.). Los Angeles, CA: Author.
- Olajide, K., Munjiza, J., Moran, P., O'Connell, L., Newton-Howes, G., Bassett, P., ... Crawford, M. J. (2017). Development and Psychometric Properties of the Standardized Assessment of Severity of Personality Disorder (SASPD). *Journal of Personality Disorders*, 32(1), 44–56. https://doi.org/10.1521/pedi_2017_31_285
- Oltmanns, J. R., & Widiger, T. A. (2018). A self-report measure for the ICD-11 dimensional trait model proposal: The personality inventory for ICD-11. *Psychological Assessment*, 30(2), 154–169. <https://doi.org/10.1037/pas0000459>

- Oltmanns, J. R., & Widiger, T. A. (2019a). Evaluating the assessment of the ICD-11 personality disorder diagnostic system. *Psychological Assessment*. Advance online publication. <https://doi.org/10.1037/pas0000693>
- Oltmanns, J. R., & Widiger, T. A. (2019b). The Five-Factor Personality Inventory for ICD-11: A Facet-Level Assessment of the ICD-11 Trait Model. *Psychological Assessment*. Advance online publication.
- R Core Team (2018). R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from <https://www.r-project.org/>
- Rammstedt, B., & Farmer, R. F. (2013). The impact of acquiescence on the evaluation of personality structure. *Psychological Assessment*, 25(4), 1137–1145. <https://doi.org/10.1037/a0033323>
- Reed, G. M., First, M. B., Kogan, C. S., Hyman, S. E., Gureje, O., Gaebel, W., ... Saxena, S. (2019). Innovations and changes in the ICD-11 classification of mental, behavioural and neurodevelopmental disorders. *World Psychiatry*, 18(1), 3–19. <https://doi.org/10.1002/wps.20611>
- Revelle, W. (2019). psych: Procedures for psychological, psychometric, and personality research [Software]. Evanston, IL: Northwestern University. Retrieved from <https://cran.r-project.org/web/packages/psych/index.html>
- Revelle, W., & Condon, D. M. (2019). Reliability from α to ω : A tutorial. *Psychological Assessment*. Advance online publication.

- Roche, M. J. (2018). Examining the alternative model for personality disorder in daily life: Evidence for incremental validity. *Personality Disorders: Theory, Research, and Treatment*, 9(6), 574–583. <https://doi.org/10.1037/per0000295>
- Rosseel, Y. (2012). lavaan: an R package for Structural Equation Modeling. *Journal of Statistical Software*, 48(2), 1-36.
- RStudio Team (2016). RStudio: Integrated development for R. Boston, MA: RStudio, Inc. Retrieved from: <https://www.rstudio.com/>
- Samuel, D. B., Suzuki, T., Bucher, M. A., Griffin, S. A. (2018). The agreement between clients' and their therapists' ratings of personality disorder traits. *Journal of Consulting and Clinical Psychology*, 86(6), 546-555.
- Sellbom, M., Anderson, J. L., & Bagby, R. M. (2013). Assessing DSM-5 Section III personality traits and disorders with the MMPI-2-RF. *Assessment*, 20(6), 709-722.
- Sellbom, M., Solomon-Krakus, S., Bach, B., & Bagby, R. M. (2019). Validation of Personality Inventory for DSM–5 (PID-5) algorithms to assess ICD-11 personality trait domains in a psychiatric sample. *Psychological Assessment*. Advance online publication.
- Shi, D., Lee, T., & Maydeu-Olivares, A. (2019). Understanding the model size effect on SEM fit indices. *Educational and Psychological Measurement*, 79(2), 310-334.
- Sleep, C. E., Lamkin, J., Lynam, D. R., Campbell, W. K., & Miller, J. D. (2018). Personality disorder traits: Testing insight regarding presence of traits, impairment, and desire for change. *Personality Disorders: Theory, Research, and Treatment*. Advance online publication.

- Somma, A., Gialdi, G., & Fossati, A. (2019). Reliability and construct validity of the Personality Inventory for ICD-11 (PiCD) in Italian adult participants. *Psychological Assessment*. Advance online publication. doi: 10.1037/pas0000766
- Soto, C. J., John, O. P., Gosling, S. D., & Potter, J. (2008). The developmental psychometrics of big five self-reports: Acquiescence, factor structure, coherence, and differentiation from ages 10 to 20. *Journal of Personality and Social Psychology*, 94(4), 718–737. <https://doi.org/10.1037/0022-3514.94.4.718>
- Trull, T. J., Usuda, J. D., Costa Jr, P. T., & McCrae, R. R. (1995). Comparison of the MMPI-2 Personality Psychopathology Five (PSY-5), the NEO-PI, and the NEO-PI-R. *Psychological Assessment*, 7(4), 508-516.
- Tyrer, P., Mulder, R., Kim, Y.-R., & Crawford, M. J. (2019). The Development of the ICD-11 Classification of Personality Disorders: An Amalgam of Science, Pragmatism, and Politics. *Annual Review of Clinical Psychology*, 15, <https://doi.org/10.1146/annurev-clinpsy-050718-095736>
- World Health Organization. (2018). *ICD-11 for mortality and morbidity statistics (ICD-11 MMS) 2018 version*. Retrieved from <https://icd.who.int/browse11/l-m/en>
- Wright, A. G. C., & Simms, L. J. (2016). Stability and Fluctuation of Personality Disorder Features in Daily Life. *Journal of Abnormal Psychology*, 125(5), 641–656. <https://doi.org/10.1037/abn0000169>

Table 1

Descriptive statistics and reliability estimates for PiCD domains

	Mean (<i>SD</i>)	Skew (Kurtosis)	Range	α [95% CI]	MIC	ω
Negative Affective	2.91 (.68)	-.08 (-.22)	1.17 – 5	.83 [.81, .85]	.28	.85
Detachment	2.41 (.60)	.44 (.04)	1 – 4.42	.77 [.74, .80]	.22	.80
Dissocial	2.23 (.55)	.34 (-.06)	1 – 4	.73 [.70, .76]	.19	.77
Disinhibition	2.22 (.62)	.47 (-.01)	1 – 4.08	.81 [.79, .84]	.27	.87
Anankastia	3.38 (.53)	-.11 (-.07)	1.92 – 5	.74 [.71, .78]	.20	.83

Note. $N = 518$. α = coefficient alpha; CI = confidence interval; MIC = mean interitem correlation; ω = coefficient categorical omega.

Table 2

Intercorrelations between PiCD domain scores

	NA	DT	DL	DN	AN
NA	-				
DT	.292	-			
DL	.059	<u>.149</u>	-		
DN	.343	.249	.374	-	
AN	.158	<u>.144</u>	-.020	-.409	-

Note. $N = 518$. NA = Negative Affective domain; DT = Detachment domain; DL = Dissocial domain; DN = Disinhibition domain; AN = Anankastia domain. All correlations are Pearson's correlation coefficients. Correlations that are: (a) underlined are significant at $p < .01$, and (b) bolded are significant at $p < .001$. 95% confidence intervals for the correlation coefficients can be found in the R output at <https://osf.io/ekwv6/>.

Table 3

Standardized factor loadings and factor intercorrelations for the four-factor ESEM model

Item	NA	DT	DL	DN/AN
NA1	.673*	.142	-.044	.073
NA6	.524*	.080	.053	.105
NA11	.660*	.033	-.017	-.014
NA16	.691*	.238	-.104	.083
NA21	.643*	.157	-.113	.001
NA26	-.069	.119	.073	.005
NA31	<u>.469*</u>	.051	-.165*	-.055
NA36	<u>.372*</u>	.062	-.027	-.049
NA41	.619*	.163	.018	-.035
NA46	.581*	.220	-.042	.069
NA51	<u>.356*</u>	.295*	.041	-.135
NA56	.637*	.191	.048	-.047
DT3	.155	.631*	-.085	-.009
DT8	-.130	<u>.478*</u>	.106	.080
DT13	.089	.627*	<u>-.333*</u>	.141
DT18	.050	<u>.488*</u>	-.027	-.139
DT23	<u>-.305*</u>	.297*	.065	.010
DT28	.106	.193*	.092	-.139
DT33	.129	.602*	.034	-.051
DT38	-.009	.555*	-.032	-.112
DT43	-.078	.632*	<u>-.320*</u>	.043
DT48	-.001	.549*	.049	-.032
DT53	<u>-.348*</u>	<u>.416*</u>	.286*	.065
DT58	.186*	<u>.448*</u>	-.226*	-.032
DL4	<u>.362*</u>	.121	.176*	-.097
DL9	-.110	<u>.312</u>	<u>.368*</u>	-.092
DL14	-.111	-.032	.590*	.200*
DL19	.063	-.016	.591*	.194*
DL24	-.233*	<u>.307*</u>	<u>.366*</u>	-.150
DL29	.032	.037	<u>.403*</u>	.068
DL34	-.030	.124	<u>.484*</u>	-.043
DL39	-.149	<u>.318*</u>	<u>.322*</u>	-.073
DL44	.007	<u>.301*</u>	.670*	-.008
DL49	-.025	.030	.508*	.051
DL54	-.290*	<u>.333*</u>	<u>.447*</u>	-.014
DL59	-.035	<u>.304*</u>	.625*	-.021
DN2	<u>.398*</u>	-.052	.297*	<u>-.337*</u>
DN7	.124	.268*	-.023	-.561*

Item	NA	DT	DL	DN/AN
DN12	.028	.291*	-.025	-.619*
DN17	<u>.435*</u>	.020	.240*	<u>-.380*</u>
DN22	.054	<u>.302*</u>	.279*	-.240*
DN27	.082	.288*	.040	-.508*
DN32	.261*	-.116	.242*	-.504*
DN37	.113	<u>.322*</u>	.206*	-.274*
DN42	-.226*	.256*	.017	<u>-.421*</u>
DN47	<u>.433*</u>	-.087	.185*	-.519*
DN52	.172*	.141	.201*	<u>-.316*</u>
DN57	.035	.247*	.006	<u>-.484*</u>
AN5	.278*	-.062	.222*	.519*
AN10	.093	<u>.310*</u>	-.248*	.117
AN15	-.166*	.268*	-.018	.633*
AN20	.262*	-.001	<u>.464*</u>	.636*
AN25	.031	.271*	-.148	.242*
AN30	-.251*	.147	-.153	.284*
AN35	.266*	-.037	<u>.453*</u>	.662*
AN40	.145	.166	-.025	<u>.336*</u>
AN45	.029	.298*	.043	.701*
AN50	.143	-.072	.281*	<u>.494*</u>
AN55	.130	<u>.312*</u>	-.028	.543*
AN60	-.081	.199*	-.025	.506*
NA	-			
DT	.188*	-		
DL	.022	-.026	-	
DN/AN	-.074	-.085	-.270*	-

Note. NA = Negative Affective factor; DT = Detachment factor; DL = Dissocial factor; DN/AN

= Disinhibition/Anankastia factor. Factor loadings $\geq |.30|$ are underlined, and factor loadings $\geq |.50|$ are bolded.

* $p < .001$.

Table 4

Zero-order correlations and multiple regression models between PiCD domains and MMPI-2-RF scales

	NA	DT	DL	DN	AN	R^2
	r / β	r / β	r / β	r / β	r / β	
PSY-5 scales						
Negative Emotionality/Neuroticism	[.75* / .76*]	<u>.21*</u> / -.01	.04 / .01	<u>.28*</u> / .01	.08 / -.03	.58
Introversion/Low Positive Emotionality	<u>.21*</u> / .16*	[.47* / .54*]	-.16* / <u>-.23*</u>	.05 / -.15	-.04 / <u>-.22*</u>	.34
Aggressiveness	-.04 / -.01	-.10 / -.18*	[.46* / .53*]	.05 / -.04	.08 / .09	.28
Disconstraint	.04 / .00	.03 / -.05	<u>.43*</u> / <u>.39*</u>	[.31* / .14]	(-.19* / -.13*)	.24
Psychoticism	<u>.45*</u> / <u>.38*</u>	<u>.20*</u> / .06	<u>.25*</u> / .17*	<u>.32*</u> / .14*	.07 / .05	.29
Higher-order scales						
Emotional/Internalizing Dysfunction	[.74* / .71*]	[.41* / .26*]	.00 / -.09*	<u>.33*</u> / -.04	-.03 / -.21*	.64
Behavioral/Externalizing Dysfunction	<u>.20*</u> / .16*	.07 / -.06	[.47* / .43*]	[.34* / .12]	(-.13* / -.12)	.30
Thought Dysfunction	<u>.42*</u> / <u>.37*</u>	.18* / .07	<u>.26*</u> / .19*	<u>.29*</u> / .10	.06 / .03	.27

Note. $N = 518$. All correlations are Spearman's rank correlation coefficients. Correlations and regression weights that are underlined have a medium effect size ($|\cdot| \geq .20$), and those that are bolded have a large effect size ($|\cdot| \geq .50$). PiCD domain coefficients that have squared brackets were hypothesized to be positively related to a respective MMPI-2-RF scale, while rounded brackets were hypothesized to be negatively related, based on Anderson et al. (2013) and Sellbom et al. (2013). All model R^2 values are significant at $p < .001$. 95% confidence intervals for the correlations and regression coefficients can be found in the R output at <https://osf.io/ekwv6/>.

* $p < .01$ (after correction for multiple testing using the Benjamini-Hochberg procedure).

Table S1

Descriptive statistics for MMPI-2-RF subscales

	Mean (SD)	Skew (Kurtosis)	Range	α
Higher-order scales				
Emotional/Internalizing Dysfunction	60.12 (11.93)	.23 (-.59)	29.86 – 91.52	.91
Thought Dysfunction	63.14 (14.95)	1.00 (1.31)	38.93 – 122.07	.85
Behavioral/Externalizing Dysfunction	50.78 (9.38)	.63 (.31)	32.09 – 86.39	.78
Psychopathology-Five (PSY-5) scales				
Aggressiveness	50.30 (10.00)	.70 (.40)	28.19 – 83.11	.73
Psychoticism	64.33 (14.73)	.97 (1.07)	38.43 – 116.30	.85
Disconstraint	48.03 (8.48)	.77 (.80)	31.05 – 85.09	.71
Negative Emotionality/Neuroticism	59.88 (12.25)	.28 (-.60)	32.25 – 91.21	.79
Introversion/Low Positive Emotionality	53.62 (12.77)	.67 (-.03)	32.22 – 93.29	.82

Note. $N = 518$. α = coefficient alpha. Scale scores specifically correspond to unbounded and unrounded T-scores as opposed to raw scores.

Table S2

Standardized factor loadings and factor intercorrelations for the five-factor ESEM model

Item	NA	DT	DL/DN	DN/AN1	DN/AN2
NA1	.708*	.061	-.062	-.054	.092
NA6	.548*	.014	.001	-.050	.144
NA11	.699*	-.145*	.066	-.008	-.027
NA16	.752*	.095	-.047	.047	.019
NA21	.684*	.044	-.055	-.019	-.020
NA26	-.057	.065	.119	.067	-.025
NA31	<u>.491*</u>	.000	-.117	-.053	-.061
NA36	<u>.387*</u>	-.010	.013	-.051	-.028
NA41	.656*	-.012	.109	-.014	-.035
NA46	.630*	.087	.007	.039	.025
NA51	<u>.382*</u>	.146	.177	-.014	-.125
NA56	.676*	-.005	.153*	-.013	.043
DT3	.189*	.634*	-.048	.005	-.021
DT8	-.129	.553*	.033	-.013	.129
DT13	.156	.681*	<u>-.315*</u>	.141	-.003
DT18	.051	.508*	.029	-.074	-.087
DT23	-.295*	.296*	.110	.102	-.038
DT28	.124	.050	.234*	.028	-.147
DT33	.127	.675*	-.007	-.139	.064
DT38	.018	<u>.499*</u>	.101	.058	-.153
DT43	-.043	.742*	<u>-.302*</u>	.074	-.051
DT48	.023	.514*	.113	.037	-.041
DT53	<u>-.371*</u>	.502*	.191	-.033	.166
DT58	.234*	<u>.405*</u>	-.111	.089	-.136
DL4	<u>.339*</u>	.110	.124	-.221*	.088
DL9	-.111	.185	<u>.443*</u>	.002	-.016
DL14	-.119	-.140	<u>.474*</u>	.028	<u>.302*</u>
DL19	.025	-.010	<u>.355*</u>	-.157*	<u>.430*</u>
DL24	-.228*	.123	.524*	.072	-.126
DL29	.024	-.056	<u>.352*</u>	-.026	.167
DL34	-.055	.033	<u>.456*</u>	-.099	.125
DL39	-.169	.286*	<u>.327*</u>	-.061	.044
DL44	.042	-.042	.797*	.129	.026
DL49	-.049	-.047	<u>.425*</u>	-.081	.211*
DL54	<u>-.314*</u>	<u>.310*</u>	<u>.410*</u>	-.044	.120
DL59	-.001	-.029	.763*	.136	-.003
DN2	<u>.315*</u>	-.023	.229*	<u>-.467*</u>	.040
DN7	.099	.161	.243*	-.211*	<u>-.427*</u>

Item	NA	DT	DL/DN	DN/AN1	DN/AN2
DN12	.059	-.037	<u>.465*</u>	.028	-.645*
DN17	<u>.363*</u>	.015	.231*	<u>-.438*</u>	-.038
DN22	.027	.233*	<u>.347*</u>	-.166	-.070
DN27	.111	-.008	<u>.441*</u>	.014	-.508*
DN32	.112	.084	.111	-.667*	.016
DN37	.112	.160	<u>.382*</u>	-.067	-.191*
DN42	-.231*	.121	<u>.304*</u>	-.003	<u>-.415*</u>
DN47	<u>.314*</u>	.028	.122	-.616*	-.056
DN52	.150	.018	<u>.332*</u>	-.170	-.169
DN57	.032	.075	<u>.308*</u>	-.082	<u>-.432*</u>
AN5	.297*	.000	-.087	.046	.535*
AN10	.190*	.134	-.040	<u>.367*</u>	-.189*
AN15	-.018	.049	.039	.660*	.173*
AN20	.277*	.034	.079	.049	.698*
AN25	.155	-.005	.092	.521*	-.158
AN30	-.160	.013	-.027	<u>.460*</u>	-.065
AN35	.281*	.019	.043	.041	.730*
AN40	.239*	-.016	.043	<u>.369*</u>	.073
AN45	.175	.100	.020	.601*	<u>.304*</u>
AN50	.166	-.057	.019	.096	<u>.490*</u>
AN55	.277*	.096	.019	.533*	.171*
AN60	.047	-.011	.043	.553*	.116
NA	-				
DT	.296*	-			
DL/DN	.099	.223*	-		
DN/AN1	-.036	.098	-.294*	-	
DN/AN2	-.163*	-.173*	.028	.213*	-

Note. Factor loadings $\geq |.30|$ are underlined, and factor loadings $\geq |.50|$ are bolded.

* $p < .001$.

Table S3

Standardized factor loadings and factor intercorrelations of four-factor random-intercept ESEM

Item	NA	DT	DL	DN/AN	RI
NA1	.639*	.080	-.027	-.035	.207*
NA6	.475*	.006	.010	-.045	.217*
NA11	.572*	-.048	-.061	.070	.215*
NA16	.657*	.115	.134	-.027	.210*
NA21	.609*	.066	-.114	.032	.205*
NA26	-.063	.025	.025	.002	.236*
NA31	.429*	-.021	-.172	.056	.206*
NA36	.327*	-.025	-.062	.066	.210*
NA41	.549*	.066	-.003	.084	.198*
NA46	.557*	.088	-.064	-.020	.189*
NA51	.316*	.164	-.002	.175*	.236*
NA56	.573*	.080	.037	.096	.201*
DT3	.190*	.614*	.042	-.008	.220*
DT8	-.096	.462*	.186	-.063	.192*
DT13	.165*	.566*	-.183	-.180*	.213*
DT18	.077	.430*	.068	.108	.215*
DT23	-.289*	.193	.007	.020	.223*
DT28	.073	.032	-.015	.160	.245*
DT33	.149	.623*	.194*	.019	.219*
DT38	.019	.437*	.010	.081	.237*
DT43	-.001	.594*	-.142	-.107	.199*
DT48	.026	.477*	.118	.036	.195*
DT53	-.307*	.374*	.310*	-.053	.211*
DT58	.204*	.375*	-.179	.017	.227*
DL4	.291*	.054	.164	.126	.195*
DL9	-.113	.147	.219	.156	.255*
DL14	-.179*	-.161	.401*	-.085	.252*
DL19	-.014	-.111	.471*	-.093	.211*
DL24	-.220*	.092	.155	.203	.225*
DL29	-.027	-.086	.268*	.012	.218*
DL34	-.095	-.024	.326*	.125	.216*
DL39	-.132	.183	.234	.097	.211*
DL44	-.045	.013	.356	.160	.239*
DL49	-.076	-.067	.378*	.018	.209*
DL54	-.258*	.160	.296*	.056	.241*
DL59	-.090	.042	.329	.173	.206*
DN2	.288*	-.095	.255*	.370*	.230*
DN7	.043	.087	-.098	.552*	.225*

Item	NA	DT	DL	DN/AN	RI
DN12	-.027	.002	-.200	.650*	.206*
DN17	.325*	-.067	.184	.416*	.230*
DN22	.035	.146	.182	.209*	.264*
DN27	.016	.026	-.129	.549*	.211*
DN32	.144	-.091	.229	.440*	.230*
DN37	.070	.095	.062	.292*	.234*
DN42	-.252*	.085	-.072	.417*	.211*
DN47	.292*	-.124	.145	.497*	.233*
DN52	.103	-.035	.086	.348*	.214*
DN57	-.027	.029	-.120	.516*	.233*
AN5	.260*	-.026	.213*	-.461*	.224*
AN10	.120	.168	-.294*	-.105	.230*
AN15	-.142	.105	-.165	-.523*	.258*
AN20	.216*	-.028	.394*	-.537*	.193*
AN25	.022	.016	.344*	-.161	.224*
AN30	-.216*	.011	-.266*	-.255*	.227*
AN35	.195*	-.070	.362*	-.531*	.222*
AN40	.105	-.042	-.197	-.240*	.232*
AN45	.032	.110	-.104	-.600*	.240*
AN50	.083	-.111	.171	-.359*	.268*
AN55	.116	.111	-.200	-.439*	.260*
AN60	-.082	.026	-.181	-.386*	.237*
NA	-				
DT	.096	-			
DL	.022	-.183*	-		
DN/AN	.102	.112	.159*	-	
RI	0	0	0	0	-

Note. RI = Random-intercept factor. Factor loadings $\geq |.30|$ are underlined, and factor loadings $\geq$

$|.50|$ are bolded.

* $p < .001$.