Psychometric Properties of the Italian Version of the Personality Assessment Inventory (PAI)

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Abstract

The Personality Assessment Inventory (PAI) has been translated into different languages (e.g., Spanish, German, and Greek) and several authors investigated psychometric properties, internal structure, and the convergent validity of translated versions of PAI. Recently, an Italian version of the test has been published, but its psychometric properties has never been explored. The aims of the present study were: (a) to examine the hypothesized subscale structure of scales that have subscales; (b) to evaluate the internal structure of the 22 PAI full scales; (c) to report on the convergent validity of the PAI scales with the Millon Clinical Multiaxial Inventory-III (MCMI-III) scales. The sample consisted of 1,538 participants recruited from all over Italy. Our findings provided support to the cross-cultural applicability of the PAI and contributed to enhance confidence in the validity and utility of the PAI.

Public Significance Statement

This study suggests that the three-component structure of the Personality Assessment Inventory (PAI) full scales is consistent across cultures and that the hypothesized subscale structure is confirmed by observed data. Additionally, it highlights features shared between the PAI and the Millon Clinical Multiaxial Inventory-III (MCMI-III).

Keywords: Personality Assessment Inventory (PAI); Italian validation; PCA; CFA; MCMI-III
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The Personality Assessment Inventory (PAI; Morey, 1991, 2007) is a self-administered measure of psychopathology designed to provide critical information in professional settings. The PAI is composed of four Validity scales (Inconsistency [ICN], Infrequency [INF], Negative Impression Management [NIM], and Positive Impression Management [PIM]), 11 Clinical scales (Somatic Complaints [SOM], Anxiety [ANX], Anxiety-Related Disorders [ARD], Depression [DEP], Mania [MAN], Paranoia [PAR] Schizophrenia [SCZ], Borderline Features [BOR], Antisocial Features [ANT], Alcohol Problems [ALC], and Drug Problems [DRG]), five Treatment scales (Aggression [AGG], Suicidal Ideation [SUI], Stress [STR], Nonsupport [NON], and Treatment Rejection [RXR]), and two Interpersonal scales (Dominance [DOM] and Warmth [WRM]). Because the constructs investigated by the PAI scales were multidimensional, Morey examined the literature to identify the most important components to the definition of the clinical syndromes included in the PAI. He created three to four conceptual subscales for each of the Nine Clinical scales (SOM, ANX, ARD, DEP, MAN, PAR, SCZ, BOR, and ANT) and for one Treatment scale (AGG) to include an adequate coverage of the content being investigated. By using a two-step procedure, he conducted an in-depth conceptual analysis of the items and evaluated the psychometric characteristics of the items, scales, and subscales. At the beginning, a pool of more than 2,200 items was written by the research group to tap the constructs previously selected. First, members of the research group were asked to assign each item of the initial pool to the conceptual subscale. Only items that reached at least 75% of agreement were retained. Subsequently, a panel of experts in psychopathology assigned each item to the appropriate construct supposedly measured by the scales. As a result, a pool of 776 items remained. Finally, Morey
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evaluated a series of item parameters and the psychometric properties of this initial version, obtaining the final version of 344 items. Soon after its publication, the PAI rapidly gained popularity among clinical training programs (Piotrowski & Belter, 1999) and, currently, the PAI is the second most frequently taught test in clinical training programs (Mihura, Roy, & Graceffo, 2017). As a result, additional research examining its psychometric properties is needed to improve confidence in the validity and utility of the PAI (Kurtz & Blais, 2007).

The PAI has been translated into other languages by several authors. Morey (1991) published a Spanish-language translation of the PAI, but he did not provide specific norms for this population, so that the norms were the same for both the American and Spanish versions. In 2007, Groves and Engel developed a German version of the PAI and provided German norms based on a sample of 749 adults. The authors found differences lower than 5 T scores between the American and German mean scores on the PAI scales. Lyrakos (2011) developed the Greek version of the PAI based on 1,870 participants divided in nonclinical \( (n = 1,120) \) and clinical \( (n = 750) \) samples. The comparison between the Greek and American versions showed some differences in the mean values of two scales (NON and WRM) and three subscales (Affective Instability [BOR-A], Negative Relationships [BOR-N], and Egocentricity [ANT-E]). Recently, an Italian version of the test has been published in Italy (Zennaro et al., 2015). The Italian PAI was administered to 1,799 participants recruited from all over Italy and the final standardization sample was composed of 1,000 individuals. Comparing the Italian to the US normative samples, largest effect sizes (Cohen’s \( d > .50; \) Cohen, 1988) were found for the Cognitive Anxiety (ANX-C; \( d = .65 \)), Irritability (MAN-I; \( d = .60 \)), Hypervigilance (PAR-H; \( d = .91 \)), and Self-
Harm (BOR-S; $d = -.52$) subscales, with the Italian normative sample showing higher mean scores on all but the BOR-S subscale.

Morey (1991, 2007) investigated the conceptual subscale structure applying Confirmatory Factor Analyses (CFAs) on each scale with subscales: individual PAI items were considered as observed variables and the subscales were considered as latent variables correlated to each other (Figure 1). The Bentler-Bonett Normed Fit Index (NFI; Bentler & Bonett, 1980) and the Comparative Fit Index (CFI; Bentler, 1990) were above .97 for all scales, suggesting that observed data showed a good fit to the hypothesized subscale models. Subsequently, Jackson and Trull (2001) examined the four-factor model introduced by Morey (1991) of the BOR scale (i.e., affective instability, identity disturbance, negative relationship, and self-harm) in a large sample of college students by using maximum likelihood (ML) as estimation method and they found relatively poor fit of the model ($\chi^2 [246, N = 4,682] = 8,279.5$; RMSEA = .08, CFI = .74; TLI = .70). Therefore, they proposed a six-factor model (lack of control/impulsive behavior, mood instability, chronic emptiness/loneliness/boredom, separation and abandonment concerns, negative relationships, and reckless spending) that showed a better fit of the data ($\chi^2 [237, N = 2,341] = 2,432.67$; RMSEA = .06; CFI = .86; TLI = .83). Given that the hypothesized subscale structure of the other PAI scales has never been tested, more studies are needed to replicate Morey’s findings.

The factor structure of the PAI scales has been investigated mostly by using principal components analysis (PCA) and exploratory factor analysis (EFA). Morey (1991) performed four PCAs with Varimax rotations retaining components with eigenvalue greater than 1 for both the normative and the clinical samples: two
involved only the 11 Clinical scales and two involved all the 22 PAI scales. Morey found two to three components when considering only the Clinical scales; however, he found four components in both samples when considering the 22 PAI scales: (a) subjective distress and affective disruption, with positive loading on the NIM, SOM, ANX, ARD, DEP, PAR, SCZ, BOR, SUI, and STR scales and negative loadings on the PIM and RXR scales; (b) behavioral acting-out and impulsive tendencies, with loadings on the ICN, INF, NIM, ANT, ALC, DRG, and SUI scales; (c) egocentricity, exploitativeness, and hostility in interpersonal relationships, with positive loadings on the MAN, ANT, AGG, and DOM scales; (d) social detachment and sensitivity in social relationships, with positive loadings on the PAR, SCZ, and NON scales and negative loadings on the WRM scale. Subsequent independent studies (see Morey, 2007) examined the factor structure of the PAI scales, but the results were contradictory, resulting in a number of extracted factors ranging from two to three for the 11 Clinical scales and from three to five for the 22 PAI full scales.

Hoelzle and Meyer (2009) investigated whether different samples’ characteristics and using different criteria to determine the number of components/factors to be extracted might have contributed to the incongruity of the findings related to the structure of the PAI scales. The PAI was administered to 227 individuals who sought psychological services at the University of Toledo Training Clinic: The participants were mostly White (76.7%) and female (59.1%), with age ranging from 17 to 59 years ($M = 27.28; SD = 9.57$). The authors determined the number of components to be extracted by using parallel analysis (PA), Velicer’s minimum average partial (MAP) procedure, and the inclusion of random variables in genuine data (Gorsuch, 1983), and then performed a PCA with oblimin rotation. The
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PAI had three components minimally correlated to each other: (a) general distress, with positive loadings on the NIM, SOM, ANX, ARD, DEP, PAR, SCZ, BOR, SUI, STR, and NON scales, and negative loadings on the PIM, RXR, and WRM; (b) elevated mood and dominance, with positive loadings on the MAN, ANT, AGG, and DOM scales; (c) substance abuse and psychopathy, with positive loadings on the ICN, INF, ANT, ALC, and DRG scales. Hoelzle and Meyer (2009) examined the congruence of the component structure found in the first study with factor structures reported in five previous studies (i.e., clinical samples: Karlin et al., 2005; Morey, 1991; Tasca, Wood, Demidenko, & Bissada, 2002; nonclinical samples: Groves and Engel, 2007; Morey, 1991). They used PA, MAP, and random variables to determine the number of components to be extracted for each selected study. Finally, they performed a series of PCA with varimax rotation and computed congruence coefficients. Overall, the authors found that the three-component structure was highly congruent and invariant across the different samples.

The PAI scales have shown good convergent validity with most of self-reports assessing personality disorders and traits (see Morey, 2007); however, the convergent validity of the PAI scales with the Millon Clinial Multiaxial Inventory-III (MCMI-III; Millon, Millon, Davis, & Grossman, 2009) scales has never been investigated. The MCMI–III is one of the most widely used and researched clinical assessment instruments for assessing personality disorders (PDs) and clinical syndromes (CSs) (Wise, Streiner, & Walfish, 2010) and data about the convergent validity of the PAI scales with the MCMI-III scales may help clinicians and researchers to have a better understanding of these tests. At the level of individual scale comparisons (e.g., comparing the PAI Clinical scales with the MCMI–III scales), Rielage (2005)
reported correlation values between the PAI and the MCMI-II (Millon, 1987) scales in a sample of 251 veterans. One-hundred and forty-five of the 550 correlations computed were greater than .50 and most of the correlations between scales that should measure the same construct showed large ($r > .50$) effect sizes. The only exceptions were the correlation values between the PAI SOM and the MCMI-II H (Somatoform) scales ($r = .37$) and between the PAI SCZ and the MCMI-II PP (Delusional Thinking) scales ($r = .34$).

At the dimensional level, there might be some conceptual overlap between MCMI–III dimensions and the aforementioned PAI dimensions. Although the MCMI-III scales were derived from Millon’s theory, several researchers found three to four factors underlying the MCMI–III scales (Craig & Bivens, 1998; Haddy, Strack & Choca, 2005; Pignolo et al., 2017; Rossi, Van der Ark, & Sloore, 2007). These four factors are: (a) General Maladjustment (different clinical syndrome and personality disorder scales have high loadings on this factor), (b) Aggression/Social Deviance (positive loadings of the 6A - Antisocial, 6B - Aggressive, B - Alcohol Dependence, and T - Drug Dependence scales and negative loadings of the 7 – Compulsive scale), (c) Paranoid/Delusional Thinking (P - Paranoid and PP - Delusional Disorder scales), and (d) Emotion Instability/Detachment (4 – Histrionic and 5 - Narcissistic scales on one hand and 1 - Schizoid and 2A - Avoidant on the other). Comparing the internal structure of both tests, some similarities in the latent factors may be found. The first dimension of both the MCMI-III and the PAI refers to general distress and symptomatology. The MCMI-III Aggression/Social Deviance dimension may be related to the PAI Substance Abuse and Psychopathy dimension because antisocial features and alcohol and drug abuse are characteristics of both of these dimensions.
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Theoretically, the fourth PAI dimension found by Morey (1991), *social detachment and sensitivity in social relationships*, may be related to the MCMI-III *Emotion Instability/Detachment* dimension, given that they both share social detachment scales (PAR, SCZ, NON, reversed WRM).

The validation of psychological tests to other languages plays an important role in the international scientific field. Because operational definitions at the base of psychological tests are shared across cultures, researchers from all over the world can increase the amount of data and provide support to the validity and reliability of tests’ scores and interpretations (Brislin, 1986). Thus, the aims of the current study were: (a) to replicate Morey’s findings about the hypothesized subscale structure of the nine clinical scales and the one treatment scale that have subscales; (b) to explore the internal structure of the Italian PAI and to evaluate its cross-cultural congruency with the three-component structure of the 22 PAI full scales reported by Hoelzle and Meyer (2009); (c) to report on the convergent validity of the PAI scales with the MCMI-III scales.

**Method**

**Participants**

Data collection was carried out from the beginning of 2014 to the end of 2014 by five Italian universities (i.e., Torino, Padova, Perugia, Chieti Pescara, and Catania). The inclusion criteria were age between 18 and 89 years, less than 18 missing items at the PAI, and raw scores lower than 14 on the Inconsistency (ICN) scale and lower than 10 on the Infrequency (INF) scale according to the PAI American Professional Manual (Morey, 2007). The initial sample comprised 1,799 participants recruited from all over Italy to evaluate the adequacy and validation of the Italian translation of
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the PAI (Zennaro et al., 2015). Fifty-seven (3.2%) participants were eventually
excluded because they had more than 18 missing answers, and 204 (11.3%) partici-
pants were excluded due to random responding (i.e., raw ICN ≥ 13 or raw INF
≥ 9). The final sample consisted of 1,538 participants, 618 (40.2%) men and 920
women. Descriptive statistics for the socio-demographic characteristics of the sample
are reported in Table 1. Of those 1,538 participants, 1,000 individuals were selected
on the basis of census projections for the year 2014 (Italian National Institute of
Statistics, ISTAT), to form the Italian normative sample.

The study was approved by the University Research Ethics Board of the
University of Perugia, Italy. Participation was voluntary and all participants read and
signed an informed consent form prior to taking part in the study.

Measures

Personality Assessment Inventory (PAI; Morey 1991, 2007). The PAI
(Morey, 1991, 2007) contains 344 items and consists of 22 non-overlapping scales: 4
Validity scales, 11 Clinical scales, 5 Treatment scales, and 2 Interpersonal scales. The
PAI offers information about clinical syndromes and symptoms, response style and
potential distortions, potential complications in treatment, and the respondent’s
interpersonal behavior. The standardization of the PAI was based on data from three
samples: (a) U.S. census-matched standardization sample of dwelling adults (n =
1,000), (b) a sample of adult patients (n = 1,265), and (c) a sample of college students
(n = 1,051). The evaluation of the psychometric properties of the test in the U.S.
normative sample suggested a good reliability of the PAI scores and a good validity of
test score interpretations. Morey (1991) reported Cronbach’s alphas ranging from .45
for the ICN scale to .90 for the ANX scale, with a median value of .81, and mean
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inter-item correlation coefficients ranging from .17 for the PIM and MAN scales to .41 for the SUI scale, with a median value of .22. Moreover, Morey (1991) investigated the temporal stability of the PAI scales by administering the test on two different occasions, an average of 24 days apart. Test-retest reliability correlations ranged from .29 for the ICN scale to .91 for the DEP scale, with a mean difference of three to four T-score points between the two administrations.

For the adaptation of the PAI to the Italian population, a translation and a subsequent back-translation procedure was followed (Brislin, 1980; International Test Commission, 2005; Van de Vijver & Hambleton, 1996) and the Italian translation was sanctioned by Psychological Assessment Resources (PAR). As for the internal consistency of the Italian PAI (Zennaro et al., 2015) the median alpha value for all the scales was .73, whereas Morey found a median alpha value of .81 for the U.S. normative sample. The temporal stability of the Italian PAI scales was evaluated administering the Italian PAI on two different occasions an average of 24 days apart to 53 participants recruited from the normative sample. The two-way random effects model, intraclass correlation coefficients (ICCs) were computed and the mean ICC values were .79 (SD = .08; Range: .60 - .94) for the scales and .78 (SD = .09; Range: .54 - .93) for the subscales, whereas Morey (2007) reported a mean correlation of .90 for the scales and of .79 for the subscales for the U.S. normative sample. According to the interpretative benchmarks suggested by Cicchetti (1994) and Shrout and Fleiss (1979), most of the Italian PAI scales and subscales showed good to excellent test-retest reliability.

Millon Clinical Multiaxial Inventory-III (MCMI-III; Millon, Millon, Davis, & Grossman, 2009). The Millon Clinical Multiaxial Inventory-III (MCMI-III;
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Millon, Millon, Davis, & Grossman, 2009) is a psychological assessment tool intended to provide information on clinical symptoms and personality disorders based on Millon (1986)’s Evolutionary Theory. Millon’s Evolutionary Theory is based on the existence of three polarities (i.e., pain-pleasure, active-passive, and self-other) that form the structure form of a categorical and dimensional approach to personality assessment. Personality prototypes are characterized by functional domains (i.e., expressive acts, interpersonal conduct, cognitive style, and regulatory mechanisms) and structural domains (i.e., object representations, self-image, morphologic organization, and mood/temperament). The MCMI-III is comprised of 24 scales measuring personality disorders (1 = Schizoid, 2A = Avoidant, 2B = Depressive, 3 = Dependent, 4 = Histrionic, 5 = Narcissistic, 6A = Antisocial, 6B = Sadistic [Aggressive], 7 = Compulsive, 8A = Negativistic [Passive-Aggressive], 8B = Masochistic [Self-Defeating], S = Schizotypal, C = Borderline, and P = Paranoid), and clinical syndromes (A = Anxiety, H = Somatoform, N = Bipolar: Manic, D = Dysthymia, B = Alcohol Dependence, T = Drug Dependence, R = Posttraumatic Stress, SS = Thought Disorder, CC = Major Depression, and PP = Delusional Disorder). Three modifying indices (X = Disclosure, Y = Desirability, and Z = Debasement) and two random responding indicators (V = Invalidity and W = Inconsistency) are also included.

Although the test was designed for and based on clinical populations, Choca (2004) stated that administering the MCMI to nonclinical samples is appropriate, as far as the interpretation of elevations is limited to stylistic personality differences rather than personality disorders. High alpha coefficients (> .70) were reported for all the scales, with the exception of the 7 (Compulsive; $\alpha = .66$) and 5 (Narcissistic; $\alpha =$
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.67) scales, and test-retest correlation values greater than .80 (Wise, Streiner, & Walfish, 2010).

The Italian standardization of the MCMI-III (Zennaro, Ferracuti, Lang, & Sanavio, 2008) was based on 789 psychiatric patients recruited from public or private services in Northern and Center Italy. Three hundred patients had a clinical syndrome as a primary Axis I diagnosis, whereas 343 had a personality disorder as a primary Axis II diagnosis. The sample was equally distributed by gender (female = 51.9%). A translation and back-translation procedure was used to produce the Italian version of the MCMI-III that was approved for use by Pearson Assessment Inc (see Zennaro et al., 2013). In the Italian validation sample, Cronbach’s alphas were greater than .80 for all the scales and were comparable to those obtained for the U.S. scales. In the present study, Cronbach’s alphas ranged from .57 for the 7 (Compulsive) Personality Pattern scale to .79 for the 2B (Depressive) Personality Pattern scale and from .58 for the T (Drug) scale to .84 for the R (PTSD) scale.

Results

Different analyses were carried out in the present study. First, a series of CFAs were conducted to evaluate whether the hypothesized subscale factor structure identified by Morey (1991, 2007) would also fit our Italian data. Then, we evaluated the internal structure of the Italian PAI full scales by computing a PCA with oblimin rotation. Finally, we conducted a canonical correlation analysis (CCA) to assess the overall relationships between the PAI and the MCMI-III.

Confirmatory Factor Analyses (CFA) of the PAI Scales with Subscales

To test whether the factor structure of each PAI parent scale in the present study might replicate Morey’s findings, we computed a series of CFAs (i.e., one for
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each parent scale) considering the items of each subscale as observed variables and
the subscales as latent factors correlated to each other (Figure 1). The estimation
method used was Weighted Least Squares Mean-and-Variance-adjusted (WLSMV;
Muthén, 1993) for ordinal variables. WLSMV is robust to violations of multivariate
normality because it starts from polychoric correlations. We considered five fit
indices: the root mean square error of approximation (RMSEA), the CFI, the NFI, the
goodness-of-fit index (GFI), and the nonnormed fit index (NNFI). GFI, CFI, NFI, and
NNFI values greater than .90 indicate good fit of the data to a model (Bentler &
Bonett, 1980; Hu & Bentler, 1999), whereas RMSEA values lower than .05 indicate
good fit, lower than .08 fair fit, and lower than .10 marginal fit (Browne & Cudeck,
1993). The analyses were performed using the lavaan package (Rosseel, 2012) in R
statistical software (R Development Core Team, 2011).

According to the aforementioned thresholds, most of the 10 scales presented
fair to good fits between the models and the data. CFI values were lower than .90 for
all the scales except the SOM, ANX, and AGG scales (Table 2). Morey (2007)
reported a CFI value of .98 and NFI values between .97 and .98 for all the scales.
Comparing the results related to the Clinical scales with those reported by Morey
(2007), the Italian scales showed lower fit indices (i.e., CFI and NFI) than the
American scales. However, RMSEA values ranged between .05 and .07 for all the
Clinical scales, indicating a fair fit, and GFI and NNFI values were greater than .90,
indicating an acceptable fit. Finally, descriptive statistics for factor loadings of each
subscale are presented in Table 3. Overall, the mean factor loadings were higher than
.40 for all the subscales and ranged from .42 (MAN-A) to .74 (ARD-T). However, 38
of the items (11%) presented factor loadings lower than a commonly-used threshold
of .40, and, among them, 22 items (6%) showed factor loadings lower than .30. Thus, although fit indices were lower than those reported by Morey (1991), the evaluation of factor loadings seemed to indicate that most of the items are consistent with their scale assignments.

**Principal Component Analysis (PCA) of the PAI Full Scales**

Prior to compute PCA with oblimin rotation, we applied parallel analysis (PA) and Velicer’s (1976) minimum average partial (MAP) procedure to determine the appropriate number of components to retain, by using O’Connor’s (2000) SPSS syntax. PA results indicated three components to be retained: the third eigenvalue was larger than the 95th percentile for the third randomly generated eigenvalue (actual = 1.725; 95th percentile PA = 1.156), whereas the fourth eigenvalue was smaller than the 95th percentile for the fourth randomly generated eigenvalue (actual = 1.127, 95th percentile PA = 1.133). Also the MAP suggested that three components might be retained: the average squared partial correlation reached the lowest value after the third root was extracted. Therefore, we extracted three components.

Finally, we computed congruence coefficients by using Barrett’s (2005) program to assess similarity of the Italian and American factor structures. Given that the raw score correlation matrix of the U.S. normative sample (n = 1,000) can be found in the PAI Manual (Morey, 2007), we performed a PCA with oblimin rotation and found component loadings based on the raw score correlation matrix in the PAI Manual. As for Hoelzle and Meyer (n = 227), we used the factor loadings presented in Table 2 of Hoelzle and Meyer (2009). Then, we compared the Italian solution with both the one found by Hoelzle and Meyer (2009) and a three-component solution computed on the U.S. normative sample. In evaluating congruence coefficients, we
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followed the guidelines suggested by MacCallum, Widaman, Zhang, and Hong (1999), so that coefficients between .98 and 1.00 were considered excellent, between .92 and .98 good, between .82 and .92 borderline.

Loading coefficients for the three dimensions are presented in Table 4. The first component was characterized by high positive loadings on the NIM, SOM, ANX, ARD, DEP, MAN, PAR, SCZ, BOR, AGG, SUI, STR, and NON scales and by negative loadings on the PIM and RXR scales. The second component had positive coefficients for the MAN, ANT, AGG, and DOM scales and, to a lesser degree, for the WRM scale. The third component provided high positive loadings for the ICN, ANT, ALC, and DRG scales. Overall, these findings are similar to those reported by Hoelzle and Meyer (2009), so that the first dimension is one of symptomatology and general distress, the second reflects elevated mood and dominance, and the third emphasizes substance abuse and psychopathy. Finally, we computed congruence coefficients between the three-dimension solutions found within the Italian sample and both within the U.S. normative sample (Morey, 2007) and by Hoelzle and Meyer (2009). The congruence coefficients were .97 for Component 1, .96 for Component 2, and .95 for Component 3 when the Italian sample was selected as the target matrix and .97, .97, and .92, respectively, when the U.S. normative sample was selected as the target matrix. As for the factor solution found by Hoelzle and Meyer (2009), we found that the congruence coefficients were .99, .97, and .96 when the Italian sample was selected as the target matrix and .99, .94, and .97 when Hoelzle and Meyer’s sample was selected as the target. According to the aforementioned benchmarks, the component structure of our sample showed good to excellent congruence with Hoelzle and Meyer’s structure.
Convergent Validity

To provide data on the convergent validity of the PAI scales with the MCMI-III scales, we conducted a canonical correlation analysis (CCA). CCA is a useful approach to identify synthetic variables underlying observed variables by producing maximally, orthogonal correlate variables across two sets of variables (e.g., PAI and MCMI-III scales). We used Sherry and Henson’s (2005) SPSS syntax to conduct CCA. From the total sample \(N = 1,538\), 21 participants were excluded because they had more than 12 missing items at the MCMI-III (Millon, Millon, Davis, & Grossman, 2009) and 70 participants were excluded due to their invalid MCMI-III profiles (Scale V (Invalidity) > 1; Scale W (Inconsistency) > 9; Scale X (Disclosure) < 34 or X > 178; all of the BR score on the Clinical Personality Patterns scales were lower than 60). Thus, we obtained a final sample of 1,447 participants. Because the MCMI-III final scale scores are expressed in base rate scores (BR; i.e., weighed transformations based on the prevalence of disorders in a given population), consistently with previous studies (Hsu, 2005), we used the raw scale scores of both tests.

The full model across all functions was statistically significant, Wilks \(\Lambda = .006, F(528, 22,860.7) = 15.84, p < .001\). Given that Wilks's \(\Lambda\) constitutes the variance unexplained by the model, for the set of 22 canonical functions, the full model explained about 99% of the variance shared between the two test scale scores. Given the great amount of variance shared between the PAI and the MCMI-III scales, we chose to interpret only those functions that explained at least 30% of the variance \((R_c^2)\). In Table 5 are reported the standardized canonical function coefficients \((R_c)\), the
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The hypothesized subscale structure of the PAI has been underinvestigated and only Morey (2007) and Jackson and Trull (2001) reported evidence of the hypothesized subscale model structure of the test. Overall, CFI values were lower than .90 for all the scales except the SOM and ANX scales, whereas GFI and NNFI
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were higher than .90 and RMSEA values were lower than .10, suggesting that the conceptual subscale structure appeared to be confirmed in the present study.

Nevertheless, focusing on factor loadings, only 38 out of 344 items showed factor loadings lower than .40. Given that Morey did not report the factor loading he obtained from his CFAs, it was not possible to evaluate whether low loadings were related to translation issues or cultural differences. As for the BOR scale, our fit indices were higher than findings reported by Jackson and Trull (2001) and only two items (BOR-N: items 139 and 219) showed factor loadings lower than .40. Although all the studies used the same model specification, different estimation methods were used. While Morey (1991) did not report the estimation method he used, Jackson and Trull (2001) used ML estimation and we used WLSMV estimation. ML estimation is most commonly used in CFA because of its statistical properties (e.g., the multivariate normal distribution of the observed indicators, maximal efficiency, and asymptotic unbiasedness; Li, 2016); however, WLSMV estimation is suggested to analyze observed ordinal variables (Muthén, 1993). ML estimation may underestimate the size of the loadings compared to WLSMV estimation; however, simulation studies revealed that both estimation methods may lead to similar descriptive fit index values (Beauducel & Herzberg, 2016).

The internal structure of the PAI full scales have been largely investigated by several authors (see Morey, 2007), but the results were inconclusive. Recently, Hoelzle and Meyer (2009) found that a three-component structure was highly congruent across samples from different countries. Our findings revealed that the Italian PAI has a three-dimensional structure; the first dimension is related to symptomatology and general distress, the second reflects elevated mood and
dominance, and the third emphasizes substance abuse and psychopathy. The congruence coefficients between Italian and US data showed that the three-dimension solution is consistent across cultures.

The present study also contributed to fill the gap of the convergent validity of the PAI scales and the MCMI-III scales. The canonical correlation analysis (CCA) individuated four functions that each explained more than 30% of the variance. Overall, the results indicated that both tests shared a first factor of general distress and psychopathology, as reported by previous factor analytic studies (see Morey, 2007; Hoelzle and Meyer, 2009; Craig & Bivens, 1998; Haddy, et al., 2005; Rossi, et al., 2007). Moreover, as indicated by the second function, scales related to aggression, paranoia, mania, and antisocial and borderline personality disorder characteristics showed good convergent validity between the two tests. The third function identified two opposite, interpersonal styles in that it was characterized by an attention-seeking, submissive style on one end (MCMI-III 4 – Histrionic, 3 – Dependent scales) and by an unengaged, apathetic style at the other (MCMI-III 1-Schizoid scale). The Histrionic PD Prototype is described as individuals who try to maximize the amount of attention they may receive from others and who fear of not being accepted by others. Moreover, the Dependent PD Prototype is characterized by assuming a passive role and willingly submitting to others’ wishes. On the contrary, the Schizoid PD Prototype is defined by indifference to social relationships, coldness, and a tendency of being apathetic, asocial, and distant. Accordingly, these MCMI-III scales were associated with the bipolar, interpersonal WRM scale, so that high scores on the WRM scale are typical of individuals characterized by a strong need to be accepted by others and who attempt to avoid the loss of relationships, whereas low scores indicate
individuals who are reserved, asocial, and unable to display affection. As for the convergent validity of the PAI scale scores, our results indicated that high scores on the WRM scale suggest either the attention-seeking interpersonal style typical of the histrionic PD or the interpersonally submissive style typical of the dependent PD. Conversely, low scores on the WRM scale are related to the unengaged and apathetic interpersonal style typical of the schizoid PD.

Finally, the fourth function identified a bipolar dimension with a domineering, managerial interpersonal style on one end (MCM-I-III 7 – Compulsive and P – Paranoid scales and high PAI DOM), and a lack of assertiveness and substance abuse at the other (drug and alcohol scales and low PAI DOM). Although individuals characterized by the Compulsive PD Prototype tend to maintain an appearance of overt passivity, they have marked difficulty accepting others’ way of being, respond with irritation when their routine is disrupted, and do not elicit or integrate feedback from others. Also the Paranoid PD Prototype is characterized by an uncompromising interpersonal style and a rigid approach to life. Moreover, these individuals display a marked fear of losing their autonomy and despise being dependent on others. These two PD Prototypes are related to high scores on the DOM scale that describe individuals who expect respect and admiration by others and are viewed as domineering and overcontrolling. This fourth function also identified an overlapping between the alcohol abuse scales on both tests and a general relationship between the substance abuse and low scores on the DOM scale, indicating that these individuals prefer a passive interpersonal style and are characterized by self-effacing and a lack of confidence in social interactions. Overall, the results from the CCA indicated that
PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI

there is a great amount of overlap between the PAI and the MCMII-III scales and that the two measures converge on both clinical disorders and personality traits.

Even though the findings provided in this article support the cross-cultural applicability and validity of the PAI, a number of limitations are worth mentioning. First, we did not include U.S. normative data in our analysis to make direct comparisons across cultures. Ideally, systematic comparisons of the factor structures across two national groups should be made using a series of a multi-group confirmatory factor analysis. Given that the PAI items are ordinal, we would have needed the original data in order to evaluate each step of the cross-cultural invariance (e.g., the thresholds). However, to provide information on the comparison of factor structures across the two national groups, we evaluated the internal structure of the PAI full scales and computed congruence coefficients between the Italian and the American solutions. Second, divergent validity (i.e., the degree to which a test does not measure dissimilar constructs) of the PAI scales has not been addressed by this study. Third, we did not perform CFAs excluding items with factor loadings lower than .40 because our aim was to investigate the validity of the Italian PAI and to replicate Morey’s results. Although Jackson and Trull (2001) have proposed a six-factor model of the BOR scale, we did not examine different factor models for each scale. Given that no other studies have reported on the CFAs, we do not know whether the results from the CFAs are limited to Italian data or are similar in other versions of the PAI. Fourth, we did not report data on clinical samples. Although the internal structure of the PAI seemed to be consistent across countries and sample characteristics, the hypothesized subscale structure of the test has been investigated mostly with nonclinical sample. Thus, examining the structure of the PAI scales that
have subscales in clinical samples may help researchers to shed light on these questions.
References


PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI


http://dx.doi.org/10.1207/s15327752jpa7001_13


PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI


PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI


http://dx.doi.org/10.4236/psych.2011.28122


http://dx.doi.org/10.1037/1082-989X.4.1.84


PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI


PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI


PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI

Table 1

*Composition of the Sample (N = 1538)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequencies</th>
<th>% of sample</th>
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<td>30-49</td>
<td>521</td>
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<td>24.4</td>
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<td>65-89</td>
<td>206</td>
<td>13.4</td>
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<tr>
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**Table 2**

*Goodness-of-Fit Indices for the PAI Scales with Subscales*

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<th>$X^2$</th>
<th>df</th>
<th>$p$</th>
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<th>CFI</th>
<th>NFI</th>
<th>GFI</th>
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<td>.97</td>
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<td>.94</td>
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<td>.94</td>
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*Note. $N = 1,538$*
### PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI

#### Table 3

*Descriptive Statistics for Factor Loading Obtained from the CFAs*

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<tr>
<th></th>
<th># of items</th>
<th>M</th>
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<th>Min</th>
<th>Max</th>
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<th>Items with factor loading between .30 - .40</th>
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<td>Cognitive (DEP-C)</td>
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<td>.07</td>
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<td>.57</td>
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### PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI

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*Note. N = 1,538*
**Psychometric Properties of the Italian PAI**

Table 4

*Rotated Pattern Component Matrix for the 22 PAI Scales for the Italian sample, the U.S. normative sample, and the Hoelzle and Meyer’s sample*

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<th>Component 2</th>
<th>Component 3</th>
<th>Component 1</th>
<th>Component 2</th>
<th>Component 3</th>
<th>Component 1</th>
<th>Component 2</th>
<th>Component 3</th>
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<td>.08</td>
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<td>-.08</td>
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PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI

Table 5

Canonical Solution for the PAI Scales Predicting the MCMI-III Scales

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Rc .85 .75 .71 .63
### PSYCHOMETRIC PROPERTIES OF THE ITALIAN PAI

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**Note.** Coef = standardized canonical function coefficient; $r_s$ = structure coefficient; $r_s^2$ (%) = squared structure coefficient; $h^2$ = communality coefficient, $R_c$ = canonical correlation coefficient. Structure coefficients ($r_s$) greater than |.35| are bolded for emphasis. Communalities coefficients ($h^2$) greater than 45% are bolded for emphasis.
Figure 1

*Example of the Hypothesized Subscale Factor Model Tested with the CFA*

*Note.* The present model was tested for the SOM, ANX, ARD, DEP, MAN, PAR, SCZ, and ANT scale. For the BOR scale, there were four latent variables (i.e., one for each BOR subscale). For the AGG scale, there were three latent variables (i.e., one for each AGG subscale) and 18 observed variables (i.e., the items).