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Short Communication

Personality Assessment Inventory internalizing and externalizing structure in college students: Invariance across sex and ethnicity

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ABSTRACT

Recent research suggests that several forms of adult psychopathology can be understood as reflecting lower-order elements of a higher-order internalizing/externalizing structure. Internalizing and externalizing factors have been identified with several measures of psychopathology constructs, including the widely used Personality Assessment Inventory (PAI). However, research comparing different models of this structure as well as the fit of the structure across sex and ethnicity has been limited and no research on this topic has been conducted with the PAI. In this study, a simplified PAI internalizing and externalizing structure was found to be superior to a more complex model. Furthermore, the structure was found to be invariant across men and women and Hispanic and Anglo undergraduate respondents living in the United States. These results demonstrate the viability of the PAI to study these constructs and the applicability of this structure across various demographic groups.

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1. Introduction

The internalizing/externalizing model of psychopathology (Achenbach, 1966; Krueger, 1999; Krueger, Caspi, Moffitt, & Silva, 1998) proposes that diagnostic overlap between several common forms of psychopathology can be explained by two oblique higher order factors, internalizing and externalizing. In this model, internalizing represents a substrate of depressive and anxiety disorders, whereas externalizing links substance abuse and antisocial personality characteristics. In addition to its potential to provide a scientifically viable explanation for psychiatric “comorbidity”, this model also depicts etiological factors that can be studied directly. For example, this model has been used in research on the degree to which heritability for discrete disorders is accounted for by the heritability of these broad dimensions (Krueger et al., 2002).

Robust support for this model has been provided by investigations with diagnostic interviews and multi-dimensional self-report measures that consistently reveal internalizing and externalizing dimensions in adults (e.g., Hoelzle & Meyer, 2008; Kendler, Davis, & Kessler, 1997; Krueger, 1999; Krueger et al., 1998; Krueger, Chentsova-Dutton, Markon, Goldberg, & Ormel, 2003). The Personality Assessment Inventory (PAI; Morey, 1991), a widely used mea-

sure of adult personality and psychopathology (Smith, Gorske, Wiggins, & Little, 2010), has often been used in this research (Hoelzle & Meyer, 2009; Hopwood, Baker, & Morey, 2008; Morey, 1991; Ruiz & Edens, 2008), although ambiguity exists with regard to optimal methods for such recovery. In particular, some researchers have used exploratory techniques (Hoelzle & Meyer, 2009; Hopwood et al., 2008; Morey, 1991) whereas, others have used confirmatory methods (Ruiz & Edens, 2008) and researchers have varied with regard to which PAI scales to include in the internalizing/externalizing models (Hopwood et al., 2008; Morey, 1991; Ruiz & Edens, 2008).

Of the existing studies demonstrating a higher-order internalizing/externalizing structure using the PAI, only Ruiz and Edens (2008) utilized confirmatory factor analysis (CFA). Their model included the 11 PAI clinical scales as well as the suicidal ideation and aggression scales, which they deemed relevant to internalizing and externalizing factors, respectively. Although their model demonstrated adequate fit in a large adult corrections sample, their model incorporated a number of scales not typically included in structural models of common psychopathology (e.g., Krueger, 1999) such as schizophrenia and mania. In addition, their sample comprised inmates in correctional facilities, and the generalizability of their model to other samples has not been tested.

The current study aimed to build on past research by comparing the PAI internalizing/externalizing structure demonstrated by Ruiz

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and Edens (2008) to a simplified structure based on the model identified by Krueger and colleagues (Krueger, 1999; Krueger et al., 1998, 2003). Specifically, we compared the Ruiz and Edens PAI internalizing/externalizing structure to a model wherein the depression, anxiety, and anxiety-related disorders scales reflected the internalizing factor and the alcohol problems, drug problems, and antisocial features scales reflected the externalizing factor. We reasoned that this simplified model, which is more congruent with previous theory and research on internalizing and externalizing, would be more generalizable than the more complex one developed by Edens and Ruiz, and thus it would be more likely to fit our data. Moreover, we chose to examine these models in a sample of college students, as previous research has yet to test either of these PAI internalizing/externalizing structures in students.

To further explore the fit of these models in the current sample, we also examined invariance across sex and ethnicity. No studies to date have tested invariance of the internalizing/externalizing structure across demographic groups using the PAI and invariance tests across sex and ethnicity for this model have been limited in general. Testing invariance is important for understanding the degree to which this model generalizes across demographic groups, particularly since some internalizing/externalizing constructs show different properties as a function of demography (e.g., rates and correlates of antisocial behavior tend to vary across genders; c.f., Cale & Lilienfeld, 2002). Krueger and colleagues (Krueger, 1999; Krueger et al., 2003) showed that their internalizing/externalizing structure was similar across men and women using diagnostic data. However similar research has not been conducted with self-report measures such as the PAI. With regard to ethnicity, Guttmanova, Szanyi, and Cali (2008) found that the regression paths between internalizing and externalizing dimensions and the items of the Behavior Problem Index were invariant across Hispanic, Black, and Anglo samples of children in the United States aged 5 to 7. Krueger et al. (2003) found that the internalizing/externalizing structure was invariant across data from several nationalities using a diagnostic interview. However, respondents in this study varied by nationality rather than ethnicity per se, and externalizing problems were represented only by alcohol problems. As such, no study has tested sex and ethnic invariance in this structure using a broadband self-report measure of psychopathology in adults. Another purpose of this study, then, was to test the invariance of the internalizing/externalizing model using PAI data across men and women and Anglo and Hispanic respondents.

2. Method

Participants were 246 undergraduates from a large public university in the southern United States. Of these, 150 self-identified as Hispanic and 96 as Anglo. There were 108 (44%) women and 138 (56%) men, and the average age was 19.03 (SD = 1.43). Sex

and age did not vary across ethnic groups. All participants were consented, received course credit for participating, and completed the PAI in one session. This research was approved by a local Institutional Review Board. All participants completed the Personality Assessment Inventory (PAI; Morey, 1991), a 344-item self-report instrument with 22 scales that measure psychopathology, personality, and other constructs commonly used in contemporary clinical assessment practice.

2.1. Analyses

Maximum Likelihood CFA models were constructed in AMOS 17.0. Two CFA models were fit in the data. The first model factored the 11 PAI clinical scales (somatic complaints, anxiety, anxiety-related disorders, depression, mania, paranoia, schizophrenia, borderline features, antisocial features, alcohol problems, drug problems) as well as aggression and suicidal ideation and freed errors from the depression, anxiety-related disorders, and mania scales to covary as in Ruiz and Edens (2008). The second, simplified model factored the PAI scales directly related to psychopathology constructs previously identified in diagnostic interview research by Krueger and colleagues. Specifically, internalizing included depression, anxiety, and anxiety-related disorders scales whereas externalizing comprised antisocial features, alcohol problems, and drug problems scales. We used CFI (with values $>.90$ indicating acceptable fit) and RMSEA ($<.10$) values to judge overall model fit (cf. Byrne, 2001; Kline, 2005) and the χ^2 difference test and AIC comparisons to judge the decrement in fit among nested models. Baseline models allowed all regression paths and the covariance between internalizing and externalizing to vary across men and women and Hispanic and Anglo respondents, whereas the tested model constrained these paths to be equal across samples.

3. Results

Initial examination of raw data showed that PAI scale T-scores were sufficiently normal for covariance modeling (i.e., skew ≤ 3 , kurtosis ≤ 10 across all variables). The baseline Ruiz and Edens (2008) model did not fit the data well ($\chi^2_{(60)} = 281.94$, $p < .001$; CFI = .87, RMSEA = .12, AIC = 343.94). Applying the simplified Krueger and colleagues structure (Krueger, 1999; Krueger et al., 1998; Krueger et al., 2003) to the current sample, on the other hand, resulted in a superior fit by comparison ($\chi^2_{(8)} = 29.07$, $p < .001$; CFI = .96, RMSEA = .10, AIC = 55.07; See Table 1) and was thus the focus of subsequent analyses. The baseline simplified model for the sex invariance test fit the data well ($\chi^2_{(16)} = 24.27$, $p < .001$; CFI = .98, RMSEA = .05, AIC = 76.27). Constraining the model to be invariant across sexes resulted in a good fit (CFI = .97, RMSEA = .05), and did not decrement the fit relative to the baseline model ($\chi^2_{(7)} = 12.87$, ns; AIC = 75.14). The baseline simplified model for the ethnicity invariance test also fit the data well ($\chi^2_{(7)} = 45.34$, $p < .001$; CFI = .94, RMSEA = .09, AIC = 97.43).

Table 1
Fit indicators across several models of internalizing and externalizing.

	χ^2	df	CFI	RMSEA	AIC
Ruiz and Edens (2008)	281.94	60	.87	.12	343.94
Simplified (Krueger based)	29.07	8	.96	.10	55.07
<i>Invariance test for simplified model across sexes</i>					
No invariance constraints	24.27	16	.98	.05	76.27
Regression and covariance paths constrained equal	37.14	23	.97	.05	75.14
<i>Invariance tests for simplified model across ethnicities</i>					
No invariance constraints	45.34	16	.94	.09	97.43
Regression and covariance paths constrained equal	55.56	23	.93	.08	93.56

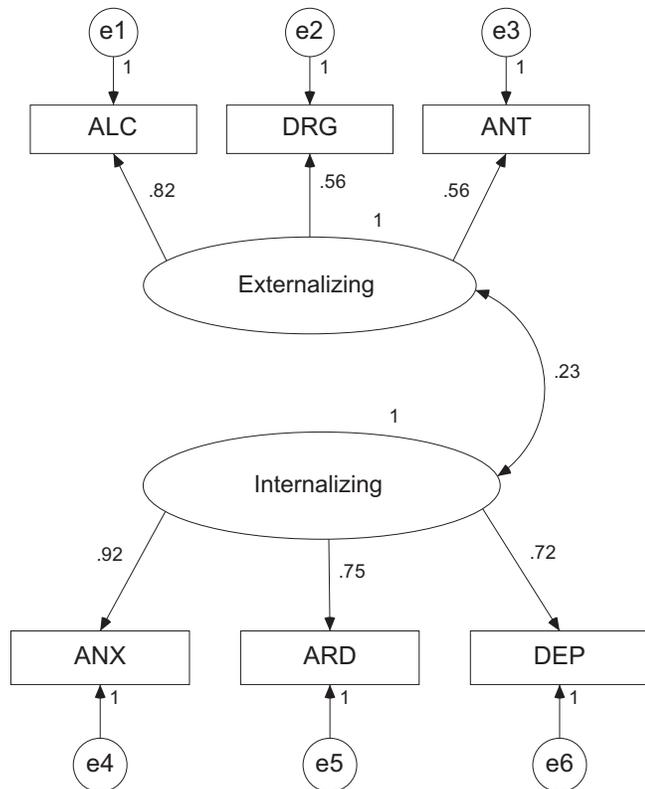


Fig. 1. PAI internalizing and externalizing model in a mixed sample of Hispanic and Anglo respondents with path coefficients and latent variable covariances constrained to be equal across ethnicities. ALC = Alcohol problems, DRG = Drug problems, ANT = Antisocial features, ANX = Anxiety, ARD = Anxiety-related disorders, DEP = Depression.

Constraining the model to be invariant across ethnicities resulted in a good fit (CFI = .93, RMSEA = .08), and, as with the sex invariance test, did not decrement the fit relative to the baseline model ($\chi^2_{(7)} = 10.22$, ns; AIC = 93.56; see Table 1 & Fig. 1).

4. Discussion

Studies of the factorial structure of psychopathology often reveal broad internalizing and externalizing factors (Kendler et al., 1997; Krueger, 1999; Krueger et al., 1998; Krueger et al., 2003). This finding extends to the Personality Assessment Inventory (PAI), for which this structure has been identified across several methods and in various kinds of samples (Hoelzle & Meyer, 2009; Hopwood et al., 2008; Morey, 1991; Ruiz & Edens, 2008). In this study, we compared the fit of a previously demonstrated PAI internalizing/externalizing structure (Ruiz and Edens (2008)) to a simplified structure based on a robust model of common psychopathology found using diagnostic interview data (Krueger, 1999; Krueger et al., 2003). The simplified model demonstrated superior fit in the current sample and was also found to be invariant across sexes and Hispanic and Anglo respondents.

These findings support the internalizing/externalizing framework in that it has now been observed across a number of instruments with varied development strategies and underlying theories. The current results are consistent with the view that the internalizing/externalizing structure may provide a parsimonious explanation of psychiatric comorbidity and a model for studying etiological factors. Although the nature or expression of psychopathology may differ across ethnicities (e.g., Shrout et al., 1992) and sexes (Hartung & Widiger, 1998) in some respects, several forms of common

psychopathology can be understood in an integrative structure that does not appear to vary as a function of sex and ethnic differences. Given these findings, other ways in which the nature or expression of psychopathology may differ as a function of sex and ethnicity should be explored empirically.

Findings also support the construct validity of the PAI in that scales from this instrument are able to recover the internalizing/externalizing structure. Researchers and clinicians may benefit from conceptualizing selected PAI scales as related to internalizing/externalizing propensities (Hoelzle and Meyer, 2009). Finally, results support the viability of this simplified model across men and women and Hispanic and Anglo participants. The fact that the simplified PAI model offered a better fit in the current study suggests that this structure may be more applicable across various assessment methodologies (i.e., self reports and interviews) and samples (i.e., prisoners, patients, and students) than more complex models. For example, one difficulty fitting the Ruiz and Edens (2008) model in this study might derive from its having been developed among prisoners. Notably, the simpler model tested here has not been tested among prisoners, and it may, in fact, fit better or be more generalizable than the Ruiz and Edens model. Future research should test this hypothesis.

This study was limited in several respects. First, all participants were undergraduates, suggesting the need for further research in other kinds of samples, such as clinical patients, incarcerated persons, or community residents. Second, all participants were sampled from the same university, and might be somewhat homogeneous. Research with more diverse samples is needed to test the degree to which this may have affected study results. Third, this study used a single measure to conceptualize psychopathology, and further research using other measures is needed to test the degree to which instrument characteristics might moderate these effects.

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References

- Achenbach, T. M. (1966). The classification of children's psychiatric symptoms: A factor analytic study. *Psychological Monographs*, 80(7), 1–37.
- Byrne, B. M. (2001). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Cale, E. M., & Lilienfeld, S. O. (2002). Sex differences in psychopathy and antisocial personality disorder: A review and integration. *Clinical Psychology Review*, 22, 1179–1207.
- Guttmanova, K., Szanyi, J. M., & Cali, P. W. (2008). Internalizing and externalizing behavior problem scores: Cross-ethnic and longitudinal measurement invariance of the behavior problem index. *Educational and Psychological Measurement*, 68, 676–694.
- Hartung, C. M., & Widiger, T. A. (1998). Gender differences in the diagnosis of mental disorders: Conclusions and controversies of the DSM-IV. *Psychological Bulletin*, 123, 260–278.
- Hoelzle, J. B., & Meyer, G. J. (2008). The factor structure of the MMPI-2 restructured clinical (RC) scales. *Journal of Personality Assessment*, 90, 443–455.
- Hoelzle, J. B., & Meyer, G. J. (2009). The invariant component structure of the personality assessment inventory (PAI) full scales. *Journal of Personality Assessment*, 91, 175–186.
- Hopwood, C. J., Baker, K. L., & Morey, L. C. (2008). Personality and drugs of choice. *Personality and Individual Differences*, 44, 1413–1421.
- Kendler, K. S., Davis, C. G., & Kessler, R. C. (1997). The familial aggregation of common psychiatric and substance abuse disorders in the national comorbidity survey. *British Journal of Psychiatry*, 170, 541–548.
- Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York: Guilford.
- Krueger, R. F. (1999). The structure of common mental disorders. *Archives of General Psychiatry*, 56, 921–926.
- Krueger, R. F., Caspi, A., Moffitt, T. E., & Silva, P. E. (1998). The structure and stability of common mental disorders (DSM-III-R): A longitudinal-epidemiological study. *Journal of Abnormal Psychology*, 107, 216–227.

- Krueger, R. F., Chentsova-Dutton, Y. E., Markon, K. E., Goldberg, D., & Ormel, J. (2003). A cross-cultural study of the structure of comorbidity among common psychopathological syndromes in the general health care setting. *Journal of Abnormal Psychology, 112*, 437–447.
- Krueger, R. F., Hicks, B. M., Patrick, C. J., Carlson, S. R., Iacono, W. G., & McGue, M. (2002). Etiologic connections among substance dependence, antisocial behavior, and personality: Modeling the externalizing spectrum. *Journal of Abnormal Psychology, 111*, 411–424.
- Morey, L. C. (1991). *The personality assessment inventory professional manual*. Odessa, FL: Psychological Assessment Resources.
- Ruiz, M. A., & Edens, J. F. (2008). Recovery and replication of internalizing and externalizing dimensions within the personality assessment inventory. *Journal of Personality Assessment, 90*, 585–592.
- Shrout, P. E., Canino, G. J., Bird, H. R., Rubio-Stipec, M., Bravo, M., & Burnam, M. A. (1992). Mental health status among Puerto Ricans, Mexican Americans, and non-Hispanic Whites. *American Journal of Community Psychology, 20*, 729–752.
- Smith, S. R., Gorske, T. T., Wiggins, C., & Little, J. A. (2010). Personality assessment use by clinical neuropsychologists. *International Journal of Testing, 10*, 6–20.