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Prospective investigation of a PTSD personality typology among individuals with personality disorders

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Abstract

This study investigated the replicability of a previously proposed personality typology of posttraumatic stress disorder (PTSD, and explored stability of cluster membership over a 6-month period. Participants with current PTSD (n = 156) were drawn from the Collaborative Longitudinal Personality Disorders Study (CLPS). The CLPS project tracked a large sample of individuals who met criteria for 1 of 4 target diagnoses (borderline, schizotypal, avoidant, and obsessive-compulsive) and a contrast group of individuals who met criteria for depression but no personality disorder. A cluster analysis using scales from the Schedule of Nonadaptive and Adaptive Personality yielded 3 clusters: "internalizing," "externalizing," and "low pathology." Using K-means cluster analysis, the results did not replicate previous work. Using Ward's method, the hypothesized 3-cluster structure was confirmed at baseline but did not demonstrate temporal stability at 6 months. © 2011 Elsevier Inc. All rights reserved.

1. Prospective investigation of a PTSD personality typology

A personality typology of posttraumatic stress disorder (PTSD) has been proposed such that persons with PTSD may be classified as (a) low in personality pathology, (b) internalizing type, or (c) externalizing type [1]. These subtypes could signal clinically relevant information about course and comorbidity patterns (with externalizers carrying higher risk for substance abuse and aggression, and internalizers at higher risk for co-occurring mood, anxiety,

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and eating disorders). Miller speculated that premorbid personality influenced the relationship between trauma exposure and the emergence of a profile of PTSD symptoms, contextualizing this discussion in light of the work of personality researchers. Krueger et al [2-4] have described the 3 underlying personality dimensions of positive emotionality, negative emotionality, and constraint, and the 2 personality/temperament dimensions of internalization and externalization, work that follows Achenbach's [5] empirical studies suggesting that 2 broad dimensions of internalizing and externalizing may be the most parsimonious descriptors for disordered behavior among children.

Miller [1] predicted that the internalizing type would occur in persons who premorbidly displayed high negative emotionality and low positive emotionality, whereas the externalizing type would occur in persons who premorbidly displayed high negative emotionality and low constraint. This personality typology parallels work by Asendorpf and Van Aken [6] and Robins et al [7] describing a personality typology based on the 5-factor

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model of personality comprised of those designated as undercontrolled, overcontrolled, and resilient. In that typology, "resilient" describes individuals with low neuroticism and adaptive levels of extraversion, conscientiousness, openness, and agreeableness. "Overcontrolled" denotes those with low extraversion and high neuroticism, and "undercontrolled" refers to individuals low agreeableness and low conscientiousness [8].

The field has shifted toward favoring dimensional models of psychopathology [9], and models of hierarchical organization of psychopathology have been proposed. The placement of PTSD within these models has been uncertain, however, partly because of its more recent entry into the diagnostic system, partly because of empirical findings suggesting it does not load similarly to other anxiety disorder [9,10] and likely in part because the symptoms of PTSD seem to comprise 3 or 4 distinct factors [11,12], suggesting it is a multidimensional construct. It seems likely, then, that persons meeting criteria for PTSD are a heterogenous group and may include those scoring high and low along both the internalizing and externalizing dimensions. The placement of PTSD within these newer classification models also raises the importance of considering alternative models, rather than strictly categorical or dimensional. Miller's proposed typology seems to reflect a "class quantitative" model [13,14], a hybrid dimensional-categorical model in which categories are formed based on individuals' relative positions along a series of dimensions.

1.1. Empirical studies of Miller's model

Six studies to date have examined Miller's model [1]. Three of the studies exclusively sampled male Vietnam veterans with PTSD [15-17]. A fourth study examined both a sample of Reserve/National Guard members and sample of recent combat veterans recruited from a Veterans Affairs Medical Center [18]. Two studies have included civilian trauma samples, one with survivors of workplace trauma [19] and one with female survivors of sexual assault [20]. All 6 studies used cluster analysis, and each arrived at a 3-cluster solution including internalizing, externalizing, and low pathology clusters, with the clusters varying along 3 personality dimensions: positive emotionality (or temperament), negative emotionality (or temperament), and constraint (or its inverse, disconstraint/disinhibition).

Table 1 summarizes results from these 6 investigations, separately listing the 2 samples from the study of Rielage et al [18]. In the first study [16], not all participants met criteria for PTSD, but the rate of PTSD was significantly higher in the internalizing and externalizing groups compared with the low pathology group. In one study, Miller and Resick [20] explored the correspondence between the typology and the construct of "complex PTSD" [25]. "Complex PTSD" has been used to describe a set of symptoms that include aspects of PTSD as defined by Diagnostic and Statistical Manual of Mental Disorders,

Fourth Edition, Text Revision (DSM-IV-TR) [26] but also aspects of borderline PD, including affective instability, impulsivity, self-injury, interpersonal difficulties, and substance abuse. Miller and Resick's [20] findings suggested that both the internalizing and externalizing subtypes exhibit aspects of complex PTSD, whereas the low pathology group may be described as "simple PTSD". The internalizing and externalizing subtypes had higher rates of childhood sexual abuse, an experience thought to increase the likelihood of complex PTSD. Flood et al [15] investigated mortality among the clusters and found both internalizers and externalizers are more likely to die of cardiovascular causes compared with those in the low pathology group but externalizers were more likely to die from substance-related causes.

No data have yet been published to support the longitudinal assumption of the model that PTSD subtype reflects personality type, which is persistent across time and context. Studies of temporal relations between personality disorders (PDs) and PTSD suggest that a reciprocal relationship may exist between personality and PTSD symptom presentation. For example, a study of veterans suggested that pretrauma borderline PD may influence PTSD symptoms, although borderline symptoms were assessed retrospectively [27]. A previous report from the Collaborative Longitudinal Personality Disorders Study (CLPS) found that improvement in PTSD may predict remission from borderline PD [28].

We undertook the present study primarily to validate Miller's [1] model in a distinct sample, drawn from the CLPS, a prospective, multisite naturalistic, longitudinal study of PDs. Using cluster analysis to derive a 3-cluster solution, we hypothesized that results would mirror previous work [15-20], with 1 cluster reflecting internalizing type PTSD, 1 cluster reflecting externalizing PTSD, and 1 cluster reflecting a "low pathology" group. We predicted that the clusters would be differentiated both in profiles on an independent personality measure, the NEO Personality Inventory (NEO-PI) [29], and in comorbidity patterns. Based on a study that investigated relations among the NEO-PI scales and scales assessing the 3 broad traits of interest [30], we hypothesized that the internalizing and externalizing clusters would score significantly higher than the low pathology cluster on the Neuroticism scale and significantly lower than the low pathology group on Agreeableness. We also predicted that the internalizing group would have significantly lower mean scores on Extraversion and Openness compared with the externalizing and low pathology clusters and that the externalizing cluster would have a significantly lower mean score than the other groups on Conscientiousness. With respect to comorbidity, we hypothesized that the externalizing cluster would demonstrate higher rates of co-occurring substance use disorders and borderline PD and that the internalizing cluster would demonstrate higher rates of co-occurring mood and anxiety disorders and avoidant and obsessivecompulsive PDs.

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Table 1 Summary of previous research by Miller et al

Investigation	Sample	Instrument used to derive clusters	Cluster analysis findings	Comorbidity findings
Miller, Greif, and Smith [16]	205 male combat veterans; 159 with PTSD	Multidimensional Personality Questionnaire [21,22]	CON: LP > Int > Ext NEM: Ext > Int > LP PEM: LP > Ext > Int	Base rate of PTSD higher in Int, Ext groups compared with LP group. Int showed higher rates of depression, compared with Ext or LP. No difference in rate of other anxiety disorders. Ext showed higher rates of SUD, compared with Int, but not LP
Miller, Kaloupek, Dillon, and Keane [17]	736 male combat veterans; all with PTSD	MMPI-2 PSY-5 scales [23]	CON: Int, LP > Ext NEM: Int, Ext > LP PEM: LP > Ext > Int	Int showed higher rates of panic, MDD Ext showed higher rates of antisocial PD, SUD Int showed more severe scores on PTSD scales, relative to Ext, LP
Miller and Resick [20]	143 female sexual assault survivors, all with PTSD	SNAP [24]	DIS: Int, Simple < Ext NT: Int, Ext > Simple PT: S, Ext > Int, Simple	Int group showed higher rates of MDD, higher scores on SNAP scales for schizoid, avoidant personality. Ext showed higher scores on SNAP scales assessing cluster B personality pathology.
Flood, Boyle, Calhoun, Dennis, Barefoot, Moore, and Beckam	5248 male combat veterans, 1176 with PTSD	MMPI-2 PSY-5 scales [23]	CON: Int > LP > Ext NEM: Int > Ext > LP PEM: LP > Ext > Int	Did not examine psychiatric comorbidity. Int and Ext more likely to die over follow-up period due to behavioral causes.
Sellbom and Bagby [18]	225 workplace trauma claimants	MMPI-2 PSY-5 Scales [23]	DISC: LP, Int < Ext NEM: Int > LP, Ext	No differences reported between Int and Ext. Int showed higher rate of panic disorder relative to LP. Both Int and Ext showed higher rate of MDD than LP.
Rielage, Hoyt, and Renshaw sample 1 [18]	65 combat veterans recruited from VAMC	MMPI-2 PSY-5 scales [23]	DISC: LP, Int < Ext NEM: Int > LP, Ext	Int showed higher levels of depression and anxiety than Ext and LP. Ext showed higher level of current alcohol abuse than Int and LP, but similar rate for lifetime AA to Int
Rielage, Hoyt, and Renshaw sample 2 [18]	183 National Guard/ Reserve service members, who served in combat	Big 5 Inventory [44]	Conscientiousness: LP > Int > Ext Neuroticism: Int > Ext > LP Extraversion: LP > Ext, Int	Int showed higher levels of depression and anxiety than Ext and LP. Both Int and Ext showed higher levels of substance abuse than LP.

LP indicates low pathology; Int, internalizing; Ext, externalizing; Simple, simple PTSD. CON, constraint; NEM, negative emotionality; PEM, positive emotionality; DIS, disinhibition; NT, negative temperament; PT, positive temperament; DISC, disconstraint.

An important second aim of the present study was to investigate the stability of cluster assignment (PTSD subtype) over a 6-month interval. Stability of cluster analysis results has been used as evidence of the validity of diagnostic subtypes in another area of psychopathology, binge eating disorder [24]. We hypothesized that the cluster structure would demonstrate temporal stability, with a repeat cluster analysis using the Schedule of Nonadaptive and Adaptive Personality (SNAP) [31] data from a 6-month follow-up replicating baseline results and participants' cluster membership demonstrating stability across time.

2. Method

2.1. Participants

Participants were drawn from the CLPS [31]. Individuals recruited from clinical sites in 4 cities in the northeastern United States were eligible to participate in CLPS if they met screening and diagnostic criteria for at least 1 of the 4 PD diagnoses of interest (schizotypal, borderline, avoidant, or obsessive-compulsive) or if they met criteria for major

depressive disorder and no PD. The CLPS study followed 733 participants, of whom 156 (21.3%) met DSM-IV criteria for PTSD at baseline and were included in the current analysis. Participants were between 18 and 45 years (mean age 33.3 years), mostly women (n = 118, 75.6%), and white (n = 101, 64.7%), with significant proportions of African Americans (n = 34, 21.8%) and Hispanics (n = 15, 9.6%). Nearly all participants (n = 147, 94%) with PTSD met criteria for at least 1 PD.

Gunderson et al [31] have fully described the CLPS project. CLPS longitudinally followed participants with the goal of investigating the stability and comorbidity patterns of a set of 4 PDs. Groups were constructed based on the PDs selected as primary diagnoses: schizotypal, borderline, avoidant, and obsessive-compulsive. A control group comprised of individuals meeting criteria for major depressive disorder, but no PD, was included to control for aspects of psychopathology that are not unique to Axis II. The investigators selected these diagnoses based on a combination of theoretical and logistical factors [31]. As a longitudinal study of groups based on each of the *DSM* PDs was not feasible, the investigators chose a subset of

4

diagnoses that reflected key aspects of PDs, generally, and covered the full spectrum of DSM clusters A, B, and C, adding obsessive-compulsive PD, which some factor analyses suggest is distinct from the 3 clusters [32]. Participants were recruited from multiple clinical sites in 4 northeastern cities: Boston, New Haven, New York, and Providence. Investigators also used media advertisements in those cities. Forty-three percent of participants were recruited from outpatient mental health clinic, 12% from inpatient facilities, and the remainder were self-referred from posted signs and media advertisements. All recruited participants were currently in treatment or reported having been in psychiatric treatment in the past. Participants with PDs had to meet criteria for 1 of the 4 study diagnoses based on the Diagnostic Interview for DSM-IV Personality Disorders (DIPD-IV), with this diagnosis then confirmed with a combination of self-report measures. There were no exclusion criteria related to comorbidity. When participants met criteria for more than 1 of the 4 index diagnoses, interviewers followed an algorithm to determine which diagnosis was primary and, hence, which group the participant was assigned to.

2.2. Measures

At each assessment session, participants completed self-report and interview measures of personality and psychopathology. Diagnoses were made using structured interviews: the DIPD-IV [33] for PD diagnoses and the Structured Clinical Interview for *DSM-IV* for Axis I Disorders (SCID) [34]. An investigation of reliability for these instruments in the CLPS sample [33] reported good psychometric characteristics. The Longitudinal Interval Follow-up Evaluation (LIFE) [35] was used at each follow-up point to query about symptoms of Axis I disorders that were rated as present at baseline. The LIFE asks participants to report on their symptom severity for each week of the follow-up interval (in this case, 6 months), and the interviewer rates the presence or absence of each disorder based on *DSM-IV* rules regarding severity and duration of symptoms.

Participants also completed the SNAP [36] and the NEO-PI [29]. The SNAP is a 425-item (items are rated true/false) self-report instrument designed to measure 12 personality traits and 3 temperament dimensions as well as 13 diagnoses. The 3 temperament scales (positive temperament, negative temperament, disinhibition), of particular interest to the current investigation, were used in the cluster analysis.

The NEO-PI [29], with 240 items rated on a 5-point Likert scale (from *strongly disagree* to *strongly agree*) was written to assess the dimensions comprising the 5-factor model of personality: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness.

2.3. Procedure

Upon meeting inclusion criteria and giving informed consent, participants completed a baseline clinical interview

(the CLPS project was approved by the Institutional Review Boards at each institution affiliated with the project). At baseline, participants were assessed for *DSM-IV* Axis I and Axis II diagnoses using the SCID and the DIPD-IV and completed self-report measures. Participants completed a follow-up assessment at 6 months after baseline. This investigation used data from the SCID, DIPD-IV, SNAP, and NEO-PI for baseline analyses. Data from the 6-month follow-up included the SNAP and the LIFE.

2.4. Data analysis

Our effort to validate Miller's typology required 5 steps. Because cluster analysis may be conducted using a number of approaches, with no single approach having emerged as superior for all samples, we elected to conduct our analyses using 2 different statistical approaches to cluster analysis: K-means clusters (an iterative partitioning method) and Ward's method (a hierarchical agglomerative method). Previous tests of Miller's model [1] have used K-means clustering, but some sources suggest Ward's method may be preferable in handling cases that may overlap clusters [37].

We first conducted cluster analyses with data from the SNAP using 2 cluster analytic methods. For the baseline analyses, we used the full sample of participants who met criteria for PTSD, regardless of whether they completed the 6-month follow-up assessment. We chose this approach rather than limiting the baseline analyses to those who also completed the follow-up because this more accurately reflects the CLPS sample. We sought to use as large a sample as possible for those analyses, to optimize power to detect differences between the clusters. We followed the Kmeans cluster analysis method used by Miller et al [16,17]. We also conducted a cluster analysis using Ward's method with standardized values on the SNAP scales. Using the Ward's method clusters, we investigated both the pattern of specific pairwise differences on the SNAP scales and the pattern of group differences on an external measure, the NEO-PI. To confirm the cluster results and to examine specific differences between groups on each scale, we conducted analysis of variance with pairwise contrasts. Next, we investigated differences in rates of co-occurring disorders using χ^2 analyses. Our fourth step investigated the temporal stability of the cluster structure and cluster assignment. This involved a second cluster analysis using Ward's method, based on a second administration of the SNAP 6 months after baseline. We investigated the stability of individual cluster assignment, using Cohen κ [38]. The fifth step examined the stability of the 3 scales that contributed to the cluster analysis, using correlations.

3. Results

Results of the K-means cluster analysis did not replicate Miller's suggested typology. One cluster produced a relatively flat profile, characterized by low scores on all 3

Table 2 Raw scores on SNAP temperament scales by cluster (baseline, n = 156) based on K-means clusters

	Cluster 1: "internalizing" (n = 50)	Cluster 2: "low pathology" (n = 77)	Cluster 3: "externalizing" (n = 29)	F	Pairwise contrasts
Positive temperament	8.90 (5.3)	16.04 (4.97)	13.55 (5.30)	29.07 [†]	2 > 3, 1* 3> 1*
Negative temperament	24.56 (3.22)	23.40 (2.94)	12.14 (4.25)	150.22 [†]	1 > 2*, 3* 2 > 3*
Disinhibition	16.94 (5.49)	8.74 (3.62)	10.17 (5.68)	47.97 [†]	1 > 2*, 3*

Data are mean (SD).

dimensions resembling the "low pathology" pattern. A second cluster resembled the "externalizing" pattern, with a mean profile characterized by a high score on negative temperament and high score on disinhibition. A third cluster displayed a mean profile characterized by a high score on negative temperament, relative to the low pathology cluster, and a low score on disinhibition. Contrary to our prediction and to Miller et al's findings, none of the groups displayed the internalizing pattern (particularly on positive temperament). Table 2 displays means and SDs for the clusters across the 3 scales.

3.1. Results from Ward's method

Results of the cluster analysis using Ward's method revealed 3 clusters, displayed in Fig. 1, which appear consistent with Miller's suggested typology. The "low pathology" cluster produced a relatively flat profile, characterized by low scores on all 3 dimensions. The "internalizing" cluster displayed a mean profile characterized by a high score on negative temperament, relative to the low pathology cluster, and low scores on positive temperament and disinhibition. The "externalizing" cluster produced a mean profile characterized by a high score on negative temperament and high score on disinhibition. Cluster 1 ("internalizing") had 83 participants (53.2% of the sample); cluster 2 ("low pathology"), 15 participants (9.6% of the

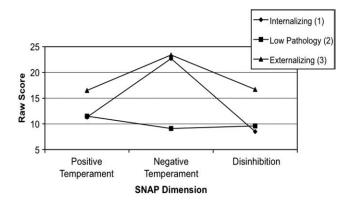


Fig. 1. Three-cluster solution using Ward's method, based on SNAP administered at baseline.

sample); and cluster 3 ("externalizing"), 58 participants (37.2% of the sample). Table 3 displays means and SDs for the clusters across the 3 scales. There was no significant gender difference in the frequency of cluster assignment.

On the NEO-PI, the clusters were discriminated on 4 of the 5 scales. Table 4 illustrates the scores by cluster on each of the NEO-PI facets. As predicted, the internalizing and externalizing clusters both scored significantly higher than the low pathology cluster on neuroticism. Again consistent with predictions, the externalizing cluster scored significantly higher than the internalizing cluster on extraversion and significantly lower than the internalizing cluster on agreeableness and conscientiousness. Fig. 2 depicts the NEO-PI results.

The clusters did not differ with respect to age at first trauma exposure or in frequencies of each category of trauma exposure. With regard to comorbidity, significant differences between clusters emerged for alcohol and drug use disorders but not for any of the mood, anxiety, somatoform, or eating disorders we investigated. Of the sample, 48.7% (n = 76) met criteria for a lifetime alcohol use disorder. This included 38.6% (n = 32) of participants in cluster 1 (internalizing), 46.7% (n = 7) of cluster 2 (low pathology), and 63.8% (n = 37) of cluster 3 (externalizing), a statistically significant difference (Pearson $\chi_2^2 = 8.733$, P < .05). Slightly less than half (49.4%) the sample (n = 77) met criteria for a lifetime drug use disorder, including 36.1% (n = 30) of participants in cluster 1, 53.3% (n = 8) of cluster 2, and 67.2% (n = 39) of cluster 3. This difference was statistically significant (Pearson $\chi_2^2 = 13.31$, P < .01).

We investigated patterns of comorbidity of the 4 CLPS index PD diagnoses. Only borderline PD was disproportionately represented among the clusters. In the full sample (n = 156), 91 participants (58.3%) met criteria for borderline PD. This included 49.4% of participants (n = 41) in cluster 1 (internalizing), 26.7% (n = 4) in cluster 2 (low pathology), and 79.3% (n = 46) of cluster 3 (externalizing). This difference was statistically significant (Pearson χ^2_2 = 19.4, P < .001).

Using data from a second administration of the SNAP 6 months after baseline, we conducted a second cluster analysis to investigate the stability of the 3-cluster structure. Data were available for 131 of the original 156 participants,

^{*} *P* < .05.

[†] P < .01

Table 3 Raw scores on SNAP temperament scales by cluster (baseline, n = 156) based on Ward's method

	Cluster 1: "internalizing" (n = 83)	Cluster 2: "low pathology" (n = 15)	Cluster 3: "externalizing" (n = 58)	F	Pairwise contrasts
Positive temperament	11.35 (5.3)	11.53 (5.2)	16.52 (5.9)	15.82 [†]	$3 > 1, 2^{\dagger}$
Negative temperament	22.71 (3.6)	9.13 (3.6)	23.45 (4.3)	86.56 [†]	$1, 3 > 2^{\dagger}$
Disinhibition	8.48 (3.6)	9.60 (6.4)	16.67 (5.1)	57.71 [†]	$3 > 1, 2^{\dagger}$

Data are mean (SD).

and the rate of missing data did not differ across the 3 original clusters (Pearson $\chi_2^2 = 0.391$, P = .82). Results were dubious. Two of the clusters fit the expected patterns for "externalizing" and "low pathology," respectively. A third cluster displayed some of the properties expected for "internalizing," scoring significantly higher than the low pathology cluster on negative temperament and lower than the externalizing cluster on disinhibition. However, this group scored significantly higher than the other two on positive temperament, inconsistent with a true "internalizing" pattern. For the purposes of examining individual stability of cluster assignment, we considered this cluster to be "internalizing," given that it deviated from externalizing on the key feature of disinhibition. Table 5 displays means and SDs for the clusters across the 3 scales, and these results are displayed in Fig. 3.

Our hypothesis that cluster assignment would be relatively stable was not supported. From baseline to the 6-month follow-up, cluster membership was stable for 39.7% of the sample (52/131 participants) and Table 6 displays this information by cluster. The low pathology cluster was the most stable. Of participants identified as internalizers at baseline, more than half (57.7%, n = 41) were classified as externalizers at 6 months. Among the baseline externalizers, more than one third were classified as internalizers at follow-up. These data suggest there was not a significant degree of stability in cluster membership (κ = .046, NS). This is despite the stability of the 3 SNAP dimensions, as indicated by high correlations between baseline and 6-month administrations: positive temperament, r = .698 (P < .001), negative temperament, r = .749 (P < .001), and disinhibition,

r = .825 (P < .001). The intercorrelations across the scales (Table 7) suggest they assess distinct constructs, with nonsignificant to modest correlations across the scales.

Comparing participants whose cluster assignment switched at 6 months with those whose cluster assignment remained stable, on each of the 3 SNAP dimensions for both baseline and follow-up, we found that the participants who switched clusters had a significantly higher mean score (mean = 22.75, SD = 4.39) on negative temperament at baseline relative to those who remained stable (mean = 20.63, SD = 6.99). There were no other significant differences between those who switched and who did not switch on any other SNAP trait at either time point. We further examined participants who made the most extreme switches, who went from internalizing at baseline to externalizing at 6 months, or vice versa, and compared them with participants who remained stable internalizers or externalizers. Stable internalizers had significantly higher positive temperament scores at both baseline (mean = 16.20, SD = 4.21, vs mean = 9.63, SD = 4.77) and 6 months (mean = 20.40, SD = 3.33, vs mean = 8.66, SD = 3.73),significantly lower negative temperament scores at both baseline (mean = 21.85, SD = 3.18, vs mean = 23.93, SD = 3.14) and 6 months (mean = 21.10, SD = 3.93, vs mean = 24.59, SD = 2.62), and significantly lower disinhibition scores at both baseline (mean = 6.10, SD = 2.27, vs mean = 9.17, SD = 3.95) and 6 months (mean = 6.65, SD = 3.42, vs mean = 8.76, SD = 3.46) than those who switched to externalizing. Those who switched from externalizing to internalizing showed significantly higher scores on positive temperament at both baseline (mean = 18.40, SD = 6.28, vs

Table 4
Raw scores on NEO-PI scales by cluster, based on Ward's method

	Cluster 1: "internalizing" (n = 83)	Cluster 2: "low pathology" $(n = 15)$	Cluster 3: "externalizing" (n = 57)	F	Pairwise contrasts
Neuroticism	127.08 (18.1)	101.33 (19.5)	131.3 (21.1)	14.4 [†]	1,3 > 2 [†]
Extraversion	84.6 (21.1)	90.8 (18.6)	101.1 (23.1)	9.85 [†]	$3 > 1^{\dagger}$
Openness	114.1 (21.9)	116.4 (17.7)	121.2 (22.6)	1.79	
Agreeableness	117.5 (16.5)	107.6 (21.9)	106.7 (18.2)	6.97 [†]	$1 > 3^{\dagger}$
	· · ·				1 > 2*
Conscientiousness	105.8 (24.5)	103.3 (22.9)	92.5 (21.9)	5.59 [†]	$1 > 3^{\dagger}$

Data are mean (SD).

[†] P < .01.

^{*} *P* < .05.

[†] P < .01

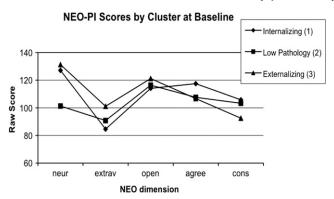


Fig. 2. NEO-PI scores by Ward's method cluster at baseline (n = 155).

mean = 13.00, SD = 5.16) and 6 months (mean = 21.55, SD = 3.10, vs mean = 9.27, SD = 4.90), significantly lower scores on disinhibition at both baseline (mean = 14.15, SD = 3.83, vs mean = 19.32, SD = 5.53) and 6 months (mean = 11.95, SD = 2.78, vs mean = 17.27, SD = 6.02) and significantly lower scores on negative temperament at 6 months (mean = 21.75, SD = 5.14, vs mean = 25.05, SD = 2.46) than those who were classified as externalizing at both time points.

We investigated whether cluster assignment and cluster stability were related to PTSD remission at 6 months. Remission from PTSD was defined as a period of 8 or more weeks, during which the patient reported minimal symptoms. Of the 131 participants for whom complete data were available at 6 months, 22 (17%) were classified as having remitted from PTSD and 109 (83%) continued to meet at least partial criteria for PTSD. A χ^2 analysis found that baseline cluster assignment was not significantly associated with PTSD remission at 6 months (Pearson $\chi^2 = 0.934$, n = 131, NS). Overall, stability of cluster membership was low (39.7%) for both remitters and nonremitters and did not differ by PTSD remission status (Pearson $\chi^2 = 0.685$, NS).

4. Discussion

The present study undertook to replicate and extend previous work conducted by Miller and others [15-20], suggesting a typology among persons with PTSD. We investigated the application of this model to a diverse sample of participants with PTSD and report here on replicability, correlates, and temporal stability of cluster assignment. Our

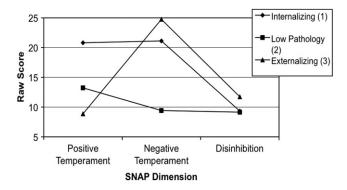


Fig. 3. Three-cluster solution using Ward's method on the SNAP administered at 6-month follow-up.

primary hypothesis was that the cluster analysis would yield a solution characterized by groups resembling patterns describable as "internalizing," "externalizing," and "low pathology." We used 2 different cluster analysis methods and found that although our results did not replicate those Miller reported when we used the same statistical approach, an alternative cluster analysis method did confirm our predictions based on Miller's previous work. The discrepancy between the findings from these 2 approaches suggests that different clustering approaches may be appropriate for different types of samples. The present sample had high rates of personality pathology, which may have made it better suited to Ward's method, which more robustly addresses overlap among clusters.

Although the Ward method cluster analysis results appear consistent with Miller typology [1], the distribution of comorbidity was less so. All 3 clusters had similar rates of co-occurring Axis I and Axis II disorders, with the exception of alcohol and drug use disorders on Axis I and borderline PD on Axis II. The externalizing cluster demonstrated higher rates of all 3 of these comorbid disorders. Although this finding ostensibly provides additional support for the model, there was no similarly increased incidence of internalizing disorders among the internalizing cluster. Therefore, it appears that, in the present sample, the internalizing/externalizing distinction may not reflect a qualitative difference much as a quantitative one, with externalizers displaying more (rather than different) comorbid disorders than internalizers.

The disinhibition dimension appears particularly important in this sample. Other researchers have noted that disinhibition (or impulse control) play a role in PTSD

Table 5 Raw scores on SNAP temperament scales by cluster (6-month administration, n = 131)

	Cluster 1: "internalizing" (n = 42)	Cluster 2: "low pathology" (n = 26)	Cluster 3: "externalizing" (n = 63)	F	Pairwise contrasts
Positive temperament	20.81 (3.3)	13.23 (6.2)	8.87 (4.1)	92.90 [†]	1 > 2 > 3 [†]
Negative temperament	21.12 (4.6)	9.42 (4.9)	24.75 (2.6)	147.44^{\dagger}	$3 > 1 > 2^{\dagger}$
Disinhibition	9.33 (4.0)	9.15 (5.2)	11.73 (6.1)	3.55*	3 > 1, 2*

^{*} P < .05.

[†] P < .01.

Table 6 Stability of cluster assignment based on baseline and 6-month cluster assignment using Ward's method (n = 131)

	Internalizing (6 months)	Low pathology (6 months)	Externalizing (6 months)
Internalizing (baseline)	20 (28.2)	10 (14.1)	41 (57.7)
Low pathology (baseline)	2 (16.7)	10 (83.3)	0
Externalizing (baseline)	20 (41.7)	6 (12.5)	22 (45.8)

Date are n (% of baseline cluster).

symptomatology. This trait might be a predisposing factor, such that individuals with higher levels of disinhibition may be at increased risk for trauma exposure [39]. Alternatively, trauma exposure may result in fundamental personality changes characterized by increased substance abuse and higher rates of borderline and antisocial PD diagnoses [40]. Results from previous work in this area as well as the present study suggest that PTSD itself is not necessarily associated with high levels of disinhibition, but that higher scores on this dimension may be associated with a more severe and complex symptom presentation. Miller's model [1] implies a pathoplastic relationship wherein a premorbid disposition characterized by high disinhibition predisposes one toward externalizing pathology. In the present study, disinhibition appeared critical to discriminating between internalizers and externalizers.

Negative temperament also emerged as an important dimension. Both the internalizing and externalizing clusters had elevated mean scores on this dimension and on the similar NEO-PI dimension of neuroticism. The negative temperament dimension was significantly associated with borderline PD, one of the diagnoses that differed by cluster. The positive temperament dimension did not appear to contribute substantively to the baseline model, as it was not significantly associated with any variable that differed by cluster and was the one dimension on which our K-means findings deviated from Miller's findings. This is consistent with previous work suggesting a minimal contribution by positive emotionality to the underlying dimensions of internalization and externalization [4].

The apparent lack of specificity for the internalizing cluster may reflect heterogeneity within that cluster. Krueger [41] proposed that the internalizing dimension

underlying psychopathology might consist of 2 subfactors, which he termed "anxious-misery" and "fear." A study of the relationship between PTSD and these factors suggested that PTSD may better fit the anxious-misery than the fear subfactor [10]. Although the current study and Miller's work in this area have not addressed Krueger's proposed internalizing subfactors, this may be a fruitful area of further study.

Despite being based upon dimensions thought to reflect relatively stable aspects of personality, cluster assignment was not stable. The magnitude of the difference between the internalizing and externalizing clusters on disinhibition diminished at 6 months, and a larger proportion of the sample was classified as externalizing at 6 months. Scores on the 3 dimensions themselves did appear to be relatively stable, consistent with previous findings on the stability of the SNAP in the CLPS sample [42]. Interestingly, the participants who switched clusters reported more negative affect at baseline than nonswitchers. This possibly reflects affective instability that is characteristic of borderline PD and may be a consequence of the sample including a large proportion of individuals meeting criteria for borderline PD. The use of discrete categories appears to result in the loss of important information. By assigning individuals to discrete categories, subtle changes in levels of traits may result in reassignment to a new cluster, which suggests a more drastic change. The striking lack of agreement of cluster assignment despite good reliability on continuous measures suggests that dimensional measures may be more appropriate for describing personality traits among persons with PTSD. This finding is consistent with Widiger's [43] point that data should inform the decision about the appropriateness of a categorical versus a dimensional approach. If reliability and validity are enhanced by the use of a dimensional scheme and diminished by the use of a categorical scheme, this suggests a dimensional approach more accurately describes the data. It is also possible that subtle shifts on the levels of broad traits were more likely to occur in this population, compared with other PTSD groups, due to the high rate of Axis II comorbidity. That is, this sample may have been more likely to display extreme values on the traits, and hence more likely to show regression to the mean when tested 6 months later. A future

Table 7 Intercorrelations among SNAP scales, across 2 administrations

	1. Positive temperament baseline	2. Negative temperament baseline	3. Disinhibition baseline	4. Positive temperament 6 months	5. Negative temperament 6 months	6. Disinhibition 6 months
1	_	10	08	$.70^{\dagger}$	10	09
2		_	.21 [†]	13	.75 [†]	.22 *
3			_	−.25 [†]	.18 *	.83 [†]
4				_	24^{\dagger}	24 [†]
5					_	.24 [†]
6						_

^{*} P < .05.

 $^{^{\}dagger}$ P < .01.

study of cluster stability in a sample with a lower rate of Axis II pathology would elucidate this issue.

The present findings raise questions about the clinical utility of dividing samples of PTSD patients into subcategories and whether to consider personality dimensions on which those with PTSD might vary (and which might affect the presentation of PTSD symptoms). In this sample, the internalizing and externalizing clusters differed most notably on the disinhibition dimension at baseline. This single dimension appears to account for nearly all of the cross-sectionally observed variance between the internalizing and externalizing clusters, particularly in comorbidity patterns. This dimensional approach to understanding heterogeneity is consistent with current thinking about psychopathology more broadly, as several recent publications have pointed out the need for a more dimensional approach to classification, when appropriate [21,22].

In sum, Miller's model [1] attempts to understand and describe the heterogeneity observed among persons with PTSD. It is evident that personality traits are an important source of this variance. The lack of stability in cluster assignment raises questions about the added value, beyond dimensions, of using this typology in practice. A measure of disinhibition could be a clinically valuable addition to standard PTSD assessment, providing information about the likelihood of particularly severe comorbidity patterns (such as substance use disorders and borderline PD). The proposed criteria for the next *DSM* revision notably include "reckless or self-destructive behavior" as a symptom, suggesting that the diagnostic criteria may formally recognize the role of disinhibition in PTSD in the future [23].

Important limitations temper interpretation of findings from the present study. First, our sample, although recruited from clinical settings and diverse in demographics and clinical characteristics, may not be representative of samples found in clinical settings due to the inclusion and exclusion criteria employed. The CLPS focuses specifically on 4 PDs and on major depressive disorder in the absence of any PD. Therefore, this sample does not reflect base rates found in typical clinical settings. It is possible that this sample had a different distribution of the 3 traits than previous samples used in this line of research, and that this may influence the cluster analysis findings. Indeed, this may explain the discrepancy between the K-means solution and the Ward's method solution, although this distribution would not likely affect the stability. Second, we did not use a continuous measure of PTSD, which limited our ability to investigate PTSD severity or the role of specific symptom clusters and how they relate to personality variables.

This topic warrants further research. Specifically, the utility of this model in diverse clinical samples deserves exploration. The relationship between broad personality traits and treatment response would be an important addition to the literature. Future studies should also investigate relationships between PTSD symptom domains and personality dimensions. Most importantly, longitudinal data,

beginning before trauma exposure are needed to fully explicate relationships among trauma exposure, PTSD, and personality and how these variables may interact.

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