

University of St. Thomas, Minnesota

## UST Research Online

---

Professional Psychology Faculty/Staff  
Publications

Graduate School of Professional Psychology

---

2010

### The concurrent and incremental validity of the Trauma Symptom Inventory in women reporting histories of sexual maltreatment

P. A. Arbisi

C. R. Erbes

M. A. Polusny

N. W. Nelson

Follow this and additional works at: [https://ir.stthomas.edu/celc\\_gradpsych\\_pub](https://ir.stthomas.edu/celc_gradpsych_pub)




Part of the [Psychology Commons](#)

---

This Article is brought to you for free and open access by the Graduate School of Professional Psychology at UST Research Online. It has been accepted for inclusion in Professional Psychology Faculty/Staff Publications by an authorized administrator of UST Research Online. For more information, please contact [asle4660@stthomas.edu](mailto:asle4660@stthomas.edu).

# The Concurrent and Incremental Validity of the Trauma Symptom Inventory in Women Reporting Histories of Sexual Maltreatment

Assessment  
17(3) 406-418  
© The Author(s) 2010  
Reprints and permission: <http://www.sagepub.com/journalsPermissions.nav>  
DOI: 10.1177/1073191110376163  
<http://asmnt.sagepub.com>  


Paul A. Arbisi<sup>1,2</sup>, Christopher R. Erbes<sup>1,3</sup>, Melissa A. Polusny<sup>1,3</sup>,  
and Nathaniel W. Nelson<sup>1,3</sup>

## Abstract

The Trauma Symptom Inventory (TSI), Minnesota Multiphasic Personality Inventory-2 (MMPI-2), and Posttraumatic Diagnostic Scale (PDS) were administered to 71 women who reported histories of childhood and/or adult sexual maltreatment and 25 women who did not report a history of victimization. The TSI validity scales were not effective in identifying MMPI-2 defined invalid responding although were moderately related to MMPI-2 validity scales designed to identify similar response styles. In contrast, the TSI clinical scales displayed good convergent validity with conceptually related scales on the MMPI-2 and PDS. Also, the TSI added incrementally, albeit modestly, to the MMPI-2 in prediction of PDS defined PTSD.

## Keywords

assessment, posttraumatic stress disorder (PTSD), MMPI-2, Trauma Symptom Inventory (TSI), trauma

With the high degree of psychiatric comorbidity associated with a posttraumatic stress disorder (PTSD) diagnosis, multiple self-report measures are frequently used simultaneously when assessing PTSD in clinical practice (Miller, Kaloupek, Dillon, & Keane, 2004; Miller, Vogt, Mozley, Kaloupek, & Keane, 2006). The Minnesota Multiphasic Personality Inventory-2 (MMPI-2) is currently one of the most commonly used broadband measures of psychopathology and personality in clinical practice across a wide range of settings (Archer, Buffington-Vollum, Stendy, & Handel, 2006; Camara, Nathan, & Puente, 2000). The MMPI-2 has demonstrated utility in the identification of PTSD although questions regarding the specificity of PTSD diagnosis based on MMPI-2 scale elevations and particularly the PK scale have been raised (Graham, 2006; Polusny & Arbisi, 2006). With regard to the more focused assessment of PTSD, the Trauma Symptom Inventory (TSI; Briere, 1995) is one of the most frequently employed self-report measures of PTSD symptomatology in clinical practice (Elhai, Gray, Kashdan, & Franklin, 2005). In a recent survey of International Society of Traumatic Stress Studies members, only the Clinician Administered PTSD Scale (CAPS; Blake et al., 1990) for the *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition (DSM-IV) was used more frequently in clinical practice to assess PTSD symptoms. With the widespread use of the TSI, it is important to establish the empirical

validity of the instrument in identifying PTSD symptoms across a range of traumatogenic events. Also, given the time and expense associated with the administration of a battery of self-report measures, it is important to establish whether independent measures add incrementally and serve to complement each other or whether the measures are largely redundant (Haynes & Lench, 2003). In the current study, we examine the concurrent and predictive validity of the TSI and examine the incremental validity of the TSI in comparison with the MMPI-2 in the identification of PTSD in a group of sexually traumatized women.

The TSI is a 100-item self-report instrument that contains three validity indicators (Response Level [RL], Atypical Response [ATR], and Inconsistent Response [INC]) and 10 clinical scales (Anxious Arousal [AA], Depression [D], Anger/Irritability [AI], Intrusive Experiences [IE], Defensive Avoidance [DA], Dissociations [DIS], Sexual Concerns [SC], Dysfunctional Sexual Behaviors [DSB], Impaired

<sup>1</sup>Minneapolis Veterans Affairs Medical Center, Minneapolis, MN, USA

<sup>2</sup>University of Minnesota Departments of Psychiatry and Psychology

<sup>3</sup>University of Minnesota Department of Psychiatry

## Corresponding Author:

Paul A. Arbisi, Minneapolis Veterans Affairs Medical Center, One Veterans Drive, Minneapolis, MN 55417, USA  
Email: [paul.arbisi@va.gov](mailto:paul.arbisi@va.gov)

Self-References [ISR], and Tension Reduction Behavior [TRB]). The items for the TSI were rationally derived to tap 10 possible posttraumatic domains. Items contained on the 10 clinical scales underwent psychometric refinement to maximize the overall reliability and predictive validity of the scales.

Distinctive among stand-alone, self-report, measures of PTSD is the inclusion of validity scales on the TSI. These scales lend a potential advantage in clinical practice for the TSI over other self-report instruments of PTSD symptomatology in that the validity scales provide critical information regarding the accuracy of the test takers' self-reported PTSD symptoms. Indeed, the capacity to gauge an individual's approach to assessment of PTSD is essential especially when demand characteristics associated with the evaluation of PTSD could motivate individuals to distort their self-report and appear either more symptomatic or less symptomatic than they actually are (Arbisi, 2005; Ben-Porath & Waller, 1992). The TSI contains three validity scales that assess various forms of distorted self-report. The RL scale reflects the extent to which the individual denies behaviors, thoughts, or feelings that most other individuals are likely to acknowledge. High scores on RL suggest a defensive or uncooperative respondent. The ATR scale was developed to identify motivated overreporting and includes 10 items that describe bizarre or unusual phenomena. Elevations on this scale suggest deviant responding arising either from over endorsement of items or from actual psychotic experiences (Briere, 1995). Finally the INC scale assesses inconsistent responding to the TSI by comparing the responses with pairs of TSI items with similar content. Higher scores on INC suggest that individual did not attend to the content of the items and responded carelessly or indiscriminately to the TSI.

The advantage of the TSI as a stand-alone measure of PTSD in clinical practice is contingent on the evidence for the effectiveness of the TSI's validity and clinical scales. Preliminary evidence for the TSI validity scales comes from information reported in the test manual (Briere, 1995). As reported in the TSI manual, in 100 college students who were administered the TSI, MMPI-2, and Personality Assessment Inventory (PAI), the ATR correlated .52 with PAI Negative Impression Management (NIM) and .50 with the MMPI-2 F scale. The RL correlated .50 with PAI Positive Impression Management (PIM) and .36 and .46 with the MMPI-2 L and K scales respectively. In contrast, the INC correlated .05 with PAI-Inconsistency, a scale designed to detect random or indiscriminant responding on the PAI (Briere, 1995). Surprisingly, correlations between INC and the MMPI-2 Variable Response Indicator (VRIN) and True Response Indicator (TRIN) scales, which both assess inconsistent reporting, were not reported in the manual.

### Construct Validity of the TSI Validity Scales

Although the TSI demonstrates acceptable concurrent validity with other symptom checklists and with the CAPS, there is growing consensus that the TSI validity scale ATR is relatively ineffective in identifying non credible or distorted responding (Efendov, Sellbom, & Bagby, 2008; Elhai et al., 2007; McDevitt-Murphy, Weathers, & Adkins, 2005; Sellbom & Bagby, 2008). In studies of college students instructed to feign PTSD or respond candidly, the TSI ATR scale demonstrated acceptable classification accuracy (Edens, Otto, & Dwyer, 1998; Guriel et al., 2004; Guriel-Tennant & Fremouw, 2006; Rosen et al., 2006). Unfortunately, the cut score recommended by the TSI manual ( $T \geq 90$ ) for the ATR performed poorly in discriminating between college students asked first to respond to the TSI honestly and then complete the TSI as if they had developed PTSD following a motor vehicle accident (Carmody & Crossman, 2005). Furthermore, the TSI ATR appears to be associated with severity of PTSD symptoms and thus is plagued by a high rate of false positives. When examined in combat veterans undergoing treatment for chronic PTSD through an outpatient Veterans Affairs (VA) PTSD clinic, the ATR scale of the TSI identified 19% of the group as responding in a noncredible manner (Nye, Qualls, & Katzman, 2006). The individuals who produced invalid TSI profiles based on the ATR were all receiving disability payments and had service connected disability ratings between 70% and 100% as a result of PTSD symptoms. Individuals who produced higher scores on the TSI scales Dissociative Experience and Tension Reduction Behaviors also produced higher scores on the ATR suggesting that higher ATR scores may be associated with severity of PTSD symptoms. In a community dwelling group of trauma exposed residents who were evaluated using the CAPS, the mean score on the ATR for the group that met *DSM-IV* criteria for PTSD was significantly higher than the group that did not meet criteria for PTSD. Moreover, the ATR scale correlated .45 with CAPS total severity score. In contrast, the correlation between the CAPS total severity score and TSI clinical scales was equal to or lower than the correlation between ATR and TSI Anger/Irritability, Dissociation, Sexual Concerns, Dysfunctional Sexual Behavior, and Tension Reduction Behavior scales. This pattern of correlation suggests that the ATR scale may assess severity of PTSD symptoms in clinical populations (McDevitt-Murphy et al., 2005).

In a study comparing responses of college students asked to feign PTSD on the TSI with a clinical comparison group, the ATR failed to discriminate between healthy college students provided with training related to the symptoms of PTSD and treatment seeking patients with PTSD (Elhai, Gray, Naifeh, et al., 2005). Individual ATR cutoffs resulted

in generally poor classification of the simulator group. In the most ecologically valid study to date, Efendov et al. (2008) examined the relative ability of the MMPI-2 F family of scales ( $F$ ,  $F_B$ , and  $F_p$ ) in comparison to the ATR to detect feigned PTSD in a group of remitted trauma victims under both coached and uncoached conditions from a group of individuals with well-documented current PTSD symptoms. Regardless of the coaching condition, the MMPI-2 F family of scales, both as a group and individually, outperformed the ATR. Furthermore, the ATR was unable to add incrementally to the F scales in prediction of feigned PTSD.

To summarize findings regarding the TSI validity scales, there is essentially no independent evidence beyond what is reported in the TSI manual to support the utility of the RL or INC in identifying positive self-presentation or indiscriminate responding. In ecologically valid study designs using clinical comparison groups, the ATR does not perform adequately in detection of feigned PTSD especially under coached conditions and does not add incrementally to the MMPI-2 validity scales in identifying feigned PTSD (Efendov et al., 2008). Moreover, the cutoff score recommended in the manual for the ATR has resulted in a high rate of false positives in clinical settings perhaps due to the relationship between ATR and severity of PTSD. These findings taken together suggest that the validity scales on the TSI, especially ATR, should not be relied on independently to assess the credibility of self-reported PTSD symptomatology.

### *Construct Validity of the TSI Clinical Scales*

The TSI was developed in response to a perceived need for a standardized clinically useful measure of posttraumatic symptomatology that encompassed a range of symptoms relevant to the psychological assessment of traumatized individuals (Briere, Elliott, Harris, & Cotman, 1995). Given the stated purpose for the development of the TSI, in comparison with the number of published studies examining the utility of the TSI ATR to detect feigning of PTSD symptoms, there are few studies that examine the concurrent validity of the TSI clinical scales with other self-report measures of psychopathology. As reported in the manual, the reliability of the TSI clinical scales are excellent and range from a high of .91 for D to a low of .74 for TRB in the standardization sample and a high of .90 for D and IE and a low of .74 for TRB in a clinical sample. Although 100 university students were administered the TSI, MMPI-2, and PAI, the manual does not report correlations between the TSI clinical scales and conceptually related scales on the MMPI-2 or the PAI (Briere, 1995). In a large combined sample of psychiatric inpatients and outpatients comprising primarily women, all TSI scales were elevated in patients who reported a history of victimization relative to psychiatric patients who did

not report a history of either childhood or adult victimization (Briere et al., 1995). In the only other published study to examine the validity of the TSI, the TSI along with a number of self-report instruments designed to assess history of sexual and physical maltreatment, physical health concerns and somatic symptoms, major life events, and overall perceived level of stress were administered to a large number of women enrolled in a first-year psychology course at a Canadian university (Runtz & Roche, 1999). The TSI clinical scales were elevated in women who reported a history of childhood sexual abuse and in women who reported a history of childhood physical maltreatment. Furthermore, scores on the TSI clinical scales generally showed convergent validity with conceptually related measures of stress.

The above findings suggest the TSI is sensitive to early sexual or physical maltreatment and associated distress, but do not speak to the specificity (i.e., discriminant validity) of the TSI scales. Further, with the exception of the correlations between the TSI clinical scales and the Brief Symptom Inventory (BSI) scales reported in the manual, there are no published studies that examine the convergent validity of the individual TSI clinical scales (Briere, 1995). Although there is evidence for convergent validity between the TSI scales and the BSI as reported in the manual, the discriminant validity of the individual TSI scales is less clear. For example, although the TSI D scale is most highly correlated with BSI Depression, it is also substantially correlated with BSI Anxiety, Interpersonal Sensitivity, Obsessive-Compulsive, Phobic Anxiety, and Psychoticism suggesting the TSI clinical scales are saturated with general distress and maladjustment (Tellegen et al., 2003; Tellegen et al., 2006). Furthermore, published studies have not addressed whether the TSI adds incrementally to broadband self-report measures of psychopathology in the prediction of PTSD.

The goals of the current study are to examine the construct validity of the TSI in a group of trauma exposed women and a group of women who did not report a history of victimization. It is expected that TSI validity and clinical scales should be strongly related to MMPI-2 scales that assess the same clinical dimensions. A secondary goal is to examine the incremental validity of the TSI clinical scales in detection of PTSD beyond the MMPI-2 Clinical (CS), Restructured Clinical (RC), and PK scales among women with a history of sexual victimization.

## **Method**

### *Participants and Procedures*

A total of 112 female veterans receiving health care from a Women Veterans Comprehensive Health Care Clinic located within a Veterans Affairs Medical Center (VAMC) were recruited via letters and fliers. As part of larger

laboratory study of emotional processing deficits in sexually victimized women, participants were administered a number of self-report measures of lifetime sexual victimization experiences, personality, and psychopathology. Participants received \$20 compensation. Of the 112 participants, 5 were excluded because they did not complete the TSI, MMPI-2, or Posttraumatic Diagnostic Scale (PDS); 3 were excluded because they were identified as controls but still screened positive for PTSD. Of the remaining 104 participants, 8 provided invalid MMPI-2 profiles based on standard invalidity criterion (Cannot Say  $\geq 30$ , VRIN and/or TRIN  $\geq 80$ ,  $F_p \geq 90$ ). One participant was excluded for failing to respond to greater than 30 MMPI-2 items, 3 participants were excluded for a TRIN score greater than 79, 3 participants were excluded for  $F_p$  scores greater than 89 and 1 participant was excluded for both elevated TRIN and elevated  $F_p$  scores. Of note, none of the participants would have been excluded solely on the basis of the recommended cutoffs on the TSI validity scales (ATR  $>89$  and INC  $>74$ ). The participants excluded based on MMPI-2 invalidity were included in the demographic and validity scale analyses but were excluded from all other analyses. The mean age of this sample was 47.6 ( $SD = 9.8$ ). Reflecting ethnic composition of the local community, most participants were Caucasian (89%). In all, 35% were married and 15% were divorced or separated. Women reported a mean of 6.4 ( $SD = 6.9$ ) years of active duty military service. Although nearly two thirds of the sample reported at least some college (65%), 27% were unemployed and reported being 100% disabled from military service. The majority reported a history of mental health treatment (76%); 39% reported currently being in mental health treatment.

Based on self-reported history of sexual victimization, two groups were formed. The first group of 71 women consisted of women who reported experiencing either childhood sexual abuse, adult sexual assault, or who reported experiencing both childhood sexual abuse and adult sexual assault. A second group of 25 women who reported no lifetime history of sexual victimization served as controls. Of the 25 women who reported no lifetime history of sexual assault, 76% reported experiencing other potentially traumatic events, including serious motor vehicle accidents (48%), natural disasters (36%), nonsexual assault (16%), military combat or war zone exposure (20%), life-threatening illness (24%), or other potentially traumatic events (16%). Overall, sexually assaulted women were more likely to report suffering additional nonsexual traumas than controls (100% vs. 76%,  $\chi^2 = 18.18$ ,  $df = 1$ ,  $p < .001$ )

## Measures

**Sexual victimization experiences.** Lifetime sexual victimization experiences were assessed using the Childhood Sexual

Abuse Subscale from the Wyatt Sex History Questionnaire (WSHQ; Wyatt, Lawrence, Vodounon, & Mickey, 1992) and the Sexual Experiences Survey (SES; Koss & Oros, 1982). The WSHQ contains dichotomously endorsed items (*yes* = 1 or *no* = 0) that range from fondling to completed intercourse prior to age 14 with someone 5 years older than the participant or with someone of any age if the contact was not desired or involved coercion (Wyatt et al., 1992). The SES is a 10-item self-report measure that assesses degrees of sexual victimization. The SES was modified to add three items assessing oral, anal, and vaginal penetration and was administered twice to distinguish adolescent from adult experiences (Koss & Oros, 1982). The SES has been shown to have good internal consistency, reliability, and concurrent validity with interview data (Koss & Gidycz, 1985).

**Trauma Symptom Inventory (TSI).** As described above, the TSI (Briere et al., 1995) was designed to measure a broad range of trauma-related symptoms yielding 10 clinical scales and 3 validity scales. The instrument is composed of 100 self-report items rated on a 4-point Likert-type scale ranging from 0 (*never*) to 3 (*often*). The 10 clinical scales of the TSI are internally consistent and correlate with "positive" or "negative" status on self-report PTSD screening measures. McDevitt-Murphy et al. (2005) found that seven of the TSI clinical scales and the ATR scale differentiated between those with and without PTSD diagnosis.

**Posttraumatic Diagnostic Scale (PDS).** The PDS (Foa, 1995) was designed to assess the overall severity of PTSD symptoms, as well as severity of clusters of re-experiencing, avoidance, and hyperarousal symptoms according to *DSM-IV* criteria. The PDS has excellent psychometric properties and has been used with a wide range of trauma exposed individuals. The 49-item self-report scale contains four sections: the first and second assess PTSD Criterion A of the *DSM-IV*, and the third and fourth assess the 17 symptoms of PTSD outlined in Sections B, C, and D of the *DSM-IV*, with higher scores indicating increased symptoms and severity (Foa, 1995). The PDS has demonstrated high internal consistency; validity of the PDS is supported by correlations with the Impact of Events Scale-Revised (IES-R;  $r = .66$  to  $.80$ ) and the State-Trait Anxiety Inventory ( $r = .73$  to  $.74$ ; Foa, Cashman, Jaycox, & Perry, 1997). The PDS has demonstrated convergent validity as evidenced by kappa of  $.52$  between the PDS and CAPS (Griffin, Uhlman-siek, Resick, & Mechanic, 2004) and kappa of  $.65$  between the PDS and SCID (Foa et al., 1997). For the purposes of classifying participants into the PTSD group, the participant had to endorse symptoms that fit a diagnosis of PTSD, including reacting to a trauma with fear, helplessness, or horror (Criterion A), one Criterion B symptom, three Criterion C symptoms, two Criterion D symptoms, a duration of more than 1 month (Criterion E), and significant impairment (Criterion F).



**Table 1.** TSI and MMPI-2 Validity Scale Correlates

Scale	ATR	RL	INC	L	F	F <sub>B</sub>	F <sub>P</sub>	K	VRIN	TRIN	FBS
ATR	<b>1.00</b>	-.28*	.09	-.13	.54**	.56**	.38**	-.31*	.15	.09	.44**
RL	-.23	<b>1.00</b>	-.31**	.52**	-.30**	-.27*	-.12	.33**	-.26*	-.15	-.43**
INC	-.02	-.17	<b>1.00</b>	-.16	.11	.10	.10	-.30**	.27*	.05	.12
L	-.10	.50**	-.03	<b>1.00</b>	-.26*	-.25*	-.02	.45**	-.22	-.12	.04
F	.51**	-.25	-.03	-.23	<b>1.00</b>	.90**	.77**	-.48**	.41**	.26*	.51**
F <sub>B</sub>	.53**	-.21	-.03	-.20	.90**	<b>1.00</b>	.71**	-.46**	.37**	.30**	.53**
F <sub>P</sub>	.35**	-.06	.03	-.07	.78**	.72**	<b>1.00</b>	-.33**	.21	.27*	.29*
K	-.26	.27	-.19	.46**	-.46**	-.44**	-.34*	<b>1.00</b>	-.43**	-.31**	-.15
VRIN	.09	-.18	.14	-.18	.35*	.33*	.18	-.35**	<b>1.00</b>	.05	.41**
TRIN	.05	-.15	.04	-.13	.24	.28	.26	-.25	.24	<b>1.00</b>	.04
FBS	.43**	-.39**	-.02	.12	.51**	.53**	.25	-.09	.39**	.07	<b>1.00</b>

Note. TSI = Trauma Symptom Inventory; MMPI-2 = Minnesota Multiphasic Personality Inventory-2. Depicted above the diagonal (entries in boldface) are zero-order correlates of the entire sample, including sexual assault group and controls ( $n = 104$ ). Depicted below the diagonal are zero-order correlates of the sexual assault group excluding controls ( $n = 81$ ).

\* $p \leq .01$ . \*\* $p \leq .001$ .

*Minnesota Multiphasic Personality Inventory-2 (MMPI-2).* The MMPI-2 (Butcher et al., 2001) is a widely used and accepted self-report measure of psychopathology and personality. The instrument is composed of 567 statements to which participants are asked to respond using a true-false format. The MMPI-2 yields 10 standard clinical scales, a variety of content and supplementary scales as well as 9 validity scales. The MMPI-2 also contains the PK scale developed to identify individuals who may be experiencing symptoms associated with PTSD. The validity and clinical utility of the MMPI and MMPI-2 are well documented (e.g., Graham, 2006; Greene, 2000). Recently, the Restructured Clinical (RC) Scales of the MMPI-2 were developed to address the conceptual overlap and heterogeneity of the MMPI-2 clinical scales (Tellegen et al., 2003). The RC scales have been shown to be less intercorrelated and have produced clearer relationships with measures of personality and psychopathology (Handel & Archer, 2008; Kamphuis, Arbisi, Ben-Porath, & McNulty, 2008; Sellbom, Ben-Porath, & Bagby, 2008; Simms, Casillas, Clark, Watson, & Doebbeling, 2005) and demonstrate improved discriminant validity over the MMPI-2 clinical scales in identification of PTSD (Wolf et al., 2008).

### Data Analyses

Analyses involved several stages. The mean comparisons and correlations between TSI validity scales and MMPI-2 validity scales were calculated for all 104 participants (see Table 1). Subsequent analyses were conducted on the remaining 96 participants who produced valid MMPI-2 protocols. Because the study, in part, examines the concurrent validity of the TSI validity scales against conceptually related MMPI-2 validity scales, excluding the participants who produced invalid MMPI-2 protocols would result in range restriction

across these scales. In contrast, when examining the concurrent validity of the TSI clinical scales, including participants who produced invalid MMPI-2s would place the TSI at an undue disadvantage because the MMPI-2 scales from these protocols would not be expected to correspond well with conceptually related scale counterparts from the TSI.

For mean comparisons, participants were categorized into three groups: control women ( $n = 25$ ) who did not report a history of sexual assault (SA), sexually assaulted women who did not ( $n = 41$ ) screen positive for PTSD on the PDS, and sexually assaulted women who did ( $n = 30$ ) screen positive for PTSD. Groups were compared on the MMPI-2 validity, clinical, and restructured clinical (RC) scales. In each case, a three-group multivariate analysis of variance (MANOVA) was followed by univariate ANOVAs. Group means, comparison statistics, and effect sizes are reported in Tables 2 and 3. Bivariate correlations between TSI scales and MMPI-2 Clinical, Restructured, and the PK Scale were examined. Differences between correlations were examined using Fisher's  $Z$  transformations for comparing correlated overlapping coefficients as described in Meng, Rosenthal, and Rubin (1992).

## Results

### Comparison of TSI Validity Scales Performance With MMPI-2 Validity Scales

As shown in Table 1, correlations between MMPI-2 validity scales and conceptually related TSI validity scales were at best modest. ATR correlated .54, .56, and .38 with F, F<sub>B</sub>, and F<sub>P</sub> respectively. RL correlated .52 and .33 with L and K, and INC correlated .27 and .05 with VRIN and TRIN, respectively. The magnitude of the correlations were greater between conceptually related MMPI-2 and TSI validity

**Table 2.** MMPI-2 Data for Sexually Assaulted Women With PTSD, Without PTSD, and Control Group

MMPI-2 Scale	Group; <i>M</i> ( <i>SD</i> )			Statistic				
	Control	SA Without PTSD	SA With PTSD	<i>F</i>	<i>d</i> 1	<i>d</i> 2	<i>d</i> 3	$\eta^2$
<b>Validity</b>								
L	57.9 (12.6)	51.8 (9.2)	49.2 (9.8)	4.5	-0.56	-0.78	-0.27	.09
F	49.0 (6.4)	53.1 (11.8)	73.5 (18.0)	28.4**	0.43	1.81	1.35	.39
K	58.6 (9.6)	50.6 (9.8)	49.5 (12.1)	5.5*	-0.82	-0.83	-0.10	.11
TRIN	55.0 (4.9)	59.6 (6.7)	58.2 (6.2)	0.4	0.77	0.57	-0.21	.01
VRIN	45.2 (8.6)	50.2 (9.9)	55.2 (10.9)	5.7*	0.54	1.02	0.48	.11
F <sub>B</sub>	44.4 (3.8)	48.7 (7.6)	68.3 (19.2)	30.1**	0.72	1.73	1.34	.40
F <sub>P</sub>	47.7 (8.2)	49.8 (10.6)	56.2 (11.4)	5.0*	0.22	0.85	0.59	.10
FBS	50.6 (9.0)	52.1 (11.4)	68.3 (14.7)	16.7**	0.15	1.45	1.23	.27
S	59.3 (11.4)	47.2 (9.8)	45.7 (12.0)	12.2**	-1.15	-1.16	-0.13	.22
<b>Clinical</b>								
CS1	50.0 (7.9)	55.2 (11.8)	67.8 (13.0)	24.4**	0.52	1.66	1.02	.34
CS2	46.8 (9.2)	51.2 (11.0)	73.9 (17.6)	36.8**	0.44	1.93	1.54	.44
CS3	50.7 (8.8)	51.4 (10.8)	68.6 (13.6)	24.3**	0.07	1.56	1.40	.34
CS4	51.2 (7.1)	54.5 (10.3)	72.9 (15.1)	35.6**	0.37	1.84	1.42	.43
CS5	52.8 (9.2)	53.8 (10.4)	54.5 (9.2)	0.2	0.11	0.19	0.07	.01
CS6	49.3 (7.0)	51.2 (11.3)	63.9 (12.8)	15.5**	0.21	1.42	1.05	.25
CS7	48.0 (9.2)	52.6 (8.1)	71.8 (14.6)	33.3**	0.54	1.96	1.63	.42
CS8	49.6 (7.3)	54.7 (9.9)	75.0 (13.8)	40.2**	0.59	2.32	1.69	.46
CS9	48.2 (9.0)	52.1 (11.0)	51.9 (10.8)	2.6	0.38	0.37	-0.02	.05
CS0	44.6 (6.6)	51.3 (11.0)	57.5 (12.2)	10.2**	0.73	1.31	0.54	.18
<b>Restructured</b>								
RCd	43.6 (10.3)	50.2 (8.2)	62.9 (13.8)	22.3**	0.70	1.58	1.12	.32
RC1	45.9 (8.8)	54.6 (10.0)	63.9 (13.3)	17.7**	0.92	1.59	0.79	.28
RC2	48.7 (11.4)	52.0 (11.8)	68.7 (14.9)	21.3**	0.29	1.51	1.25	.31
RC3	45.9 (11.1)	51.9 (10.5)	54.2 (12.2)	4.9*	0.56	0.71	0.20	.10
RC4	45.3 (6.3)	53.8 (10.3)	62.1 (11.6)	19.0**	0.99	1.80	0.76	.29
RC6	48.4 (8.3)	49.3 (8.7)	60.8 (12.2)	15.6**	0.10	1.19	1.09	.25
RC7	42.0 (6.8)	49.6 (9.1)	57.1 (12.6)	17.5**	0.95	1.50	0.68	.27
RC8	44.9 (7.1)	50.3 (9.4)	58.8 (13.9)	12.6**	0.66	1.27	0.72	.21
RC9	43.8 (8.8)	49.8 (9.4)	47.9 (11.2)	3.2	0.66	0.40	-0.19	.06
PK	43.3 (6.8)	52.5 (9.4)	67.8 (14.4)	37.1**	1.13	2.17	1.25	.44

Note. MMPI-2 = Minnesota Multiphasic Personality Inventory-2; PTSD = posttraumatic stress disorder; SA = sexually assaulted women. *N* = 104 for validity scale comparisons and *N* = 96 for clinical scale comparisons. Means and standard deviations are represented as *T* scores; *F* ratios based on raw scores. *d*1 = Cohen's *d* for control group versus sexually assaulted women without PTSD; *d*2 = Cohen's *d* for control group versus sexually assaulted women with PTSD; *d*3 = Cohen's *d* for sexually assaulted women with and without PTSD.

\**p* ≤ .01. \*\**p* ≤ .001.

scales when non-trauma exposed women were included in the analysis, but the pattern of the correlations among the scales remained the same when the trauma exposed women were analyzed separately. The increase in magnitude of correlations in the larger group is likely because of the increase variation introduced when the non trauma exposed woman were included (see mean score differences across groups for validity scales in Table 2).

Means (and *SD*) for the total PDS score for the controls, women with a history of SA without PTSD, and women with a history of SA with PTSD were 3.16 (3.66), 4.37 (4.74), and 22.67 (10.56), respectively. These means were

statistically different,  $F(2, 87) = 69.61, p < .001$ , and post hoc analyses revealed that the control and SA without PTSD groups were not significantly different while both differed from the SA with PTSD group at a significance level of .001. The MANOVA comparing the three groups on the MMPI-2 validity scales was significant, Wilks's  $\lambda = .39, F(20, 160) = 4.79, p < .001$ . The overall MANOVA for the TSI validity scales was again significant, Wilks's  $\lambda = .60, F(6, 182) = 8.89, p < .001$ . MANOVAs for comparisons of the three groups on the TSI clinical scales, MMPI-2 clinical scales, and MMPI-2 RC scales were likewise significant (TSI clinical: Wilks's  $\lambda = .30$ ,

**Table 3.** TSI Subscale Data for Sexually Assaulted Women With PTSD, Without PTSD, and Control Group

TSI Scale	Group; <i>M</i> ( <i>SD</i> )			Statistic				
	Control	SA Without PTSD	SA With PTSD	<i>F</i>	<i>d</i> 1	<i>d</i> 2	<i>d</i> 3	$\eta^2$
Validity								
ATR	45.5 (2.4)	47.3 (5.4)	55.8 (12.8)	12.6**	0.44	1.12	0.87	.21
RL	50.6 (9.0)	46.0 (6.9)	42.0 (4.4)	11.4**	-0.56	-1.21	-0.70	.20
INC	43.9 (5.5)	51.2 (9.3)	51.3 (7.1)	9.2**	1.06	1.16	0.09	.17
Clinical								
AA	44.8 (7.1)	50.7 (8.6)	62.0 (8.8)	30.6**	0.76	2.16	1.30	.40
D	45.5 (6.9)	48.4 (6.8)	63.1 (10.4)	42.6**	0.43	2.00	1.68	.48
AI	44.4 (6.3)	51.8 (11.6)	57.1 (8.8)	11.7**	0.79	1.65	0.52	.20
IE	43.5 (4.9)	49.9 (7.1)	64.9 (11.0)	51.0**	1.06	2.51	1.61	.52
DA	43.4 (5.0)	49.7 (7.9)	63.1 (9.8)	45.3**	0.97	2.54	1.50	.49
DIS	45.4 (4.4)	50.6 (7.6)	66.4 (10.1)	56.0**	0.85	2.72	1.78	.55
SC	46.2 (4.0)	53.4 (10.9)	63.1 (15.6)	17.8**	0.88	1.49	0.72	.28
DSB	45.3 (1.9)	47.9 (5.5)	58.5 (19.1)	13.3**	0.64	0.98	0.76	.22
ISR	44.9 (5.4)	50.8 (8.9)	65.3 (10.0)	44.3**	0.80	2.53	1.52	.49
TSB	44.7 (3.1)	49.7 (7.9)	57.6 (11.3)	17.4**	0.84	1.56	0.82	.27

Note. TSI = Trauma Symptom Inventory; PTSD = posttraumatic stress disorder; SA = sexually assaulted women; ATR = Atypical Response; RL = Response Level; INC = Inconsistency; AA = Anxious Arousal; D = Depression; AI = Anger/Irritability; IE = Intrusive Experiences; DA = Defensive Avoidance; DIS = Dissociation; SC = Sexual Concerns; DSB = Dysfunctional Sexual Behavior; ISR = Impaired Self-Reference; TSB = Tension Reduction Behavior. *N* = 104 for validity scale comparisons and *N* = 96 for clinical scale comparisons. Means and standard deviations are represented as *T* scores; *F* ratios based on raw scores. *d*1 = Cohen's *d* for control group versus sexually assaulted women without PTSD; *d*2 = Cohen's *d* for control group versus sexually assaulted women with PTSD; *d*3 = Cohen's *d* for sexually assaulted women with and without PTSD.

\**p* ≤ .01. \*\**p* ≤ .001.

$F[20, 168] = 7.03, p < .001$ ; MMPI-2 Clinical: Wilks's  $\lambda = .35, F[20, 168] = 5.86, p < .001$ ; MMPI-2 RC: Wilks's  $\lambda = .38, F[18, 170] = 5.89, p < .001$ . Group differences on individual scales, and the interrelationship of scales, will be discussed below. Medium effect sizes (e.g.,  $d > .50$ ) were interpreted as meaningful differences between the groups (Cohen, 1988).

### Group Comparison of TSI and MMPI-2 Validity Scales

In comparing the three groups, *F* and *F*<sub>B</sub> demonstrated medium to large effects across groups. In contrast, *F*<sub>p</sub>, which showed a small effect size ( $d_1 = .22$ ) between the control group and women who had a history of SA but did not screen positive for PTSD, had a medium to large effect size in group comparisons between sexually assaulted women who screened positive for PTSD and those who did not ( $d_2 = .85$  and  $d_3 = .59$ ). With regard to the TSI ATR, there was a small to medium effect size between controls and women with a history of SA who did not screen positive for PTSD ( $d_1 = .44$ ) and a medium to large effect size between women who did not screen positive for PTSD either with or without a history of SA and the group of women who screened positive for PTSD ( $d_3 = .87$  and  $d_2 = 1.12$ ). As shown in Tables 2 and 3, having experienced an SA and

screening positive for PTSD had medium to large effect on the TSI ATR scale and the MMPI-2 *F* and *F*<sub>B</sub> scales. In contrast, mean differences between controls and women who had a history of SA were in the small range for *F*<sub>p</sub> and *F*<sub>B</sub>. On the other hand, among the women with SA histories, screening positive for PTSD resulted in a large effect size for *F*<sub>B</sub>, but only a medium effect size for *F*<sub>p</sub>. This suggests that ATR, *F*, *F*<sub>B</sub>, and *F*<sub>B</sub> are more sensitive to PTSD diagnosis than is *F*<sub>p</sub> independent of any attempt to respond in a noncredible fashion to the instrument.

### Relationship Between TSI and MMPI-2 Scales

Table 4 contains the zero-order correlation between the MMPI-2 Clinical, RC, and PK scales and the TSI scales. TSI AA was most highly correlated with MMPI-2 Clinical Scale 7 (.74) and this correlation was not significantly different from the correlations between AA and MMPI-2 Clinical Scale 8 (.72), Scale 2 (.71), Scale 1 (.66), and MMPI-2 RCd (.70; *Z* scores for comparisons of overlapping correlations coefficients were 0.65, 0.76, 1.64, and 1.34, respectively, all *ps* > .05). TSI D was most highly correlated with MMPI-2 RCd (.82), which was not significantly higher than correlations with MMPI-2 PK (.81, *Z* = 0.28, *p* > .05), CS8 (.77, *Z* = 1.56, *p* > .05), or CS2 (.76, *Z* = 1.76, *p* > .05) but was significantly higher than the correlations



**Table 4.** TSI and MMPI-2 Raw Score Correlates

MMPI-2 Scale	TSI Scale									
	AA	D	AI	IE	DA	DIS	SC	DSB	ISR	TSB
<b>Clinical</b>										
CS1	.66**	.64**	.53**	.55**	.52**	.71**	.51**	.33**	.63**	.42**
CS2	.71**	.76**	.43**	.52**	.57**	.70**	.47**	.29**	.68**	.43**
CS3	.57**	.58**	.27*	.50**	.46**	.57**	.41**	.35**	.50**	.33**
CS4	.63**	.72**	.49**	.54**	.59**	.65**	.55**	.49**	.65**	.54**
CS5	-.09	.01	-.10	.00	.03	-.15	-.09	.03	-.08	.00
CS6	.54**	.61**	.33**	.44**	.47**	.55**	.40**	.32**	.52**	.40**
CS7	.74**	.76**	.57**	.60**	.65**	.77**	.64**	.40**	.77**	.58**
CS8	.72**	.77**	.57**	.64**	.67**	.82**	.62**	.46**	.75**	.58**
CS9	.34**	.22	.44**	.30**	.26*	.46**	.30**	.08	.36**	.31**
CS0	.46**	.52**	.38**	.30**	.38**	.45**	.38**	.27*	.50**	.40**
<b>Restructured</b>										
RCd	.70**	.82**	.51**	.49**	.56**	.71**	.58**	.38**	.76**	.51**
RC1	.61**	.58**	.44**	.48**	.46**	.62**	.45**	.37**	.56**	.40**
RC2	.57**	.71**	.36**	.44**	.47**	.58**	.38**	.33**	.60**	.40**
RC3	.32**	.33**	.46**	.26*	.31**	.34**	.48**	.39**	.39**	.43**
RC4	.41**	.44**	.42**	.46**	.42**	.52**	.39**	.36**	.46**	.31**
RC6	.40**	.48**	.39**	.48**	.48**	.58**	.50**	.41**	.49**	.51**
RC7	.62**	.58**	.63**	.48**	.52**	.60**	.60**	.32**	.65**	.53**
RC8	.49**	.48**	.39**	.48**	.46**	.67**	.51**	.30**	.56**	.37**
RC9	.18	.10	.37**	.22	.19	.29**	.31**	.11	.24	.22
PK	.73**	.81**	.63**	.62**	.67**	.80**	.65**	.42**	.79**	.60**

Note. TSI = Trauma Symptom Inventory; MMPI-2 = Minnesota Multiphasic Personality Inventory-2. N = 96.

\* $p \leq .01$ . \*\* $p \leq .001$ .

with CS7 (.76,  $Z = 2.32$ ,  $p < .05$ ) as well as RC2 (.71,  $Z = 2.74$ ,  $p < .01$ ). TSI scale Anger/Irritability was most highly correlated with MMPI-2 PK (.63), which was very close to the relationship with RC7 (.63) but significantly higher than the correlations with MMPI-2 CS7 (.57,  $Z = 2.11$ ,  $p < .05$ ) and 8 (.57,  $Z = 1.95$ ,  $p = .05$ ). Intrusive Experiences was most highly correlated with CS8 (.64) and this did not differ statistically from its correlation with PK, CS7, CS1, CS2, or CS3 ( $Z = 0.56, 0.60, 0.55, 1.94$ , and  $1.84$ , respectively, all  $ps > .05$ ) but did differ from the next highest correlation with RCd (.49,  $Z = 3.38$ ,  $p < .001$ ). TSI Defensive Avoidance correlated .67 with both PK and CS8, and these correlations were not significantly different from the correlations with CS7 (.65,  $Z = 0.59$ ), CS4 (.59,  $Z = 1.53$ ), or RC2 (.62,  $Z = 1.70$ ), but were different from the next highest correlation, with RCd (.56,  $Z = 2.61$ ,  $p < .05$ ). TSI Dissociation was highly correlated with both CS8 (.82) and PK (.80), and these relationships were significantly higher than its correlations with RCd and RC8 (.71,  $Z = 3.32$  and .67,  $Z = 3.67$ , respectively, both  $ps < .001$ ). Sexual Concerns correlated most highly with CS7 (.64), PK (.65), and RC7 (.60), whereas Dysfunctional Sexual Behaviors correlated most highly with CS4 (.49), though this was not significantly higher than the correlations with CS8, PK, RC6, CS7, RC3, RCd, CS3, or CS1 ( $Z = 0.49, 1.00, 0.93,$

$1.28, 1.01, 1.60, 1.59$ , and  $1.81$ , respectively). Finally, Tension Reducing Behavior correlated most highly with PK (.60) and .58 with CS7, CS8, RC7, and RC6.

### Relationship Between the TSI and the PDS Subscales

The PDS yields a total score as well as subscale scores associated with the *DSM-IV* Criterion B—re-experiencing, Criterion C—avoidance, and Criterion D—arousal. The TSI generally produced good convergent validity with conceptually related PDS subscales; however, the discriminant validity of TSI scales was less than desired (see Table 5). For example, the highest correlation with Anxious Arousal was PDS Arousal (.64) and Intrusive Experiences was most highly correlated with PDS Re-experiencing (.69). On the other hand, although Defensive Avoidance was correlated .63 with PDS Avoidance, this was not significantly different from its correlation with PDS Re-experiencing (.64,  $Z = 0.23$ ,  $p > .05$ ). Moreover, the highest correlation for PDS Avoidance was with TSI Depression (.76). PDS Arousal was most highly correlated with TSI Dissociation (.75) followed closely by TSI Depression (.73). Indeed, the highest correlation for any TSI scale and total PDS score was for Depression (.79).

**Table 5.** Zero-Order Correlates of TSI and MMPI-2 With PDS

Measure	PDS			
	Total	Re-experience	Avoidance	Arousal
<b>TSI</b>				
AA	.65**	.58**	.57**	.64**
D	.79**	.67**	.76**	.73**
AI	.45**	.31**	.44**	.47**
IE	.67**	.69**	.62**	.55**
DA	.67**	.64**	.63**	.57**
DIS	.75**	.63**	.67**	.75**
SC	.52**	.43**	.49**	.50**
DSB	.43**	.50**	.38**	.34**
ISR	.67**	.56**	.63**	.63**
TRB	.47**	.46**	.41**	.42**
<b>MMPI-2</b>				
CS1	.63**	.57**	.60**	.56**
CS2	.71**	.61**	.70**	.63**
CS3	.61**	.62**	.54**	.53**
CS4	.69**	.58**	.67**	.62**
CS5	-.03	.04	.00	-.10
CS6	.55**	.48**	.51**	.51**
CS7	.69**	.58**	.68**	.61**
CS8	.72**	.62**	.68**	.66**
CS9	.12	.02	.06	.23
CS0	.48**	.39**	.52**	.37**
RCd	.64**	.52**	.65**	.57**
RC1	.58**	.57**	.54**	.49**
RC2	.68**	.58**	.67**	.58**
RC3	.27*	.16	.29*	.26*
RC4	.42**	.32**	.42**	.40**
RC6	.48**	.42**	.41**	.49**
RC7	.47**	.36**	.50**	.40**
RC8	.39**	.33**	.36**	.38**
RC9	-.05	.11	-.07	.03
PK	.72**	.57**	.72**	.64**

Note. PDS = Posttraumatic Diagnostic Scale; TSI = Trauma Symptom Inventory; MMPI-2 = Minnesota Multiphasic Personality Inventory-2.  $N = 90$ .

\* $p \leq .01$ ; \*\* $p \leq .001$ .

### Relationship Between the MMPI-2 and the PDS Subscales

Among the MMPI-2 Clinical Scales, total PDS score was most highly correlated with CS8 (.72) followed by CS7 (.69) and CS4 (.69; see Table 5). The corresponding MMPI-2 RC scales were correlated with PDS total score RC8 (.39), RC7 (.47), and RC4 (.42). In comparison, the MMPI-2 RC scales most highly correlated with PDS total score were RC2 (.68) and RCd (.64). RC7 correlated with PDS Avoidance .50, but only .36 and .40 with PDS Re-experiencing and Arousal, respectively ( $Z$  for differences between correlations was 2.67,  $p < .05$  and 1.62,  $p > .05$ ,

respectively). The PK scale correlated with PDS total score .72 and most highly with the avoidance subscale (.72).

### Group Comparisons of TSI and MMPI-2 Across Women With and Without PTSD

Comparison of the TSI clinical scales between women with and without SA histories who did not screen positive for PTSD ( $d1$ , Table 3) revealed large effect sizes for IE, DA, DIS, SC, ISR, and TSB. When women with SA histories and PTSD were compared with women with a history of SA but who did not screen positive for PTSD ( $d3$ , Table 3), the majority of the TSI clinical scales demonstrated large effect sizes. The exception was AI, which produced only a medium effect size ( $d = .52$ ).

There were large effects of PTSD diagnosis and small to medium effects of history of SA on the MMPI-2 Clinical scales (see Table 2). In comparison, there was a large effect of both history of SA and PTSD status on the PK scale. Relative to the CS and PK scales, the MMPI-2 RC scales demonstrated more variable effect sizes with regard to the impact of reporting a history of SA. For example, there was a large effect size for RC7, RC4, and RC1 between the control group and the women who reported a history of SA without PTSD. However, the mean scores for the women with SA fell well within the nonclinical range and in the case of RC7 fell at the mean for the normative group (49.6) suggesting that the control women were better adjusted than the general population (see Tables 2 and 3).

### Incremental Validity of the TSI and MMPI-2 in Prediction of PTSD Status

To examine the relative contribution of the subscales of the TSI and MMPI-2 scales in the prediction of PTSD diagnosis, we ran two logistic regression analyses with PTSD status, as determined by the PDS, serving as the dependent variable. Our sample size did not allow us to examine the entire set of MMPI and TSI scales as potential predictors, so we examined the incremental validity of the five TSI scales with highest correlations with the PDS total score in comparison with the set of the five MMPI-2 RC scales with the highest PDS score and the PK scale. The RC scales were chosen because they were recently found to have enhanced construct validity and improved clinical utility over the clinical scales in the assessment of PTSD in combat veteran (Wolf et al., 2008). PK was also included in the comparison because in the same study PK added incrementally to both the MMPI-2 CS and RC scales (Wolf et al., 2008) In the first analysis, the MMPI-2 RC Scales RCd, RC1, RC2, RC6, and RC7 were entered as a block, followed by the PK scale, and then finally by the five TSI scales that showed the strongest relationship with PTSD

(D, IE, DA, DIS, and ISR) as a third block. In the second analysis, the five TSI scales were entered first, and the five MMPI-2 RC scales and PK were entered second and third, respectively. In the first analysis, chi-square was significant for the Block of MMPI-2 RC scales ( $\chi^2 = 51.30$ ,  $df = 5$ ,  $p < .001$ ) correctly classifying 89.6% of the women with PTSD. The addition of the PK scale did not add significantly to the prediction ( $\chi^2 = 1.49$ ,  $df = 1$ ,  $p > .05$ ). The block of TSI scales added significantly to the MMPI-2 scales resulting in an additional 3.1% correct classification ( $\chi^2 = 29.37$ ,  $df = 5$ ,  $p < .001$ ). When the order of entry was reversed, and the TSI scales were entered first, the resulting correct classification was 89.6% ( $\chi^2 = 71.08$ ,  $df = 5$ ,  $p < .001$ ) and the MMPI-2 RC scales and PK did not add significantly to the TSI scales ( $\chi^2 = 9.94$ ,  $df = 5$ ,  $p < .10$  for RC scales and  $\chi^2 = 1.14$ ,  $df = 1$ ,  $p > .05$  for PK). The MMPI-2 RC and TSI scales performed equally well in predicting PTSD status by themselves, with both working at close to 90% accuracy. Whereas the TSI scales significantly added to prediction over and above the MMPI-2 RC scales, this was not the case for the MMPI-2 RC scales. This suggests that the TSI scales were more strongly and independently associated with PTSD status than the RC scales. The fact that the two had identical prediction rates, however, suggests that this difference may not be of practical significance.<sup>1</sup> When considering individual scales in prediction of PTSD status, only the MMPI-2 RC2 scale ( $B = -.69$ , Wald = 6.79,  $p < .01$ ) and TSI Dissociation scale ( $B = -.46$ , Wald = 4.22,  $p < .05$ ) emerged as independent predictors of PTSD status. The fact that only these two scales emerged as independent predictors is likely because of overlap between the predictors in the model.

## Discussion

The TSI has become one of the most frequently administered self-report instruments for the assessment of PTSD in clinical practice despite there being limited information on the validity and utility of the instrument across a range of trauma exposed populations (Elhai, Gray, Kashdan, et al., 2005). To address the gaps in the literature and examine the performance of the TSI in groups of female veterans receiving care through a Comprehensive Women's Health Care Clinic, the TSI was compared with the MMPI-2 in the ability to predict PTSD diagnosis in women with and without a history of sexual assault. Although both the TSI and the MMPI-2 were effective in identifying PDS-defined PTSD in women with histories of sexual assault, the TSI for the most part provided a more focused and specific assessment of PTSD as evidenced by the correlations between the TSI clinical scales and conceptually related PDS subscales. The MMPI-2 provided a broader band measure of psychopathology and the RC scales provided more discriminantly

valid information than did the clinical scales. Finally, consistent with others (see recent review by Sellbom & Bagby, 2008) the TSI validity scales were relatively ineffective in identifying individuals who responded either carelessly or in a noncredible manner to the MMPI-2.

In the current study, the TSI was found to add incrementally to the MMPI-2 in prediction of PTSD in women with histories of sexual assault. The TSI subscales displayed good convergent validity with the PDS subscales corresponding to the *DSM-IV* PTSD factors, re-experiencing, avoidance, and arousal. However, the TSI subscales displayed less favorable discriminant validity in that conceptually unrelated TSI scales were strongly correlated with PDS subscales where correlations of such magnitude would not be expected. For example, TSI Depression was more strongly correlated with PDS Avoidance than TSI Defensive Avoidance or Dissociation. Furthermore, TSI Depression correlated .73 with PDS Arousal whereas TSI Anxious Arousal correlated .64 with PDS Arousal. The MMPI-2 clinical scales displayed a similar pattern of convergent correlations in that clinical scales that were previously shown to be associated with PTSD diagnoses (CS2, CS7, and CS8) were strongly associated with PDS total score and subscale scores (Follette, Naugle, & Follette, 1997; Lyons & Wheeler-Cox, 1999; Penk, Rierdan, Losardo, & Robinowitz, 2005). The MMPI-2 RC scales displayed improved discriminant validity in comparison with the parent MMPI-2 clinical scales in that scales conceptually unrelated to PTSD such as RC4 and RC8, measures of antisocial behaviors and aberrant experiences respectively, were less strongly associated with PDS scales than their parent clinical scales. RCd, a measure of subjective distress, misery, and unhappiness was the second most highly correlated MMPI-2 RC scale with PDS total score and with the Avoidance and Arousal subscales. Similar to the TSI Depression scale, RC2 had the highest correlation with all PDS scales. The more conceptually related RC scale, RC7, dysfunctional negative emotions, was only modestly correlated with PDS scales in this sample. The modest correlation of RC7 with PTSD diagnosis is unexpected and runs counter to previous findings where the RC7 scale added incrementally in the prediction of PTSD in a sample of non-compensation seeking male veterans (Arbisi, McNulty, & Ben-Porath, 2004). The modest relationship between RC7 and PTSD diagnosis in this sample of women with sexual assault histories requires further investigation and may suggest gender differences in the expression of PTSD after exposure to trauma.

Overall, both instruments appear to capture the distress, dysphoria, and anhedonia associated with the internalized subtype of PTSD, although the TSI appears to add a modest incremental improvement over the MMPI-2 in the specific prediction of PTSD diagnosis. Of note, both instruments

alone were able to correctly classify the same number of individuals. When used in combination, the TSI added incrementally to the MMPI-2 in correctly classifying an additional 3.1% of the sample. If arriving at a PTSD diagnosis is the purpose of the evaluation, the modest increase in correct classification represented by the combined administration of the two instruments will outweigh the added cost in increased patient time and clinician effort in administering, scoring, and interpreting both instruments.

Although the TSI contains validity scales to assess inconsistent responding, defensive responding, and over-reporting, as with earlier studies we found that the TSI scales ATR, RL, and INC were only modestly correlated with comparable scales on the MMPI-2 ( $F$ ,  $F_B$ ,  $F_p$ ,  $L$ ,  $K$ , and  $VRIN$ ). Based on the current findings as well as earlier research, it is strongly recommended that the TSI not be used as a standalone measure to assess PTSD especially when there are secondary gain or compensation factors in play (Sellbom & Bagby, 2008). Of note, the mean score on the FBS for the group of women who screened positive for PTSD was a  $T$  score of 68.3 compared with a  $T$  score of 50.6 for the control women. The observation that the FBS was significantly elevated in the women who screened positive for PTSD is consistent with earlier findings regarding the FBS in psychiatric settings and suggests that the FBS may be more sensitive to genuine PTSD than  $F_p$  (Arbisi, Ben-Porath, & McNulty, 2006; Rogers, Sewell, Martin, & Vitacco, 2003). The current findings support the recommendation that the FBS should not be used to detect noncredible presentation of PTSD outside of a clinical neuropsychological context where the claim of PTSD is associated with cognitive dysfunction or mild head injury.

Mean differences in TSI scale scores across the groups were large and in the direction of scale elevation increasing from controls to women with sexual assault histories who screened positive for PTSD on the PDS. Generally, large effect sizes were found between the control group (women without histories of sexual assault) and women with histories of sexual assault without PTSD. However, the mean score across all clinical scales of the TSI for the control women fell half a standard deviation below the mean, whereas the women with a history of sexual assault but without PTSD fell at the mean on the TSI clinical scales. The same pattern held for the MMPI-2 with the exception of scales associated with health concerns and somatic preoccupation (CS1, RC1, and Health Concerns Scale) where the women with histories of sexual assault without PTSD fell half a standard deviation above the mean. This finding may reflect the observation that sexual assault survivors regardless of PTSD diagnosis develop an awareness of physical and somatic cues and sensations (Polusny & Arbisi, 2006).

There were a number of aspects of the study design that could limit the generalizability of these findings. First, the sample was drawn from women who were seeking medical treatment at a large tertiary care VAMC and who agreed to participate in the study. Thus, these findings may not generalize to nonveteran populations or to samples of women who present for psychological treatment who have histories of sexual assault. Also, information regarding conditions other than PTSD was not available from the participants. Therefore, the relative discriminant validity of the TSI in identifying PTSD from other conditions was not addressed. Further, there were no conceptually related criteria for several of the TSI scales, including Sexual Concerns, Dysfunctional Sexual Behavior, Impaired Self Reference and Tension Reduction Behavior against which to assess the convergent validity of these scales. Of note, in relationship to the MMPI-2 scales, Dysfunctional Sexual Behaviors appears to assess a relatively independent domain in contrast to Impaired Self Reference, which is strongly related to MMPI-2 RCd and therefore appears to measure general distress and unhappiness. The sample size of the present study ( $N = 96$  for most statistics, with a group size of 25 in some group comparisons) limited the scope of analyses used and is sufficient to detect only moderate ( $r > .30$ ) relationships with correlation coefficients and large effect sizes ( $d > .80$ ) with three group comparisons with a power of .80 or better (Cohen, 1988). Thus, it is important for results to be replicated with larger independent samples.

In sum, both the TSI and the MMPI-2 appeared to identify women with sexual assault histories who met criteria for PTSD. MMPI-2 scales associated with demoralization, anhedonia, somatic concerns, persecutory ideation, and unusual thoughts as well as the PK scale demonstrated the largest group differences between women with and without PTSD. The TSI subscales, depression, intrusive experiences, defensive avoidance, dissociations, and impaired self-reference had the largest mean group differences between women with and without PTSD consistent with the relationships between those subscales and the DSM-IV PTSD criteria. Further the TSI made a modest, but significant incremental contribution in identifying PTSD among women with histories of sexual maltreatment. These findings provide support for the use of both the MMPI-2 and the TSI in the assessment of PTSD in women who report histories of sexual assault.

#### **Declaration of Conflicting Interests**

The author(s) declared no conflicts of interest with respect to the authorship and/or publication of this article.

#### **Funding**

The author(s) disclosed receipt of the following financial support for the research and/or authorship of this article: A grant from the



University of Minnesota Press awarded to the first two authors provided funds to compensate participants.

## Note

1. We also examined if inclusion of the scales from the TSI and the MMPI-2 with the next strongest association with PTSD would affect model results. To do so, we first examined if the scales with the next strongest associations with PTSD were significantly different in their associations with PTSD relative to the scales included in the regression model. The difference between the correlations of the TSI Sexual Concerns subscale and PDS was not significantly different from other TSI variables included in the model (e.g., Fisher's  $Z$  for difference from the correlation between TSI Intrusive Experiences was 1.55,  $p = .12$ ). Similarly, the correlations of RC8 and RC4 were not statistically distinct from the lower correlations of predictors that were included (e.g., Fisher's  $Z$  for the difference between correlations of PDS and RC4 vs. RC7 = .41,  $p = .68$ ). To explore whether inclusion of these other variables would change results, we reran the logistic regression including these scales (TSI Sexual Concerns and MMPI-2 RC4 and RC8) Results were similar to those reported here, with the TSI scales adding significant variance to prediction over MMPI RC scales but not the reverse.

## References

- Arbisi, P. A. (2005). Use of the MMPI-2 in personal injury and disability evaluations. In J. N. Butcher (Ed.), *MMPI-2: A practitioner's guide* (pp. 407-442). Washington, DC: American Psychological Association.
- Arbisi, P. A., Ben-Porath, Y. S., & McNulty, J. (2006). The ability of the MMPI-2 to detect feigned PTSD within the context of compensation seeking. *Psychological Services, 3*, 249-261.
- Arbisi, P. A., McNulty, J. L., & Ben-Porath, Y. S. (2004, July/August). *Contribution of the MMPI-2 Restructured Clinical (RC) scales to the assessment of PTSD in veterans*. Paper presented at the 112th Annual Convention of the American Psychological Association, Honolulu, HI.
- Archer, R. P., Buffington-Vollum, J. K., Stendy, R. V., & Handel, R. W. (2006). A survey of psychological test use patterns among forensic psychologists. *Journal of Personality Assessment, 87*, 84-94.
- Ben-Porath, Y. S., & Waller, N. G. (1992). "Normal" personality inventories in clinical assessment: General requirements and the potential for using the NEO Personality Inventory. *Psychological Assessment, 4*, 14-19.
- Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Klauminzer, G., Charney, D. S., & Keane, T. M. (1990). A clinician ratings scale for assessing current and lifetime PTSD: The CAPS-1. *Behavior Therapist, 13*, 187-188.
- Briere, J. (1995). *Trauma Symptom Inventory professional manual*. Odessa, FL: Psychological Assessment Resources.
- Briere, J., Elliott, D. M., Harris, K., & Cotman, A. (1995). Trauma Symptom Inventory: Psychometrics and association with childhood and adult victimization in clinical samples. *Journal of Interpersonal Violence, 10*, 387-401.
- Butcher, J. N., Graham, J. R., Ben-Porath, Y. S., Tellegen, A., Dahlstrom, W. G., & Kaemmer, B. (2001). *MMPI-2: Manual for administration, scoring, and interpretation* (Revised ed.). Minneapolis: University of Minnesota Press.
- Camara, W. J., Nathan, J. S., & Puente, A. E. (2000). Psychological test usage: Implications in professional psychology. *Professional Psychology: Research and Practice, 31*, 141-154.
- Carmody, D. P., & Crossman, A. M. (2005). Youth deception: Malingering traumatic stress. *Journal of Forensic Psychiatry & Psychology, 16*, 477-493.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.
- Edens, J. F., Otto, R. K., & Dwyer, T. J. (1998). Susceptibility of the Trauma Symptom Inventory to malingering. *Journal of Personality Assessment, 71*, 379-392.
- Efendov, A. A., Sellbom, M., & Bagby, R. M. (2008). The utility and comparative incremental validity of the MMPI-2 and Trauma Symptom Inventory validity scales in the detection of feigned PTSD. *Psychological Assessment, 20*, 317-326.
- Elhai, J. D., Butcher, J. J., Gray, M. J., Jacobs, G. A., Fricker-Elhai, A. E., North, T. C., . . . Arbisi, P. (2007). Varying cautionary instructions, monetary incentives, and comorbid diagnostic training in malingering psychopathology research. *Journal of Personality Assessment, 88*, 328-337.
- Elhai, J. D., Gray, M. J., Kashdan, T. B., & Franklin, C. L. (2005). Which instruments are most commonly used to assess traumatic event exposure and posttraumatic effects? A survey of traumatic stress professionals. *Journal of Traumatic Stress, 18*, 541-545.
- Elhai, J. D., Gray, M. J., Naifeh, J. A., Butcher, J. J., Davis, J. L., Falsetti, S. A., & Best, C. L. (2005). Utility of the trauma symptom inventory's atypical response scale in detecting malingered post-traumatic stress disorder. *Assessment, 12*, 210-219.
- Foa, E. B. (1995). *The Posttraumatic Diagnostic Scale (PDS)*. Minneapolis, MN: National Computer Systems.
- Foa, E. B., Cashman, L., Jaycox, L., & Perry, K. (1997). The validation of a self-report measure of posttraumatic stress disorder: The posttraumatic diagnostic scale. *Psychological Assessment, 9*, 445-451.
- Follette, W. C., Naugle, A. E., & Follette, V. M. (1997). MMPI-2 profiles of adult women with child sexual abuse histories: Cluster-analytic findings. *Journal of Consulting and Clinical Psychology, 65*, 858-866.
- Graham, J. R. (2006). *MMPI-2: Assessing personality and psychopathology* (4th ed.). New York, NY: Oxford University Press.
- Greene, R. L. (2000). *The MMPI-2/MMPI: An interpretive manual* (2nd ed.). Needham Heights, MA: Allyn & Bacon.
- Griffin, M. G., Uhlmansiek, M. H., Resick, P. A., & Mechanic, M. B. (2004). Comparison of the Posttraumatic Stress Disorder Scale versus the Clinician-Administered Posttraumatic Stress Disorder Scale in domestic violence survivors. *Journal of Traumatic Stress, 17*, 497-503.



- Guriel, J., Yanez, Y. T., Fremouw, W., Shreve-Neiger, A., Ware, L., Filcheck, H., & Farr, C. (2004). Impact of coaching on malingered posttraumatic stress symptoms on the M-Fast and the TSI. *Journal of Forensic Psychology Practice, 4*, 37-56.
- Guriel-Tennant, J., & Fremouw, W. (2006). Impact of trauma history and coaching on malingering of posttraumatic stress disorder using the PAI, TSI, and M-FAST. *Journal of Forensic Psychiatry & Psychology, 17*, 577-592.
- Handel, R. W., & Archer, R. P. (2008). An investigation of the psychometric properties of the MMPI-2 Restructured Clinical (RC) Scales with mental health inpatients. *Journal of Personality Assessment, 90*, 239-249.
- Haynes, S. N., & Lench, H. C. (2003). Incremental validity of new clinical assessment measures. *Psychological Assessment, 15*, 456-466.
- Kamphuis, J. H., Arbisi, P. A., Ben-Porath, Y. S., & McNulty, J. L. (2008). Detecting comorbid Axis-II status among inpatients using the MMPI-2 Restructured Clinical Scales. *European Journal of Psychological Assessment, 24*, 157-164.
- Koss, M. P., & Gidycz, C. (1985). Sexual Experiences Survey: Reliability and validity. *Journal of Consulting and Clinical Psychology, 53*, 422-423.
- Koss, M. P., & Oros, C. J. (1982). Sexual Experiences Survey: A research instrument investigating sexual aggression and victimization. *Journal of Consulting and Clinical Psychology, 50*, 455-457.
- Lyons, J. A., & Wheeler-Cox, T. (1999). MMPI, MMPI-2 and PTSD: Overview of scores, scales and profiles. *Journal of Traumatic Stress, 12*, 175-183.
- McDevitt-Murphy, M. E., Weathers, F. W., & Adkins, J. W. (2005). The use of the Trauma Symptom Inventory in the assessment of PTSD symptoms. *Journal of Traumatic Stress, 18*, 63-67.
- Meng, X., Rosenthal, R., & Rubin, D. B. (1992). Comparing correlated correlation coefficients. *Psychological Bulletin, 111*, 172-175.
- Miller, M. W., Kaloupek, D. G., Dillon, A. L., & Keane, T. (2004). Externalizing and Internalizing subtypes of combat-related PTSD: A replication and extension using the PSY-5. *Journal of Abnormal Psychology, 113*, 636-645.
- Miller, M. W., Vogt, D. S., Mozley, S. L., Kaloupek, D. G., & Keane, T. M. (2006). PTSD and substance-related problems: The medicating roles of disconstraint and negative emotionality. *Journal of Abnormal Psychology, 115*, 369-379.
- Nye, E. C., Qualls, C., & Katzman, J. (2006). The Trauma Symptom Inventory: Factors associated with invalid profiles in a sample of combat veterans with post-traumatic stress disorder. *Military Medicine, 171*, 857-860.
- Penk, W. E., Rierdan, J., Losardo, M., & Robinowitz, R. (2005). The MMPI-2 and assessment of posttraumatic stress disorder (PTSD). In J. N. Butcher (Ed.), *MMPI-2: A practitioner's guide* (pp. 121-142). Washington, DC: American Psychological Association.
- Polusny, M., & Arbisi, P. A. (2006). Assessment of psychological distress and disability after sexual assault in adults. In G. Young, A. W. Kane, & K. Nicholson (Eds.), *Psychological knowledge and evidence in court: PTSD, pain, and TBI* (pp. 97-128). New York, NY: Springer.
- Rogers, R., Sewell, K. W., Martin, M. A., & Vitacco, M. J. (2003). Detection of feigned mental disorders: A meta-analysis of the MMPI-2 and malingering. *Assessment, 10*, 160-177.
- Rosen, G. M., Sawchuk, G. N., Atkins, D. C., Brown, M., Price, J. R., & Lees-Haley, P. R. (2006). Risk of false positives when identifying malingered profiles using the Trauma Symptom Inventory. *Journal of Personality Assessment, 86*, 329-333.
- Runtz, M. G., & Roche, D. N. (1999). Validation of the Trauma Symptom Inventory in a Canadian sample of university women. *Child Maltreatment, 4*, 69-80.
- Sellbom, M., & Bagby, R. M. (2008). Response styles on multi-scale inventories. In R. Rogers (Ed.), *Clinical assessment of malingering and deception* (3rd ed., pp. 182-206). New York, NY: Guilford Press.
- Sellbom, M., Ben-Porath, Y. S., & Bagby, R. M. (2008). Personality and psychopathology: Mapping the MMPI-2 Restructured Clinical (RC) Scales onto the five factor model of personality. *Journal of Personality Disorders, 22*, 291-312.
- Simms, L. J., Casillas, A., Clark, L. A., Watson, D., & Doebbeling, B. I. (2005). Psychometric evaluation of the Restructured Clinical Scales of the MMPI-2. *Psychological Assessment, 17*, 345-358.
- Tellegen, A., Ben-Porath, Y. S., McNulty, J. L., Arbisi, P. A., Graham, J. R., & Kaemmer, B. (2003). *The MMPI-2 Restructured Clinical (RC) Scales: Development, validation, and interpretation*. Minneapolis: University of Minnesota Press.
- Tellegen, A., Ben-Porath, Y. S., Sellbom, M., Arbisi, P. A., McNulty, J. L., & Graham, J. R. (2006). Further evidence on the validity of the MMPI-2 Restructured Clinical (RC) scales: Addressing questions raised by Rogers, Sewell, Harrison, and Jordon and Nichols. *Journal of Personality Assessment, 87*, 148-171.
- Wolf, E. J., Miller, M. W., Orazem, R. J., Weierich, M. R., Castillo, D. T., Milford, J., . . . Keane, T. M. (2008). The MMPI-2 Restructured Clinical Scales in the assessment of posttraumatic stress disorder and comorbid disorders. *Psychological Assessment, 20*, 327-340.
- Wyatt, G. E., Lawrence, J., Vodounon, A., & Mickey, M. R. (1992). The Wyatt Sex History Questionnaire: A structured interview for female sexual history taking. *Journal of Child Sexual Abuse, 1*(4), 51-68.