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PSYCHOMETRIC PROPERTIES OF THE EMBEDDED AND STAND-ALONE VERSIONS OF THE MMPI-2 KEANE PTSD SCALE

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This study investigated the comparability of the embedded and stand-alone versions of the Keane Posttraumatic Stress Disorder scale (*PK* scale) of the Minnesota Multiphasic Personality Inventory-2 (MMPI-2). Participants were 123 Vietnam theater veterans, 68 of whom (55%) were diagnosed with war zone-related posttraumatic stress disorder (PTSD). In separate testing sessions scheduled two to three days apart, all participants first completed the full MMPI-2 followed by the 46 *PK* scale items administered in a stand-alone format. Sixty participants completed the stand-alone version again in a third session. In addition, all participants were administered the Structured Clinical Interview for *DSM-III-R* (SCID), including the PTSD module, and completed a number of other questionnaire measures of combat exposure and PTSD. Results indicated that the embedded and stand-alone versions of the MMPI-2 *PK* scale are quite comparable in terms of mean scores, internal consistency, convergent validity, and diagnostic utility. Use of the stand-alone version is indicated for assessment applications in which the full MMPI-2 cannot be administered.

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Questionnaire measures of posttraumatic stress disorder (PTSD) are widely used in clinical and research settings because they are easy to administer and because they provide objective data that can aid in diagnostic formulations and treatment planning (see Litz & Weathers, 1994; Resnick, Kilpatrick, & Lipovsky, 1991). One such measure, the Keane PTSD scale (*PK* scale; Keane, Malloy, & Fairbank, 1984; see Lyons & Keane, 1992) of the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1940) and the Minnesota Multiphasic Personality Inventory-2 (MMPI-2; Butcher, Dahlstrom, Graham, Tellegen,

& Kaemmer, 1989), is an empirically derived scale that has been shown to be a reliable and valid tool for the assessment of PTSD (Blanchard, Wittrock, Kolb, & Gerardi, 1988; Cannon, Bell, Andrews, & Finkelstein, 1987; Hyer et al., 1986; Kenderdine, Phillips, & Scurfield, 1992; Koretzky & Peck, 1990; Kulka et al., 1991; Munley, Bains, Bloem, & Busby, 1995; Orr et al., 1990; Query, Megran, & McDonald, 1986; Watson, Juba, Anderson, & Manifold, 1990; Watson, Kucala, & Manifold, 1986). A significant advantage of the *PK* scale is that it is embedded in the full MMPI and MMPI-2. This permits the concurrent assessment of a broad spectrum of comorbid psychopathology often associated with PTSD. It also provides information about the validity of test responses, which can be useful in evaluating traumatized individuals seeking compensation for PTSD (see Hyer, Fallon, Harrison, & Boudewyns, 1987).

There are situations, however, when lack of time or resources prevents administration of the full MMPI or MMPI-2 or when the focus is exclusively on measuring PTSD. Administering the *PK* scale items in a stand-alone format would be advantageous under these circumstances. For example, a stand-alone version of the *PK* scale (consisting of 49 MMPI items or 46 MMPI-2 items; see Lyons & Keane, 1992) would be well suited for epidemiological surveys or for screening for PTSD in the context of a brief clinical intake assessment.

Preliminary research has demonstrated that the stand-alone version of the *PK* scale from the MMPI is comparable to the embedded version. Lyons and Scotti (1994) found that the two versions yielded nearly identical means and standard deviations and were correlated .90. They also found that 94% of their sample received the same classification as PTSD or non-PTSD when a cutoff of 30 was employed for both versions of the scale.

The present study was designed as a more extensive examination of the psychometric properties of the stand-alone version of the *PK* scale and its comparability with the embedded version. We focused on several issues left unaddressed by Lyons and Scotti (1994). First, we studied the *PK* scale of the MMPI-2 rather than the original *PK* scale of the MMPI. Although the embedded *PK* scales of the MMPI and MMPI-2 have been found to be comparable (Litz et al., 1991), a thorough evaluation of the MMPI-2 *PK* scale has not been conducted. Second, we evaluated the test-retest reliability of the stand-alone version and the internal consistency of both the embedded and stand-alone versions of the *PK* scale. Third, we compared the two versions of the *PK* scale on convergent validity, examining their correlations with other measures of PTSD. Finally, we compared the two versions on diagnostic utility, using an interview-based diagnosis of PTSD as the criterion. Employing signal detection methodology (Kraemer, 1992; see Weathers et al., 1996), we identified the optimally efficient cutoff score on each version of the *PK* scale for predicting a diagnosis of PTSD.

Method

Participants

Participants were 123 Vietnam theater veterans recruited for research participation at the National Center for PTSD in Boston, Massachusetts. Participants ranged in age from 38 to 55 years (M = 43.7 years, SD = 2.7 years). Most were White (73.2%) or African American (22.8%); had at least a high school education (87.8%); were separated, divorced, or never married (67.4%); were unemployed, retired, or disabled (60.2%); and were veterans of the Army (48.0%) or the Marine Corps (29.3%). To assess for PTSD and other Axis I disorders, doctoral-level clinicians administered the Structured Clinical Interview for *DSM-III-R* (SCID; Spitzer, Williams, Gibbon, & First, 1990). All diagnoses were made in accordance with the revised third edition of the Diagnostic and Statistical Manual of mental disorders, (*DSM-III-R*; American Psychiatric Association, 1987) criteria. Of the sample, 68 participants (55.3%) met criteria for current war zone-related PTSD.

On the demographic variables, the PTSD and non-PTSD groups differed significantly only on branch of service, χ^2 (4, N = 122) = 10.04, $p < .05$, with more PTSD participants having served in the Marine Corps (38.8% vs. 18.2%) and more non-PTSD participants having served in the Navy (21.8% vs. 7.5%). With respect to current Axis I

psychopathology, the PTSD group had higher rates of several disorders than did the non-PTSD group, including major depression (54.4% vs. 27.3%), χ^2 (1, N = 123) = 9.18, p < .005; panic disorder (26.5% vs. 7.3%), χ^2 (1, N = 123) = 7.63, p < .01; substance use disorders (30.9% vs. 14.5%), χ^2 (1, N = 123) = 4.50, p < .05; and bipolar disorder not otherwise specified (NOS; 7.4% vs. 0.0%), χ^2 (1, N = 123) = 4.22, p < .05.

Procedure

Testing occurred during three sessions, each two to three days apart. All 123 participants completed the first two sessions, and 60 participants completed the third session. In the first session, participants were administered the SCID; they then filled out several questionnaires including the MMPI-2, the Combat Exposure Scale (CES; Keane et al., 1989), and the Mississippi Scale for Combat-Related PTSD (Mississippi Scale; Keane, Caddell, & Taylor, 1988). In the second session, participants were administered the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1990); they then filled out several more questionnaires, including the stand-alone version of the *PK* scale, the Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979), and the PTSD Checklist (PCL; Weathers, Litz, Herman, Huska, & Keane, 1993). The third session was identical to the second session.

Signal Detection Analyses

Following guidelines outlined by Kraemer (1992), signal detection methods were employed to determine the optimally efficient cutoff scores for predicting a SCID diagnosis of PTSD. Kraemer distinguishes between measures of test performance and test quality. She argues that traditional measures of test performance, such as sensitivity, specificity, positive and negative predictive values, and efficiency, are ambiguous indexes of diagnostic utility because they are uncorrected for chance agreement between test and diagnosis. She advocates instead the use of weighted kappa coefficients as measures of test quality. These quality indexes are calibrated such that a value of 0.00 reflects chance agreement between test and diagnosis, and a value of 1.00 reflects perfect agreement. In the present study, we calculated measures of both test performance and test quality for a wide range of cutoffs on the embedded and stand-alone versions of the *PK* scale. We then used the kappa coefficient reflecting the quality of efficiency to identify the optimally efficient cutoff for each version.

Results

In the analyses that follow, statistical comparisons of the two versions of the *PK* scale involve the embedded version and the first administration of the stand-alone version unless otherwise noted.

Descriptive Statistics, Reliability, and Convergent Validity

As shown in Table 1, the embedded and stand-alone versions had nearly identical means and standard deviations, both in the full sample and within the PTSD and non-PTSD groups. A 3 x 2 (*PK* Scale Version: embedded, first stand-alone, second stand-alone x Diagnostic Group: PTSD, non-PTSD) repeated measures analysis of variance (ANOVA) was conducted on the data from the 60 participants who completed the *PK* scale three

Table 1
Means and Standard Deviations for the Embedded and Stand-Alone Versions of the MMPI-2 PK Scale

	Full sample[a]		PTSD[b]		Non-PTSD[c]	
Version	*M*	*SD*	*M*	*SD*	*M*	*SD*
Embedded *PK* scale	24.2	11.9	30.6	8.9	16.5	10.6
Stand-alone *PK* scale	24.4	12.9	31.5	9.1	15.5	11.4

Note. MMPI-2 = Minnesota Multiphasic Personality Inventory-2; *PK* scale = Keane posttraumatic stress disorder scale; PTSD = posttraumatic stress disorder.
[a]N = 123. [b]n = 68. [c]n = 55.

times. As expected, this analysis revealed a main effect for diagnostic group, F (1, 58) = 32.93, p < .001, but no main effect for *PK* scale version and no interaction of *PK* scale version and diagnostic group.

The Pearson correlation between the embedded and stand-alone versions was quite strong (r = .90), as was the test-retest reliability of the stand-alone version (r = .95). In addition, both versions had excellent internal consistency. For the embedded version, item-scale total correlations ranged from .33 to .74 with an alpha of .95. For the stand-alone version, item-scale total correlations ranged from .38 to .72 with an alpha of .96. As shown in Table 2, both versions correlated moderately with the CES and correlated strongly with the Mississippi Scale, the IES, the PCL and the CAPS.

Table 2
Pearson Correlations Between the Embedded and Stand-Alone Versions of the MMPI-2 PK Scale and Measures of Combat Exposure and PTSD

Measure	Embedded *PK* scale r	Stand-alone *PK* scale r
Combat Exposure Scale	.32	.37
Mississippi Scale	.81	.85
Impact of Event Scale	.65	.71
PTSD Checklist	.77	.83
Clinician-administered PTSD Scale total severity score	.77	.80

Note. All correlations significant at p < .001. MMPI-2 = Minnesota Multiphasic Personality Inventory-2; *PK* scale = Keane posttraumatic stress disorder scale; PTSD = posttraumatic stress disorder.

Diagnostic Utility

As shown in Table 3, the embedded and stand-alone versions of the *PK* scale had very similar levels of diagnostic utility. Although the optimally efficient cutoff score for the two versions differed slightly (26 for embedded vs. 24 for stand-alone), both demonstrated good sensitivity, specificity, and quality of efficiency (as indexed by a kappa coefficient). The stand-alone version had slightly higher diagnostic utility relative to the embedded version.

Discussion

Our data support the use of the stand-alone version of the MMPI-2 *PK* scale for those testing situations that do not require an administration of an MMPI-2. As Lyons and Scotti (1994) observed in their investigation of the MMPI *PK* scale, we found the stand-alone version of the MMPI-2 *PK* scale to be highly comparable to the embedded version of the test. In the present study, the two versions had nearly identical means and standard deviations both in the full sample and in the PTSD and non-PTSD groups separately. In addition, both versions had excellent internal consistency and were quite similar in terms of convergent validity and diagnostic utility. Finally, the stand-alone MMPI-2 *PK* scale was found to have excellent test-retest reliability.

To our knowledge, this is the first study to empirically derive an optimally efficient cutoff score for the MMPI-2 *PK* scale using an interview-based PTSD diagnosis as the criterion. We found that a cutoff score of 26 on the embedded version or 24 on the stand-alone version of the MMPI-2 *PK* scale yielded acceptable diagnostic utility in a sample of male Vietnam combat veterans. These cutoffs are slightly lower than the rationally derived cutoff of 28 recommended by Lyons and Keane (1992). Because optimally efficient cutoff scores on the *PK* scale may vary considerably from one population to another (e.g., Kulka et al., 1991; Watson et al., 1986), the generalizability of the present findings can only be established through cross-validation studies, not only with other samples of combat veterans, but also with other traumatized populations. The diagnostic utility of a questionnaire is directly related to the prevalence or base rate of a disorder in a given population and may also be influenced by factors such as the severity of the disorder, response style, gender, and ethnicity. Until cross-validation studies are available, we recommend that, whenever possible, investigators derive their own local cutoff scores, particularly for assessing populations other than Vietnam combat veterans.

As with any single PTSD test, scores from the stand-alone version of the MMPI-2 *PK* scale should be interpreted with caution. The *PK* scale

Table 3
Diagnostic Utility of the Optimally Efficient Cutoff Scores on the Embedded and Stand-Alone Versions of the MMPI-2 PK Scale

Scale	r_{pb} with diagnosis	Cutoff	Level of test	Sensitivity	Specificity	Efficiency	$\kappa(.5)$
Embedded *PK* scale	.59	26	.48	.72	.82	.76	.53
Stand-alone *PK* scale	.62	24	.56	.82	.76	.80	.59

Note. N = 123, Base Rate = 55%. r_{pb} = Spearman rank point-biserial correlation coefficient representing overall quality; diagnosis = Structured Clinical Interview for *DSM-III-R*-based diagnosis of posttraumatic stress disorder (PTSD); cutoff = optimally efficient cutoff; level of test = proportion of test positives; $\kappa(.5)$ = kappa coefficient representing quality of efficiency.

would be most useful as part of a comprehensive, multimethod assessment battery that provides converging information from multiple indicators of PTSD (see Keane, Wolfe, & Taylor, 1987; Litz & Weathers, 1994). Finally, as Lyons and Scotti (1994) caution, those wishing to use the stand-alone version of the MMPI-2 *PK* scale must first obtain permission from the University of Minnesota Press.

References

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., rev.). Washington, DC: Author.

Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Klauminzer, G., Charney, D. S., & Keane, T. M. (1990). A clinician rating scale for assessing current and lifetime PTSD: The CAPS-1. *The Behavior Therapist, 18*, 187-188.

Blanchard, E. B, Wittrock, D., Kolb, L. C., & Gerardi, R. J. (1988). Cross-validation of a Minnesota Multiphasic Personality Inventory (MMPI) subscale for the assessment of combat-related posttraumatic stress disorder. *Journal of Psychopathology and Behavioral Assessment, 10*, 33-38.

Butcher, J. N., Dahlstrom, W. G., Graham, J. R., Tellegen, A., & Kaemmer, B. (1989). *Minnesota Multiphasic Personality Inventory-2: Manual for administration and scoring.* Minneapolis, MN: University of Minnesota Press.

Cannon, D. S., Bell, W. E., Andrews, R. H., & Finkelstein, A. S. (1987). Correspondence between MMPI PTSD measures and clinical diagnosis. *Journal of Personality Assessment, 51*, 517-521.

Hathaway, S. R., & McKinley, J. C. (1940). A multiphasic personality schedule: I. Construction of the schedule. *Journal of Psychology, 10*, 249-254.

Horowitz, M. J., Wilner, N., & Alvarez, W. (1979). Impact of Event Scale: A measure of subjective stress. *Psychosomatic Medicine, 41*, 209-218.

Hyer, L., Fallon, J. H., Harrison, W. R., & Boudewyns, P. A. (1987). MMPI overreporting by Vietnam combat veterans. *Journal of Clinical Psychology, 43*, 79-83.

Hyer, L., O'Leary, W. C., Saucer, R. T., Blount, J., Harrison, W. R., & Boudewyns, P. A. (1986). Inpatient diagnosis of posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology, 54*, 698-702.

Keane T. M., Caddell, J. M., & Taylor, K. L. (1988). Mississippi Scale for Combat-Related Posttraumatic Stress Disorder: Three studies in reliability and validity. *Journal of Consulting and Clinical Psychology, 56*, 85-90.

Keane, T. M., Fairbank, J. A., Caddell, J. M., Zimering, R. T., Taylor, K. L., & Mora, C. A. (1989). Clinical evaluation of a measure to assess combat exposure. *Psychological Assessment: A Journal of Consulting and Clinical Psychology, 1*, 53-55.

Keane, T. M., Malloy, P. F., & Fairbank, J. A. (1984). Empirical development of an MMPI subscale for the assessment of combat-related posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology, 52*, 888-891.

Keane, T. M., Wolfe, J., & Taylor, K. L. (1987). Posttraumatic stress disorder: Evidence for diagnostic validity and methods of psychological assessment. *Journal of Clinical Psychology, 43*, 32-43.

Kenderdine, S. K., Phillips, E. J., & Scurfield, R. M. (1992). Comparison of the MMPI-PTSD subscale with PTSD and substance abuse patient populations. *Journal of Clinical Psychology, 48*, 136-139.

Koretzky, M. B., & Peck, A. H. (1990). Validation and cross-validation of the PTSD subscale of the MMPI with civilian trauma victims. *Journal of Clinical Psychology, 46*, 297-300.

Kraemer, H. C. (1992). *Evaluating medical tests: Objective and quantitative guidelines.* Newbury Park, CA: Sage.

Kulka, R. A., Schlenger, W. E., Fairbank, J. A., Jordan, B. K., Hough, R. L., Marmar, C. R., & Weiss, D. S. (1991). *Psychological Assessment: A Journal of Consulting and Clinical Psychology, 3*, 547-560.

Litz, B. T., Penk, W. E., Walsh, S., Hyer, L., Blake, D. D., Marx, B., Keane, T. M., & Bitman, D. (1991). Similarities and differences between MMPI and MMPI-2 applications to the assessment of posttraumatic stress disorder. *Journal of Personality Assessment, 57*, 238-253.

Litz, B. T., & Weathers, F. W. (1994). The diagnosis and assessment of post-traumatic stress disorder in adults. In M. B. Williams & J. F. Sommer (Eds.), *Handbook of Post-Traumatic Therapy* (pp. 19-37). Greenwood, CT: Greenwood Press.

Lyons, J. A., & Keane, T. M. (1992). Keane PTSD scale: MMPI and MMPI-2 update. *Journal of Traumatic Stress, 5*, 111-117.

Lyons, J. A., & Scotti, J. R. (1994). Comparability of two administration formats of the Keane Posttraumatic Stress Disorder scale. *Psychological Assessment, 6*, 209-211.

Munley, P. H., Bains, D. S., Bloem, W. D., & Busby, R. M. (1995). Posttraumatic stress disorder and the MMPI-2. *Journal of Traumatic Stress, 8*, 171-178.

Orr, S. P., Claiborn, J. M., Altman, B., Forgue, D. F., de Jong, J. B., Pitman, R. K., & Herz, L. R. (1990). Psychometric profile of posttraumatic stress disorder, anxious, and healthy Vietnam veterans: Correlations with psychophysiologic responses. *Journal of Consulting and Clinical Psychology, 58*, 329-335.

Query, W. T., Megran, J., & McDonald, G. (1986). Applying posttraumatic stress disorder MMPI subscale to World War II POW veterans. *Journal of Clinical Psychology, 42*, 315-317.

Resnick, H. S., Kilpatrick, D. G., & Lipovsky, J. A. (1991). Assessment of rape-related posttraumatic stress disorder: Stressor and symptom dimensions. *Psychological Assessment: A Journal of Consulting and Clinical Psychology, 3*, 561-572.

Spitzer, R. L., Williams, J. B. W., Gibbon, M., & First, M. B. (1990). *Manual for the Structured Clinical Interview for DSM-III-R–Patient Edition (SCID-P)*. Washington, DC: American Psychiatric Press.

Watson, C. G., Juba, M., Anderson, P. E. D., & Manifold, V. (1990). What does the Keane et al. PTSD scale for the MMPI measure? *Journal of Clinical Psychology, 46*, 600-606.

Watson, C. G, Kucala, T., & Manifold, V. (1986). A cross-validation of the Keane and Penk MMPI scales as measures of posttraumatic stress disorder. *Journal of Clinical Psychology, 42*, 727-732.

Weathers, F. W., Litz, B. T., Herman, D. S., Huska, J. A., & Keane, T. M. (1993, October). *The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility*. Paper presented at the annual meeting of the International Society for Traumatic Stress Studies, San Antonio, TX.

Weathers, F. W., Litz, B. T., Keane, T. M., Herman, D. S., Steinberg, H. R., Huska, J. A., & Kraemer, H. C. (1996). The utility of the SCL-90-R for the diagnosis of war-zone-related posttraumatic stress disorder. *Journal of Traumatic Stress, 9*, 111-128.