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Screening for PTSD in Motor Vehicle Accident Survivors Using the PSS-SR and IES*

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The current study compares the total scores of two potential posttraumatic stress disorder (PTSD) screening tools, the Impact of Event Scale (IES) and the PTSD Symptom Scale, Self-Report (PSS-SR), to the Clinician-Administered PTSD Scale (CAPS) in a large sample of motor vehicle accident (MVA) survivors (N = 229, of whom 43% met criteria for PTSD). For the IES using a cutoff score of 27, sensitivity was .91, specificity was .72, and overall correct classification was .80. For the PSS-SR using a cutoff score of 14, sensitivity was .91, specificity was .62, and overall correct classification was .74. Compared to those in studies of other trauma populations, the identified IES cutoff score is somewhat lower for this population of MVA survivors and the identified PSS-SR cutoff score is consistent with previous findings. These data support the use of the IES and the PSS-SR as PTSD screening tools in MVA samples.

According to the National Safety Council (2004), millions of motor vehicle accidents (MVAs) occur each year but only recently have the psychological consequences of MVAs been fully recognized. Norris (1992) has shed some light on the psychological sequelae of MVAs by examining the frequency and impact of 10 potentially traumatic events in a large multisite epidemiological study. Among traumatized individuals in this study, MVAs were found to be a leading cause of posttraumatic stress disorder (PTSD), exceeded only by sexual and physical assaults. Moreover, Norris states that "when both the frequency and severity data were considered together, MVAs emerged as perhaps the single most significant event among those studied" (p. 416). Extrapolating from the rates of trauma and PTSD, Norris estimated that MVAs alone could account for 28 cases of PTSD in every 1,000 adults in the United States.

Given the high prevalence of MVA-related PTSD, tools are needed to identify individuals who have this disorder in psychological/psychiatric settings, as well as in medical and chiropractic settings, where MVA victims often receive treatment for physical problems (e.g., Asmundson, Coons, Taylor, & Katz, 2002). Shrout and colleagues have recommended a two-step approach to identifying PTSD (Shrout, Skodol, & Dohrenwend, 1986). In the first step, individuals are administered self-report measures related to a particular disorder. If a predetermined cutoff score is

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exceeded, a more extensive and time-consuming diagnostic evaluation can be conducted. By administering a self-report measure first to identify cases that are most likely to require additional assessment and possibly treatment, clinicians can efficiently allocate clinical services where they are potentially most needed or refer cases to other health care providers for appropriate clinical services. In the case of MVA survivors, easy to administer self-report screening tools may help to identify individuals in both psychological and medical settings who are suffering serious psychological sequelae of an MVA and increase referrals to effective MVA-PTSD treatment (e.g., Blanchard & Hickling, 2004; Taylor & Koch, 1995).

In populations at high risk for PTSD, psychometrically sound self-report measures have been used to screen for PTSD and cutoff scores have been developed for these populations. For example, Lang and colleagues (Lang, Laffaye, Satz, Dresselhaus, & Stein, 2003) reported on the utility of the PTSD Checklist (PCL-C; Weathers, Litz, Huska, & Keane, 1994) in screening for PTSD among female veterans in a primary care setting. Within a treatment-seeking substance abuse population, a modified version of the PTSD Symptom Scale, Self Report (MPSS-SR; Falsetti, Resnick, Resick, & Kilpatrick, 1993) was used to identify individuals who had PTSD (Coffey, Dansky, Falsetti, Saladin, & Brady, 1998). Still other investigators have examined the psychometric properties of the Impact of Event Scale—Revised (IES-R; Weiss & Marmar, 1997) in a sample of treatment-seeking Vietnam veterans who had PTSD and a sample of veterans in the community (Creamer, Bell, & Failla, 2003).

Most relevant to the current study, Wohlfarth and colleagues (Wohlfarth, van den Brink, Winkel, & ter Smitten, 2003) evaluated two widely used self-report measures of PTSD symptoms, the Impact of Event Scale (IES; Horowitz, Wilner, & Alvarez, 1979) and the PTSD Symptom Scale—Self-Report (PSS-SR; Foa, Riggs, Dancu, & Rothbaum, 1993), as potential screening measures for a population of 79 male and female crime victims. These investigators found that the Dutch versions of both the IES (Brom & Kleber, 1985) and the PSS-SR (Arntz, 1993) performed well as PTSD screeners among crime victims regardless of whether diagnostic criteria from the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (*DSM-IV*; American Psychiatric Association, 1994) or the *International Classification of Diseases*, 10th edition (ICD-10; World Health Organization, 1993) were used as the "gold standard" criterion. Using *DSM-IV* as the diagnostic criterion, a cutoff score of 39 on the IES total score produced sensitivity of .89 and specificity of .96. A cutoff score of 15 on the PSS-SR produced sensitivity of .90 and specificity of .90 (Wohlfarth et al., 2003). Although these findings are encouraging, the results require cross-validation, primarily because of the relatively small sample that was employed.

The current study was designed to address gaps in the research literature and clinical practice by identifying empirically derived cutoff scores for the IES and PSS-SR for the identification of PTSD-positive individuals in clinical populations of MVA survivors. Specifically, this investigation attempts to support Wohlfarth and colleagues' (2003) claim that the IES and PSS-SR perform well as PTSD screeners by replicating their findings in a larger, independent sample of treatment-seeking trauma victims. Because pain is a common issue among MVA survivors (e.g., Asmundson et al., 2002), cutoff scores also were examined as a function of participant pain status.

METHOD

Participants

Recruitment. Participants were selected from a pool of 241 individuals who experienced an MVA at least 1 month before participation (mean time since MVA = 32.0 months, $SD = 54.7$) and called the Motor Vehicle Accident Clinic at the University at Buffalo seeking psychological help. Individuals contacted the project in two ways: participants were referred by heath care professionals (e.g., psychologists, physicians, physical therapists, chiropractors, massage therapists, a university pain service, specialists in rehabilitation) or participants responded to flyers posted in the offices of health care professionals, at community centers, or at the local Department of Motor Vehicles. Individuals

were not compensated for their participation; however, a portion of the individuals entered a psychotherapy clinical trial in which they were paid for follow-up assessments.

PTSD Criterion A. In order to determine whether the MVA met Criterion A for PTSD (American Psychiatric Association, 1994), the method described by Blanchard and Hickling (2004) was used. Participants were asked to rate feelings of fear, helplessness, and danger and perceptions that they might die during the accident using 0–100 scales (where 0 = not *at all* and 100 = extreme). To satisfy Criterion A, participants were required to provide (1) a rating at or above 50 on fear or helplessness (mean fear = 76.0, *SD* = 33.0; mean helplessness = 82.16, *SD* = 29.08) and (2) a rating at or above 50 on perceptions of danger or fear that they might die (mean danger = 72.8, *SD* = 35.2; mean fear of dying = 34.8, *SD* = 40.6).

Outliers. Four participants were excluded because of significant head injuries from the MVA. In addition, as recommended by Tabachnick and Fidell (1996), outliers ($n = 8$) were removed, leaving a final sample of 229 participants. Outliers were defined as a IES or PSS-SR score that was at least 2 *SDs* from its respective group mean (i.e., PTSD-positive group mean or PTSD-negative group mean).

MVA-related pain. Most participants (69%) were suffering from pain that was the result of injuries sustained during the MVA. For an individual to be described as having MVA-related chronic pain, it was required that pain symptoms be attributed to injuries sustained during their MVA and that the pain symptoms had not responded to standard medical treatment after 1 month. In addition, pain caused significant lifestyle limitations, impairment, or significant distress, determined on the basis of behavioral restriction (e.g., inability to work), continued utilization of health care resources for pain relief, or consistent use of pain medication (at least 3 days per week). Individuals who had pain symptoms tended to report musculoskeletal or soft tissue injury (80% of the pain subsample) and to have experienced pain for at least 3 months (68% of the pain subsample).

Final sample. The final sample included 159 women and 70 men ($N = 229$). All participants were between 18 and 79 years of age (mean age = 41.0 yrs, *SD* = 12.4). Within the sample, 193 (84%) were white, 25 (11%) were African American, and 11 (5%) were of another race or ethnicity. Demographic characteristics of the participants and rates of chronic pain are presented in Table 1.

Measures

PTSD measures. Two self-report measures were examined in this study, the PTSD Symptom Scale—Self Report (PSS-SR; Foa et al., 1993) and the Impact of Event Scale (IES; Horowitz et al., 1979). The PSS-SR contains 17 items, reflecting the *DSM-IV* symptoms of PTSD, which are rated on a 4-point Likert scale, ranging from *not at all* to *five or more times/week—almost always*. The highest possible score on the PSS-SR is 51. Foa and associates (1993) evaluated the psychometric properties of the PSS-SR with 46 female rape victims and 72 female nonsexual assault victims, noting that the scale showed high internal consistency ($\alpha = .91$) and good 1-month test-retest reliability ($r = .74$). Convergent validity of the PSS-SR with the IES and State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970) also was demonstrated, with correlations ranging from .52 to .81 (Foa et al., 1993). Items on the PSS-SR were summed to produce a total score. In the current sample, internal consistency, as indexed by Cronbach's coefficient (α), was .94.

The IES contains 15 items that are distributed across two subscales, which assess intrusion (7 items) and avoidance (8 items). The frequency of each item is rated on a 4-point scale: 0 (*not at all*), 1 (*rarely*), 3 (*sometimes*), or 5 (*often*). The highest possible total score on the IES is 75. The IES has been shown to have high internal consistency with alpha coefficients of .78 for the intrusion subscale and .82 for the avoidance subscale in a sample of 66 outpatients (Horowitz et al., 1979). Split-half reliability of the total scale was .86 and the 1-week test-retest reliability was .89 for the intrusion subscale and .79 for the avoidance subscale (Horowitz et al., 1979). More recently, Kopel and Friedman (1997) reported internal consistency

Table 1. Demographic Characteristics for the Sample

	PTSD–Positive ($n = 99$)	PTSD–Negative ($n = 130$)	Total ($N = 229$)
Mean age in years (*SD*)	42.0 (10.0)	40.3 (13.9)	41.0 (12.4)
Gender *n* (%)			
Female *n*	72 (73)	87 (67)	159 (69)
Race *n* (%)			
White	78 (79)	115 (89)	193 (84)
African American	17 (17)	8 (6)	25 (11)
Hispanic	4 (4)	3 (2)	7 (3)
Other races	—	4 (3)	4 (2)
Marital status *n* (%)			
Married/cohabitating	56 (57)	58 (45)	114 (50)
Single	22 (22)	48 (37)	70 (30)
Separated/divorced/widowed	21 (21)	24 (18)	45 (20)
Highest education level attained *n* (%)			
Grades 1–8	1 (1)	—	1 (.4)
Grades 9–12	23 (23)	14 (11)	37 (16)
College, less than bachelor's degree	52 (53)	53 (41)	105 (46)
Four-year degree	13 (13)	30 (23)	43 (19)
Above four-year degree	10 (10)	33 (25)	43 (19)
Current employment *n* (%)			
Full-time	34 (34)	54 (42)	88 (38)
Part-time	12 (12)	28 (21)	40 (18)
Homemaker	7 (7)	6 (5)	13 (6)
Unemployed	43 (43)	42 (32)	85 (37)
Missing	3 (3)	—	3 (1)
Participants with self-reported chronic pain *n* (%)	87 (88)[a]	71 (55)[a]	158 (69)

Note. All participants were motor vehicle accident survivors. Unless otherwise noted, the number of cases for each cell is provided, followed by the associated percentage of sample value (in parentheses). PTSD = posttraumatic stress disorder.
[a]Groups are significantly different, $p \leq .001$.

for the intrusion and avoidance subscales to be .79 and .69, respectively, in a sample of South African police officers. Robbins and Hunt (1996) reported internal consistency of .86 (intrusion subscale) and .73 (avoidance subscale) in a sample of World War II veterans. Items on the IES were summed to produce a total score. In the current sample, internal consistency for the total score, as measured by Cronbach's coefficient (α), was .86. For a recent review on the psychometric properties of the IES, see Joseph (2000).

Current PTSD was diagnosed by using the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995). The CAPS is a structured interview that assesses the 17 symptoms of PTSD identified in *DSM-IV*. The CAPS includes standardized questions to determine the frequency and intensity of PTSD symptoms in the preceding month, using a 5-point Likert scale (e.g., 0 indicates that the symptom does not occur or does not cause distress and 4 indicates that the symptom occurs nearly every day or causes extreme distress and discomfort). The CAPS also includes standardized questions assessing subjective distress and impairment in social and occupational functioning caused by these problems. Probes were added to the interview to determine whether each symptom was attributable to chronic pain. For example, if a patient reported difficulty in sleeping, the clinician assessed whether this symptom was caused by pain. If so, the symptom was not scored on the CAPS. The CAPS has strong psychometric properties (e.g., Weathers, Keane, & Davidson, 2001) and has been shown to be

sensitive to the detection of PTSD in individuals after an MVA (Blanchard et al., 1996). The original CAPS scoring rules were employed in this study. That is, a symptom counted toward a diagnosis of PTSD if it had both a rating equal to or greater than 1 on frequency and a rating equal to or greater than 2 on severity reported by the participant. A diagnosis of PTSD was given if the number of positive symptoms met or exceeded *DSM-IV* criteria and the participant reported distress or interference caused by these symptoms.

The CAPS was administered by advanced clinical and counseling psychology doctoral students who had been extensively trained in its use. The training procedure for the CAPS was adopted from procedures developed for the *Anxiety Disorders Interview Schedule for DSM-IV* (DiNardo, Brown, & Barlow, 1994) and reported by DiNardo and colleagues (DiNardo, Moras, Barlow, Rapee, and Brown, 1993). All CAPS interviews were videotaped; 30% were randomly selected for scoring by a second advanced clinical or counseling psychology doctoral student also extensively trained in its use. PTSD diagnosis interdiagnostician agreement (kappa) was .94.

Procedure

All procedures were reviewed by the University at Buffalo—SUNY Institutional Review Board. After informed consent was obtained, the CAPS was administered to the individual. Each participant returned for a second appointment and completed a self-report battery that included the PSS-SR and the IES.

Analytic Strategy

The relationship between the self-report measures of PTSD symptoms (i.e., the PSS-SR, IES) at various cutoff scores and the categorical interview measure of PTSD (i.e., CAPS diagnosis of PTSD) was assessed through 2 by 2 tables. Sensitivity, specificity, positive and negative prediction, false positive and negative rates, overall correct classification rates, and kappa statistics were calculated from data in the 2 by 2 tables (see Kessel & Zimmerman, 1993, for a complete discussion of calculating and interpreting diagnostic performance variables).

RESULTS

Using the CAPS as a diagnostic tool for PTSD, 43% ($n = 99$) met criteria for current PTSD stemming from an MVA. Mean CAPS total score for individuals who did not meet diagnostic criteria for PTSD was 24.7 ($SD = 18.7$) and the mean CAPS total score for those who did meet criteria for PTSD was 70.1 ($SD = 17.6$). Participants who met criteria for PTSD had higher scores on the IES total score ($M = 45.5$, $SD = 15.1$) when compared to participants who did not meet criteria, $M = 18.9$, $SD = 18.5$; $t(227) = 11.65$, $p < .001$. Likewise, PTSD-positive participants had higher scores on the PSS-SR total score ($M = 29.4$, $SD = 10.5$) than PTSD-negative participants ($M = 12.9$, $SD = 11.1$) $t(227) = 11.33$, $p \leq .001$. No differences were found between male and female participants on the prevalence of PTSD, $\chi^2(1, N = 229) = 0.89$, *ns*, or on the severity of their PTSD symptoms as measured by the CAPS total score (male $M = 40.2$, $SD = 31.7$; female $M = 46.1$, $SD = 46.1$), $F(1, 227) = 2.07$, *ns*. Moreover, no demographic differences were revealed between the PTSD-positive and the PTSD-negative participants. However, as can be seen in Table 1, self-reported chronic pain did differ as a function of PTSD status: more PTSD-positive participants reported chronic pain than PTSD-negative participants, $\chi^2(1, N = 229) = 29.07$, $p < .001$.

PTSD Classification Analysis Using the PSS-SR

A range of cutoff scores for the PSS-SR, along with corresponding sensitivity, specificity, positive predictive power, negative predictive power, overall correct classification rates, and kappa statistics, are presented in Table 2. To capture the greatest number of PTSD-positive cases without unduly sacrificing specificity, a target of approximately .90 sensitivity was selected *a priori* (see Coffey et al., 1998). Table 2 reveals that when using a PSS-SR total score of 14 as a cutoff (i.e., a PSS-SR total score of 14 or greater), the PSS-SR was able to classify 90 of the 99 PTSD-positive

Table 2. Sensitivity, Specificity, Positive Predictive Power, Negative Predictive Power, Overall Correct Classification, and Kappa Values for Various Cutoff Scores for the PTSD Symptom Scale—Self Report (PSS-SR) in a Sample of Motor Vehicle Accident Survivors ($N = 229$)

Cutoff score	Sensitivity	Specificity	Positive predictive power	Negative predictive power	Overall correct classification	Kappa
8	1.00	.40	.56	1.00	.66	.37
9	.98	.41	.56	.96	.66	.36
10	.96	.44	.57	.93	.66	.37
11	.93	.47	.57	.90	.67	.37
12	.93	.55	.61	.91	.71	.45
13	.93	.57	.62	.91	.72	.47
14	.91	.62	.64	.90	.74	.50
15	.88	.62	.64	.87	.73	.48
16	.87	.65	.65	.87	.74	.50
17	.85	.68	.67	.85	.75	.51
18	.85	.70	.68	.86	.76	.53
19	.83	.70	.68	.84	.76	.52
20	.83	.76	.73	.85	.79	.58
21	.79	.78	.74	.83	.79	.57

Table 3. Classification Analysis of the PTSD Symptom Scale—Self Report (PSS-SR) Total Score Employing a Cutoff Score of 14 and the Impact of Event Scale (IES) Total Score Employing a Cutoff Score of 27 in a Sample of Motor Vehicle Accident Survivors ($N = 229$)

		CAPS PTSD diagnosis		
		Present	Absent	Total
PSS-SR total score	Positive	90	50	140
	Negative	9	80	89
	Total	99	130	229
IES total score	Positive	90	37	127
	Negative	9	93	102
	Total	99	130	229

	PSS-SR	IES
Sensitivity	91%	91%
Specificity	62%	72%
Positive predictive power	64%	71%
Negative predictive power	90%	91%
False positive rate	38%	28%
False negative rate	9%	9%
Overall correct classification	74%	80%
Kappa	.50	.60

Note. CAPS = Clinician-Administered PTSD Scale; PTSD = Posttraumatic stress disorder.

patients correctly for a sensitivity rate of 91%, a specificity rate of 62%, and an overall correct classification rate of 74%. The results of this classification analysis are presented in Table 3.

In order to examine whether gender influenced this cutoff score, these analyses were repeated separately for men and women using a cutoff score of 14. For female participants, the PSS-SR was able to classify 64 of the 72 PTSD-positive patients correctly for a sensitivity rate of 90%, a specificity rate of 62%, and an overall correct classification rate of 74%. For male participants, the PSS-SR was able to classify 26 of the 27 PTSD-positive patients correctly for a sensitivity rate of 96%, a specificity rate of 61%, and an overall correct classification rate of 74%.

To examine the effects of self-reported chronic pain on correct classification of individuals with and without PTSD by using this cutoff score (14), these analyses were repeated separately for participants who had and who did not have chronic pain. For individuals who had pain, the PSS-SR was able to classify 80 of the 87 PTSD-positive patients correctly for a sensitivity rate of 92%, a specificity rate of 48%, and an overall correct classification rate of 72%. For individuals who did not have self-reported chronic pain, the PSS-SR was able to classify 10 of the 12 PTSD-positive patients correctly for a sensitivity rate of 83%, a specificity rate of 78%, and an overall correct classification rate of 79%.

PTSD Classification Analysis Using the IES

Using .90 sensitivity as a criterion, a cutoff score of 27 for the IES total score (i.e., a IES total score of 27 or greater) was selected as optimal. A range of cutoff scores for the IES, along with diagnostic efficiency data, are presented in Table 4. Using 27 as a cutoff, the IES was able to classify 90 of the 99 PTSD-positive patients correctly for a sensitivity rate of 91%, a specificity rate of 72%, and an overall correct

Table 4. Sensitivity, Specificity, Positive Predictive Power, Negative Predictive Power, Overall Correct Classification, and Kappa Values for Various Cutoff Scores for the Impact of Event Scale (IES) Total Score in a Sample of Motor Vehicle Accident Survivors ($N = 229$)

Cutoff score	Sensitivity	Specificity	Positive predictive power	Negative predictive power	Overall correct classification	Kappa
12	1.00	.45	.58	1.00	.69	.42
13	.98	.48	.59	.97	.69	.42
14	.96	.51	.60	.94	.70	.44
15	.95	.54	.61	.93	.72	.46
16	.95	.56	.62	.94	.73	.48
17	.94	.57	.62	.93	.73	.48
18	.94	.59	.64	.93	.74	.50
19	.94	.61	.65	.93	.75	.52
20	.94	.62	.65	.93	.76	.54
21	.94	.65	.67	.93	.77	.56
22	.93	.65	.67	.92	.77	.56
23	.93	.67	.68	.93	.78	.57
24	.92	.68	.68	.92	.78	.57
25	.92	.68	.69	.92	.79	.53
26	.91	.72	.71	.91	.80	.60
27	.91	.72	.71	.91	.80	.60
28	.88	.72	.70	.89	.79	.58
29	.87	.73	.71	.88	.79	.58
30	.85	.73	.71	.86	.78	.57
31	.85	.75	.72	.87	.79	.58
32	.82	.75	.71	.84	.78	.55
33	.80	.75	.71	.83	.77	.54

classification rate of 80%. The results of this classification analysis are presented in Table 3.

Similar to the analysis for the PSS-SR, classification of individuals who had and who did not have PTSD was examined as a function of gender by using the IES. Using a cutoff score of 27, the IES was able to classify 64 of the 72 female PTSD-positive patients correctly for a sensitivity rate of 90%, a specificity rate of 67%, and an overall correct classification rate of 77%. For male participants, the IES was able to classify 26 of the 27 PTSD-positive patients correctly for a sensitivity rate of 96%, a specificity rate of 81%, and an overall correct classification rate of 87%.

Likewise, these analyses were repeated to examine the effect of pain status on the IES cutoff score. For individuals who had chronic pain, the IES was able to classify 79 of the 87 PTSD-positive patients correctly for a sensitivity rate of 91%, a specificity rate of 62%, and an overall correct classification rate of 78%. For individuals who did not have chronic pain, the IES was able to classify 11 of the 12 PTSD-positive patients correctly for a sensitivity rate of 92%, a specificity rate of 83%, and an overall correct classification rate of 85%.

DISCUSSION

The results of this study provide further evidence that the total scores from the IES and the PSS-SR can be used to screen for PTSD among individuals who are at high risk for meeting diagnostic criteria for PTSD among treatment-seeking samples. Both the IES and the PSS-SR proved to be effective screeners for PTSD in this sample of MVA survivors. In this study, .90 was selected *a priori* for each measure's target sensitivity. It has been argued previously (Coffey et al., 1998; Lang et al., 2003; Wohlfarth et al., 2003) that approximately .90 is an appropriate sensitivity level for a screening tool when the primary goal is to reduce the incidence of false negative results (i.e., cases of true PTSD missed by the screening tool). With psychiatric screening tools, the incidences of false positive results are less of a concern because the initial screen can be followed by a thorough diagnostic interview (see Shrout et al., 1986). With the goal of reducing false negative results, both measures were quite capable of identifying PTSD-positive cases while maintaining an acceptable rate of false negative results. Comparing the two measures, the PSS-SR, using a cutoff score of 14, and the IES, using a cutoff score of 27, were able to identify 90 of 99 PTSD-positive cases for a sensitivity rate of .91. However, the specificity of the IES (.72) was somewhat better than the specificity produced by the PSS-SR (.62). Likewise, the overall correct classification was higher for the IES than the PSS-SR, .80 and .74, respectively.

Because of the nature of MVAs and the injuries often associated with them, chronic pain is a common problem among individuals who seek psychological treatment after MVAs. Therefore, it is important to examine whether classification efficiency varies as a function of pain status in MVA survivors. The optimal cutoff score (i.e., scores representing .90 sensitivity) for the PSS-SR and the IES in the total sample, 14 and 27, respectively, was used to examine the measures' efficiency in classifying individuals as either PTSD-positive or PTSD-negative for individuals who had or did not have chronic pain. In general, PTSD classification efficiency did not differ for either measure as a function of chronic pain status. For the PSS-SR, sensitivity in classifying PTSD in MVA survivors who did not have chronic pain was somewhat lower compared to sensitivity in classifying individuals who had chronic pain (.83 and .92, respectively). In interpreting this finding, it is important to note that the low number of PTSD-positive cases could have played a role. In the nonpain group, only 12 participants met criteria for PTSD and the PSS-SR was able to classify 10 of them correctly. By way of comparison, the IES was able to identify 11 of these 12 cases correctly. Because of the small number of PTSD-positive cases in the nonpain group, these results are potentially unstable. Continued work on the influence of pain on PTSD screening measures, such as the IES and the PSS-SR, may prove beneficial.

Similar to the analysis for pain status, the optimal cutoff scores identified for the IES and PSS-SR were examined as a function of gender. Using the optimal cutoff scores for each measure, both the IES and PSS-SR were able to identify 64 of 72 female PTSD-positive cases and 26 of 27 male PTSD-positive cases. Specificity and overall correct

classification were acceptable for both genders using both screening tools. Therefore, it is recommended that the full sample optimal cutoff scores identified for the IES and PSS-SR be used irrespective of gender.

Although both the IES and the PSS-SR perform admirably as PTSD screeners in this MVA survivor sample in this study, the optimal empirically derived cutoff score for the IES (i.e., 27) was lower than scores identified in previous published reports. Wohlfarth and coworkers (2003) found that when using *DSM-IV* criteria, the optimal empirically derived cutoff score for the IES associated with .89 sensitivity was 39. Neal and associates (1994), using the CAPS as the diagnostic tool, found that a cutoff score of 35 produced .89 sensitivity. In contrast, the optimal cutoff score (sensitivity of .90) reported by Wohlfarth and associates for the PSS-SR was 15, a score consistent with the optimal cutoff score of 14 identified in the current sample. It is possible that differences between the samples and instruments may account for the dissimilar IES cutoff scores reported by Wohlfarth and coworkers and Neal and coworkers compared to the current study. For example, Wohlfarth and colleagues used the Dutch versions of the IES rather than the original English version. These authors also relied on telephone administration of the Composite International Diagnostic Interview (CIDI; World Health Organization, 1997) to determine diagnostic status. In addition, Wohlfarth and colleagues used a sample of violent crime victims recruited from local police stations and the Neal and associates sample consisted mostly of male (i.e., 84%) British veterans who suffered a variety of traumatic experiences. In contrast, the current study used a sample of treatment-seeking MVA survivors of both genders. Finally, the samples used by Wohlfarth and colleagues and Neal and colleagues were much smaller than the sample used in this study. It is possible that the smaller samples may have produced spuriously high cutoff scores on the IES. These sample and methodological differences also may partially account for inconsistencies between the studies.

A potential limitation of this study is that administration of the CAPS interview and the self-report measures was not counterbalanced. Although the CAPS interview and the self-report measures were administered on separate days, it is possible that discussing their MVAs may have affected participants' symptom reporting on the self-report measures. The interview was administered first to assess study eligibility; therefore, this common methodological issue could not be prevented. Another limitation of the study is that the sample primarily consisted of individuals who followed up on referrals for psychological assessment by their health care professionals. Whether the recommended cutoff scores are applicable to MVA survivors in the general community is unknown.

In summary, this study provides further evidence that the IES and the PSS-SR can be used efficiently as PTSD screeners in high-risk samples. Both measures have good specificity and overall correct classification when the sensitivity criterion is set at approximately .90. Both measures are brief and each requires only 5 to 10 minutes to complete, making them ideal measures to administer in clinics frequented by MVA survivors for medical treatment after an MVA (e.g., family medicine, internal medicine, physical therapy, chiropractic clinics), settings where mental health professionals are typically not available. In clinics such as these, use of either the PSS-SR or the IES as a PTSD screening tool may substantially increase the number of MVA survivors who are referred for, and who may ultimately benefit from, PTSD treatment.

REFERENCES

American Psychiatric Association. (1994). Diagnostic and statistical manual of mental disorders (4th ed.). Washington, DC: Author.

Arntz, A. (1993). Dutch translation of the PSS-SR. Maastricht, Netherlands: Author.

Asmundson, G. J., Coons, M. J., Taylor, S., & Katz, J. (2002). PTSD and the experience of pain: Research and clinical implications of shared vulnerability and mutual maintenance models. Canadian Journal of Psychiatry—Revue Canadienne de Psychiatrie, 47, 930–937.

Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Gusman, F. D., Charney, D. S., & Keane, T. M. (1995). The development of a Clinician-Administered PTSD Scale. Journal of Traumatic Stress, 8, 75–90.

Blanchard, E. B., & Hickling, E. J. (2004). After the crash (2nd ed.). Washington, DC: American Psychological Association.

Blanchard, E. B., Hickling, E. J., Taylor, A. E., Loos, W. R., Fornere, C. A., & Jaccard, J. (1996). Who develops PTSD from motor vehicle accidents? Behaviour Research and Therapy, 34, 1–10.

Brom, D., & Kleber, R. J. (1985). De schok verwerking lijst [The Impact of Event Scale]. Netherlands Tijdschrift voor de Psychologie, 40, 164–234.

Coffey, S. F., Dansky, B. S., Falsetti, S. A., Saladin, M. E., & Brady, K. T. (1998). Screening for PTSD in a substance abuse sample: Psychometric properties of a modified version of the PTSD Symptom Scale Self-Report. Journal of Traumatic Stress, 11, 393–399.

Creamer, M., Bell, R., & Failla, S. (2003). Psychometric properties of the Impact of Event Scale—Revised. Behaviour Research and Therapy, 41, 1489–1496.

DiNardo, P., Brown, T., & Barlow, D. (1994). Anxiety Disorders Interview Schedule for DSM-IV. Albany, NY: Greywind.

DiNardo, P., Moras, K., Barlow, D., Rapee, R., & Brown, T. (1993). Reliability of DSM-III-R anxiety disorder category. Archives of General Psychiatry, 50, 251–256.

Falsetti, S. A., Resnick, H. S., Resick, P. A., & Kilpatrick, D. G. (1993). The modified PTSD Symptom Scale: A brief self-report measure of posttraumatic stress disorder. Behavior Therapist, 16, 161–162.

Foa, E. B., Riggs, D. S., Dancu, C. V., & Rothbaum, B. O. (1993). Reliability and validity of a brief instrument for assessing posttraumatic stress disorder. Journal of Traumatic Stress, 6, 459–473.

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

Joseph, S. (2000). Psychometric evaluation of Horowitz's Impact of Event Scale: A review. Journal of Traumatic Stress, 13, 101–113.

Kessel, J. B., & Zimmerman, M. (1993). Reporting errors in studies of the diagnostic performance of self-administered questionnaires: Extent of the problem, recommendations for standardized presentation of results, and implications for the peer review process. Psychological Assessment, 5, 395–399.

Kopel, H., & Friedman, M. (1997). Posttraumatic symptoms in South African police exposed to violence. Journal of Traumatic Stress, 10, 307–317.

Lang, A. J., Laffaye, C., Satz, L. E., Dresselhaus, T. R., & Stein, M. B. (2003). Sensitivity and specificity of the PTSD Checklist in detecting PTSD in female veterans in primary care. Journal of Traumatic Stress, 16, 257–264.

National Safety Council. (2004). Injury facts (Product number 02304-0000). Itasca, IL: Author.

Neal, L. A., Busuttil, W., Rollins, J., Herepath, R., Strike, P., & Turnbull, G. (1994). Convergent validity of measures of posttraumatic stress disorder in a mixed military and civilian population. Journal of Traumatic Stress, 7, 447–455.

Norris, F. (1992). Epidemiology of trauma: Frequency and impact of different potentially traumatic events on different demographic groups. Journal of Consulting and Clinical Psychology, 60, 409–418.

Robbins, I., & Hunt, N. (1996). Validation of the IES as a measure of the long-term impact of war trauma. British Journal of Health Psychology, 1, 87–90.

Shrout, P. E., Skodol, A. E., & Dohrenwend, B. P. (1986). A two-stage approach for case identification and diagnosis, first stage instruments. In J. E. Barrett & R. M. Rose (Eds.), Mental disorders in the community: Progress and challenge (pp. 286–303). New York: Guilford Press.

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). State Trait Anxiety Inventory. Palo Alto, CA: Consulting Psychologists Press.

Tabachnick, B. G., & Fidell, L. S. (1996). Using multivariate statistics (3rd ed.). New York: HarperCollins.

Taylor, S., & Koch, W. J. (1995). Anxiety disorders due to motor vehicle accidents: Nature and treatment. Clinical Psychology Review, 15, 721–738.

Weathers, F., Keane, T. W., & Davidson, J. R. T. (2001). Clinician-Administered PTSD Scale: A review of the first ten years of research. Depression and Anxiety, 13, 132–156.

Weathers, F., Litz, B. T., Huska, J. A., & Keane, T. M. (1994). The PTSD Checklist—Civilian version (PCL-C). Boston: National Center for PTSD.

Weiss, D. S., & Marmar, C. R. (1997). The Impact of Event Scale—Revised. In J. P. Wilson & T. M. Keane (Eds.), Assessing psychological trauma and PTSD (pp. 399–411). New York: Guilford Press.

Wohlfarth, T. D., van den Brink, W., Winkel, F. W., & ter Smitten, M. (2003). Screening for posttraumatic stress disorder: An evaluation of two self-report scales among crime victims. Psychological Assessment, 15, 101–109.

World Health Organization (1993). The ICD-10 classification of mental and behavioral disorders: Diagnostic criteria for research. Geneva, Switzerland: Author.

World Health Organization. (1997). Composite International Diagnostic Interview (Core Version 2.1, 12 month version). Geneva, Switzerland: Author.