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Psychophysiologic Assessment of Posttraumatic Stress Disorder in Vietnam Nurse Veterans Who Witnessed Injury or Death

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This study examined whether witnessing death and injury could produce psychophysiologically responsive posttraumatic stress disorder (PTSD). Participants consisted of medication-free female Vietnam nurse veterans with a diagnosis of current PTSD (n = 17) and who never had PTSD (n = 21), related to their military service. Individualized scripts describing personal traumatic military nursing events, a standard military nursing event, and other life events were tape recorded and played back to the participant while heart rate, skin conductance, and facial electromyograms were recorded. Nurses with PTSD showed significantly larger physiologic responses than non-PTSD nurses only during imagery of military-related nursing events. The groups' self-reported emotional responses did not differ during imagery. Psychophysiologic results support the proposition that witnessing death and serious injury to others is sufficiently stressful to cause PTSD.

Since its introduction into the official psychiatric nomenclature in 1980, posttraumatic stress disorder's (PTSD's) definition has been through three revisions in the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*): the 3rd edition (*DSM–III*); the 3rd edition, revised (*DSM–III–R*); and the 4th edition (*DSM–IV*; American Psychiatric Association, 1980, 1987, 1994, respectively). Whereas PTSD's defining symptoms have remained relatively constant across these revisions, the nature of the requisite stressor has been the subject of greatest uncertainty and debate and has therefore undergone the most revision. At present, the stressor criterion (*DSM–IV* PTSD A.1) is met if the individual "*experienced, witnessed, or was confronted with* [italics added] an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others" (American Psychiatric Association, 1994, p. 424).

Important validation for PTSD has been provided by laboratory findings of heightened physiologic responses during script-driven imagery of the traumatic event in persons diagnosed with the disorder. To date, research in this area has been largely confined to individuals who experienced a physical threat to their own selves, for example, military combatants (Orr, Pitman, Lasko, & Herz, 1993; Pitman et al., 1990; Pitman, Orr, Forgue, de Jong, & Claiborn, 1987) or victims of terrorist attacks and physical assaults (Shalev, Orr, & Pitman, 1993), motor vehicle accidents (Blanchard et al., 1996; Blanchard, Hickling, Taylor, Loos, & Gerardi, 1994), or sexual assault or abuse (Orr et al., 1998). Although witnessing violence and trauma to others has been shown to be associated with PTSD in descriptive and epidemiologic studies (Breslau et al., 1998; Eth & Pynoos, 1994; Johnsen, Eid, Løvstad, & Michelsen, 1997; Lehmann, 1997), such research has typically relied on self-report for diagnosing PTSD. The question as to whether persons who routinely witness or confront the death or injury of others can develop psychophysiologically responsive PTSD remains unanswered.

Approximately 6,000 women served in Vietnam as registered nurses (Keib, 1982). Many of these nurses were routinely exposed to the horrific injuries, mutilations, and deaths associated with war. In addition to the usual gunshot and shrapnel wounds, the nurses treated gruesome injuries inflicted by mines, high-velocity missiles, and booby traps (Neel, 1991). Advances in evacuation capability and life support methods meant that many of the more severely injured combatants, who probably would not have survived transport during World War II (WWII) or the Korean War, were able to reach field hospitals in Vietnam. As a consequence,

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Vietnam nurse veterans were exposed to an increased volume of human suffering, mutilation, and death. A study of male combat veterans found that exposure to grotesque death was a strong predictor for PTSD (Green, Grace, Lindy, Gleser, & Leonard, 1990). The intense nature of their war experiences makes Vietnam nurse veterans ideal subject candidates for testing the "witnessed" prong of the *DSM–IV* stressor criterion.

Situations that involved mass casualties were especially difficult for the nurses. The volume and intensity of this work often left the nurses with feelings of inadequacy in meeting all of their patients' needs. In a sample of 50 Vietnam nurse veterans, 72% had worked in four or more mass casualty situations (Norman, 1986). The strong emotional bonds that nurses often forged with their young patients added to the stressfulness of their role. This bond is clearly evident in a Vietnam nurse veteran's description of her experience waiting with doomed triage patients:

> The chaplain and neurosurgeon would leave. You'd try to find a heartbeat but there was nothing you could do. I felt it important to touch and talk to these boys. I couldn't let them die alone and unattended. I felt his mother would feel better knowing someone was standing with her son when he died. (Norman, 1986, p. 58)

Research with emergency workers indicates that a strong association between victim and helper can increase the latter's susceptibility to the impact of the stressor (Bartone, Ursano, Wright, & Ingraham, 1989; Ursano & McCarroll, 1990).

A small body of research has investigated the aftermath of Vietnam nurse veterans' service (Baker, Menard, & Johns, 1989; Norman, 1990; Paul, 1985). Although this early work delineated the stressors experienced by nurse veterans, it generally lacked objective measures for assessing PTSD, notably psychophysiology. One reason for the dearth of research in this important group has been that sample requirements have exceeded local availability. Even a large metropolitan city like Boston would be estimated to contain fewer than 10 Vietnam nurse veterans with PTSD (Kulka et al., 1990), an insufficient recruitment base for most studies. In the study reported here, we overcame this problem by recruiting Vietnam nurse veteran volunteers throughout the United States and flying them to our psychophysiology laboratory in Manchester, New Hampshire, for 2 days of diagnostic, psychometric, and psychophysiologic testing. Script-driven imagery was used to assess nurse veterans' physiologic responses during recollections of traumatic experiences in Vietnam as well as other life events.

Method

Participants

Research candidates included women who served as active duty nurse officers in the U.S. Armed Forces from 1964 through 1975 in the Vietnam theater (i.e., in Vietnam, Laos, or Cambodia) or in the surrounding waters or airspace of these countries (Kulka et al., 1990). They were recruited through a nationwide mailing to approximately 1,600 women listed in the Vietnam Women's Memorial Project's Sister Search database. The following screening instruments were completed and returned by 801 (50%) candidates: brief military, medical, and psychiatric history data; Women's Wartime Stressor Scale (WWSS; Wolfe, Brown, Furey, & Levin, 1993), and Mississippi Scale for Combat-Related PTSD (MISS; Keane, Cassell, & Taylor, 1988). From these 801 respondents, 77 were invited to come for 2 days of testing. Invitation was made on the basis of a screening strategy that attempted to (a) identify participant candidates unlikely to meet the exclusion criteria discussed below, (b) over-recruit participant candidates likely to have PTSD (by means of the MISS), and (c) match the anticipated PTSD and non-PTSD groups on stressor exposure (using the WWSS).

On arrival at the laboratory, the participant was provided a written informed consent form that had been approved by the Manchester Veterans Affairs Medical Center Human Studies Subcommittee, which had also approved performance of the study. After full verbal and written explanations of the procedures had been given, each participant signed informed consent for her participation.

The Clinician-Administered PTSD Scale—Diagnostic Version (CAPS; Blake et al., 1995) and the Structured Clinical Interview for *DSM–IV* (SCID; First, Spitzer, Gibbon, & Williams, 1994) were administered by one of two doctoral-level psychologists (Natasha B. Lasko or Lynn A. Paulus) trained in their administration. Interrater agreement for the CAPS total score for current PTSD was determined from the interviews of 16 early participants to be $R = .98$ (intraclass correlation coefficient). During these interviews, the CAPS was administered and scored by one of the diagnosticians and independently scored by the second diagnostician, who was also present during the interview. The diagnostic interviews focused on the most traumatic Vietnam-related event identified by each participant. This event involved witnessing death or serious injury and served as one of the two personal Vietnam-related experiences presented during psychophysiologic assessment for all participants comprising the final sample (see below). Data from 23 participants with past Vietnam-related, but not current, PTSD were excluded from the analysis as were data from 14 participants who, as indicated by history and urine testing, had been unable to abstain for at least 2 weeks prior to testing from the use of a prescription medication or substance that either was psychotropic in nature or could unduly influence the physiologic responses to be measured. Data from two participants were excluded because their Vietnam-related experiences did not meet the "witnessing" criteria described below. The 38 remaining participants were classified as either current PTSD ($n = 17$) or non-PTSD (never had it; $n = 21$), according to the CAPS.

As determined from the SCID, no participant had an excluding psychiatric condition, namely, schizophrenic, other psychotic, bipolar I, current substance dependence disorder, or current non-Vietnam-related PTSD. Thirteen PTSD participants had one or more concurrent, nonexcluding mental disorders, including the following: three other bipolar, seven major depression, one dysthymia, four panic, two agoraphobia, two social phobia, one specific phobia, one obsessive compulsive, two eating disorder, and one alcohol abuse. Three of the participants with current Vietnam-related PTSD and one non-PTSD participant met criteria for lifetime PTSD related to civilian traumatic events; for one individual in the PTSD group, the civilian trauma occurred prior to service in Vietnam. Two non-PTSD participants had a concurrent mental disorder, including one with dysthymia and one with a specific phobia.

The PTSD and non-PTSD groups were similar in terms of their mean age and years of education, as can be seen in Table 1. Nearly half of all participants—47% ($n = 8$) of PTSD and 43% ($n = 9$) of non-PTSD participants—had earned an advanced degree at the master's or doctoral level since returning from Vietnam. Eighty-two percent ($n = 14$) of PTSD participants were currently working in the nursing profession; 35% ($n = 6$) were professors or administrators or were in private practice. Sixty-seven percent ($n = 14$) of the non-PTSD group were currently working in the nursing profession; 38% ($n = 8$) were professors or administrators or were in private practice. Current marital status for the PTSD and non-PTSD groups, respectively, included the following married, 71% ($n = 12$) and 43% ($n = 9$); single, 18% ($n = 3$) and 33% ($n = 7$); divorced or separated, 6% ($n = 1$) and 19% ($n = 4$); and widowed, 6% ($n = 1$) and 5% ($n = 1$). Thirty-five percent ($n = 6$) of PTSD and 29% ($n = 6$) of non-PTSD participants had a history of divorce.

Table 1
Group Mean Demographic, Psychometric, and Resting Physiologic Measures

Variable	PTSD (n = 17) *M*	PTSD (n = 17) *SD*	Non-PTSD (n = 21) *M*	Non-PTSD (n = 21) *SD*	$t(36)$	p
Demographics						
Age (years)	53.9	3.8	54.0	3.7	−0.1	.92
Education (years)	15.9	2.3	16.3	1.6	−0.6	.53
Impact of Event Scale—Revised[a]						
Personal Vietnam	2.3	1.1	1.1	1.1	3.2	.003
Personal other stressful	1.9	1.5	1.3	1.4	1.2	.22
Questionnaires						
Women's Wartime Stressor Scale	46.7	12.6	46.4	11.9	0.1	.94
Peritraumatic Dissociative Experiences Questionnaire	25.4	11.3	23.2	7.0	0.7	.48
Clinician-Administered PTSD Scale	59.9	16.0	10.7	11.2	11.1	<.001
Mississippi Scale	99.9	17.2	81.9	13.9	3.6	.001
MMPI—2 PK Scale	63.6	16.1	49.1	7.6	3.7	<.001
SCL–90–R Global Symptom Index	1.2	0.7	0.4	0.2	4.8	<.001
Physiologic Resting Levels						
Heart rate (BPM)	75.2	7.9	67.7	9.5	2.6	.01
Skin conductance (μS)	3.7	2.8	2.6	1.5	1.6	.12
Lateral frontalis EMG (μV)	1.8	1.4	3.4	2.1	−2.6	.01
Corrugator EMG (μV)	2.3	1.0	4.8	4.9	−2.0	.05

Note. PTSD = posttraumatic stress disorder; MMPI–2 = Minnesota Multiphasic Personality Inventory—2; PK = Posttraumatic Stress Disorder—Keane; SCL–90–R = Symptom Checklist 90—Revised; BPM = beats per minute; EMG = electromyogram.
[a] Average score per item.

Measures

Questionnaires. On site, each participant completed the Minnesota Multiphasic Personality Inventory—2 (MMPI–2; Hathaway & McKinley, 1989), including its Keane PTSD (PK) scale; the Peritraumatic Dissociative Experiences Questionnaire (PDEQ; Marmar, Weiss, & Metzler, 1997); and the Symptom Checklist 90—Revised (SCL–90–R; Derogatis, 1983).

Physiologic recording. A Coulbourn Modular Instrument System was used to measure heart rate (HR), skin conductance (SC), and electromyograms (EMGs) of the left lateral frontalis (LF) and corrugator (C) facial muscles. Amplified electrocardiogram was input to a tachometer that provided a voltage output reflecting interbeat interval, which was transformed to HR. SC level was obtained through 9-mm (sensor diameter) Ag/AgCl electrodes filled with isotonic paste placed on the nondominant hypothenar surface using a constant-voltage technique (Fowles et al., 1981). EMGs were obtained through 4-mm (sensor diameter) Ag/AgCl electrodes filled with an electrolytic paste and placed according to published specifications over the respective facial muscles (Fridlund & Cacioppo, 1986). The amplified EMG signals were filtered so as to retain the 90- to 250-Hz range and integrated using a 300-ms time constant.

Procedure

Script preparation. Details of the script-driven imagery, psychophysiologic, and laboratory recording techniques used in this study have been presented elsewhere (Pitman et al., 1987); a summary is presented below. On the first day, each participant composed narratives portraying five personal events, including her two most stressful Vietnam events, her most stressful life event unrelated to Vietnam, her most positive life event, and a neutral event. On the basis of these narratives, Margaret A. Carson prepared "scripts" that included self-reported visceral and muscular reactions that accompanied each event. The participant completed the Impact of Event Scale—Revised (IES–R; Weiss & Marmar, 1997) pertaining to each of her three stressful events. Each 30-s script was recorded in a neutral voice for playback in the laboratory.

Because we were selectively interested in studying events that involved the "witnessed"prong of the *DSM–IV* PTSD A.1 stressor definition in the absence of the "experienced" prong, Margaret A. Carson and Lynn A. Paulus independently reviewed each personal Vietnam script and identified any event that involved in full or in part the "experienced" prong (i.e., a threat to the participant's own person or safety). The interrater reliability for this determination was $\kappa = 0.93$. For three scripts on which these two raters differed, Roger K. Pitman resolved the dispute. Data from the two participants who had both of their Vietnam scripts involving the "experienced" prong were excluded from subsequent analyses. For the 13 participants who had one Vietnam script involving the "experienced" prong, physiologic and self-reported responses to that script were eliminated, and only physiologic and self-reported responses to the remaining "witnessed" Vietnam script were used. There were 25 participants for whom neither personal Vietnam script involved the "experienced" prong (14 PTSD participants and 11 non-PTSD participants), $\chi^2(1, N = 38) = 3.8, p = .05$; for these participants, we averaged physiologic and self-reported responses to both scripts prior to analysis. None of the scripts involved the "confronted with" (i.e., "learned about") prong. In summary, the only scripts analyzed were those that solely involved the "witnessed" prong.

The study also used six standard scripts, namely, two neutral, one fear (public speaking), one positive (sandy beach), one action (riding a bicycle), and one Vietnam-related. The latter was constructed to reflect a hypothetical event of general relevance to Vietnam nurses involving witnessing trauma in the absence of personal physical danger, as follows:

> You're at a field hospital in Vietnam. It's been another long day in the oppressive heat, and you're very tired. Suddenly you hear the sound of incoming helicopters. You take a deep breath, and your heart starts to pound. You pause for a minute to listen more closely. The sounds are stronger and louder than usual. This can only mean another mass

casualty situation. Your muscles tensing, you spring into action to get ready for the wounded. As you look down at the first young victim, you feel a trickle of sweat roll down your neck. You try not to recoil from the sight of his devastating wounds. Despite the nausea you feel inside, you force yourself to smile reassuringly.

Laboratory procedure. On the second day, each participant was familiarized with the laboratory, had electrodes attached, and was instructed in the script-driven imagery procedure. Next, the participant listened to a 3-min relaxation instruction tape, followed by the script presentations. Each script presentation consisted of four sequential 30-s periods. After a baseline data recording period, the participant listened to the script as it was being played (read period) and imagined it as vividly as possible, as though it were actually occurring. When the script ended, the participant continued to imagine the described event (imagery period) until signaled by a brief tone. On hearing the tone, the participant relaxed (recovery period) until signaled by a second tone. The participant then rated her emotional responses to the script on 13-point (0–12) Likert-type scales. The baseline period for the next script was initiated after a rest period of 1 min or after HR had returned to within 5% of its value during the previous baseline period, whichever was longer. The rest period rarely exceeded 3 min. Scripts were presented in quasi-random order, with the constraint that no two of the personal or standard Vietnam, personal non-Vietnam stressful, or standard fear scripts were presented sequentially. A personal computer controlled the recorded script presentations, collected participants' emotional ratings, and sampled and stored the digitized physiologic signals at 2 Hz.

Data Reduction and Analysis

A response score was calculated for each physiologic dependent variable for each script by subtracting the preceding baseline period mean from the imagery period mean. We examined the data by means of multivariate analyses of variance (MANOVAs) and univariate ANOVAs and t tests. An a priori discriminant function, derived from the HR, SC, and LF–EMG responses during personal traumatic imagery of 46 previously studied individuals with current PTSD and 48 who never had PTSD (Orr et al., 1993; Pitman et al., 1987, 1990; Shalev, Orr, & Pitman, 1993), was used to classify the present participants as physiologic responders or nonresponders during their personal Vietnam imagery (insufficient previous data were available for C–EMG). The risk of Type I error attributable to multiple variables and tests was contained by the use of MANOVAs and application of the multivariate a priori discriminant function.

Results

Questionnaire and Resting Physiologic Variables

Group means are presented in Table 1. As can be seen in this table, the PTSD group showed significantly more PTSD-specific (CAPS, MISS, IES–R, MMPI–2 PK) and general psychopathology symptoms (SCL–90–R, Global Severity Index score) than the non-PTSD group. Resting HR level was significantly higher and LF–EMG and C–EMG levels were significantly lower in the PTSD group. The groups did not differ in their resting SC levels.

Physiologic Responses During Script-Driven Imagery

MANOVAs. We performed MANOVAs for each script separately, using the four physiologic responses as simultaneous dependent measures. MANOVAs did not yield a significant group effect for any of the non-Vietnam scripts.

Personal versus standard Vietnam imagery. Figure 1 presents the group mean (and *SD*) responses during imagery of the personal and standard Vietnam scripts. We performed two-factor MANOVAs and ANOVAs for the Vietnam-related scripts with group (PTSD vs. non-PTSD) as a between-subjects factor and script (personal vs. standard) as a within-subjects factor. The MANOVA for the group main effect yielded $F(8, 29) = 3.0$, $p = .01$; for the script main effect, $F(1, 36) = 4.9$, $p = .03$; and for the interaction, $F(1, 36) = 2.1$, $p = .15$. Inspection of Figure 1 indicates that PTSD participants had overall larger responses than non-PTSD participants, and participants' responses were larger during personal versus standard Vietnam imagery. Two-factor ANOVAs yielded the following: for HR, group $F(1, 36) = 5.1$, $p = .03$; script $F(1, 36) = 4.9$, $p = .03$; interaction, $F(1, 36) = 1.7$, $p = .20$; for SC, group $F(1, 36) = 13.1$, $p < .001$; script $F(1, 36) < 1$; interaction, $F(1, 36) < 1$; for LF–EMG, group $F(1, 36) = 3.9$, $p = .05$; script $F(1, 36) = 2.0$, $p = .17$; interaction, $F(1, 36) < 1$; and for C–EMG, group $F(1, 36) = 2.2$, $p = .15$; script $F(1, 36) = 4.5$, $p = .04$; interaction, $F(1, 36) = 3.2$, $p = .08$.

We performed a second set of two-factor MANOVAs and ANOVAs using only the subset of 14 PTSD and 11 non-PTSD participants who reported two trauma-related events that involved witnessing death or serious injury. These analyses eliminated the possibility that the responses of individuals who had a single witnessing script could have been contaminated by the prior presentation of a trauma-related event involving personal threat. In addition, these analyses allowed all physiologic response scores for the trauma-related experiences to be derived from the average of two scripts. Results of the MANOVA for the group main effect yielded $F(8, 16) = 2.1$, $p = .10$; for the script main effect, $F(1, 23) = 1.8$, $p = .19$; and for the interaction, $F(1, 23) = 1.0$, $p = .33$. The two-factor ANOVAs yielded the following: for HR, group $F(1, 23) = 4.2$, $p = .05$; script $F(1, 23) = 1.3$, $p = .27$; interaction, $F(1, 23) < 1$; for SC, group $F(1, 23) = 7.4$, $p = .01$; script $F(1, 23) < 1$; interaction, $F(1, 23) < 1$; for LF–EMG, group $F(1, 23) = 8.0$, $p = .01$; script $F(1, 23) < 1$; interaction, $F(1, 23) < 1$; and for C–EMG, group $F(1, 23) = 1.2$, $p = .28$; script $F(1, 23) = 3.2$, $p = .09$; interaction, $F(1, 23) = 1.3$, $p = .27$.

The possibility that increased general psychiatric symptomatology, rather than PTSD-related symptoms per se, might explain the PTSD group's heightened physiologic responsivity to trauma-related imagery was explored in the full sample of Vietnam nurses using multivariate and univariate analysis of covariance (MANCOVA and ANCOVA, respectively). A participant's SCL–90–R Global Symptom Index score served as the covariate and measure of general psychiatric symptomatology. Results of the MANCOVA for the group main effect yielded $F(8, 28) = 2.4$, $p = .04$; for the script main effect, $F(1, 35) = 2.1$, $p = .16$; and for the interaction, $F(1, 35) = 1.8$, $p = .19$. The two-factor ANCOVAs yielded the following: for HR, group $F(1, 35) = 6.3$, $p = .02$; script $F(1, 35) = 1.5$, $p = .24$; interaction, $F(1, 35) = 1.1$, $p = .29$; for SC, group $F(1, 35) = 6.6$, $p = .01$; script $F(1, 35) = 2.7$, $p = .11$; interaction, $F(1, 35) < 1$; for LF–EMG, group $F(1, 35) = 6.6$, $p = .01$; script $F(1, 35) = 2.6$, $p = .11$; interaction, $F(1, 35) = 1.7$, $p = .20$; and for C–EMG, group $F(1, 35) = 1.5$, $p = .23$; script $F(1, 35) = 1.7$, $p = .21$; interaction, $F(1, 35) = 2.5$, $p = .13$.

Discriminant function classification. The a priori physiologic discriminant function classified 13 of the 17 PTSD participants (sensitivity = 76%) and 4 of the 21 non-PTSD participants (spec-

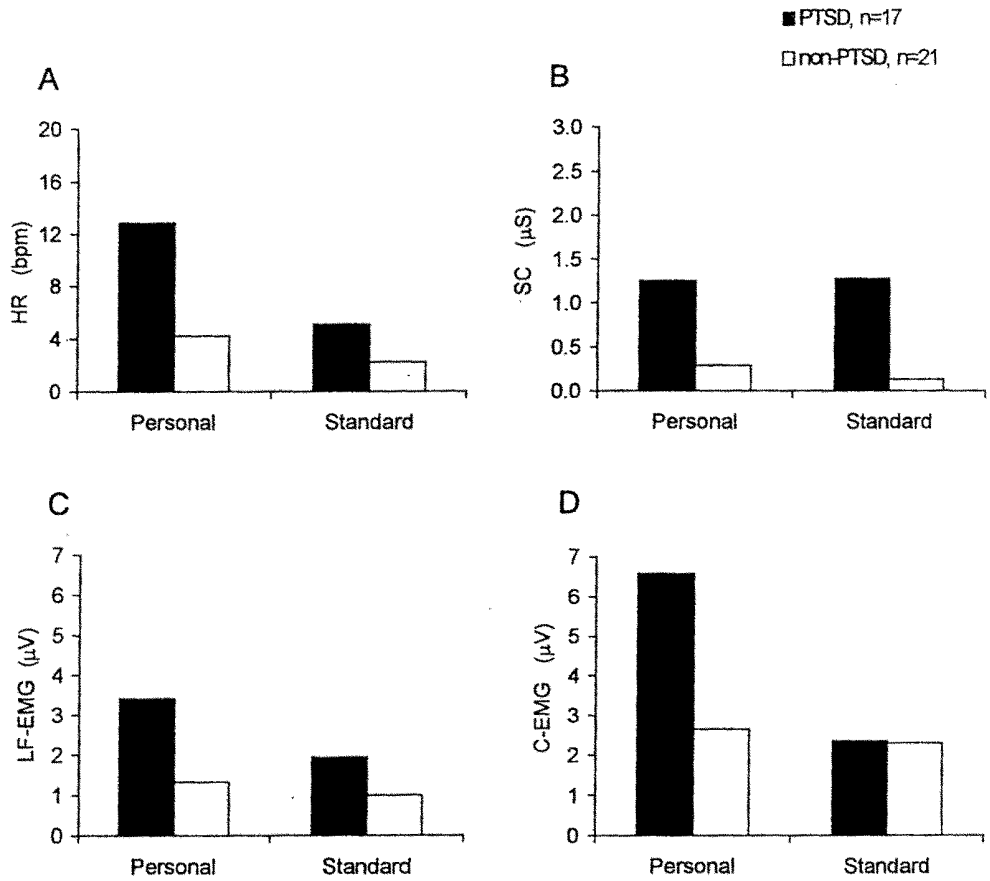

Figure 1. Group mean physiologic responses during personal and standard Vietnam-related imagery. PTSD = posttraumatic stress disorder; HR = heart rate; SC = skin conductance; LF–EMG = left lateral frontalis electromyogram; C–EMG = left corrugator electromyogram. Closed bars indicate current PTSD, n = 17; open bars indicate non-PTSD, n = 21.

ificity = 81%) as responders during personal Vietnam imagery (p = .001, Fisher's exact test). When applied to the physiologic responses of participants who reported two trauma-related events that involved witnessing death or serious injury, the a priori physiologic discriminant function classified 10 of the 14 PTSD participants (sensitivity = 71%) and 2 of the 11 non-PTSD participants (specificity = 82%) as responders (p = .02, Fisher's exact test). Within the full PTSD group, 2 of the 4 (50%) individuals classified as physiologic nonresponders by the discriminant function and 10 of the 13 (77%) individuals classified as responders endorsed *DSM–IV* PTSD Criterion B.5, "physiological reactivity on exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event" (American Psychiatric Association, 1994).

Self-Reported Emotional Responses During Personal Vietnam Imagery

These responses are shown in Table 2. Univariate analyses (t tests) revealed no significant group differences for any self-reported emotional response during personal Vietnam imagery. Indeed, inspection of Table 2 reveals highly similar self-reported emotional responses in the PTSD and non-PTSD groups.

Discussion

Measurement of physiologic responses during the recollection of traumatic events adds objectivity to the assessment of PTSD and serves as a useful means of testing the validity of this diagnosis as well as the role of various putative stressors in its pathogenesis. The present results provide psychophysiologic support for the proposition that witnessing death or serious injuries is a highly stressful experience that is associated with the development of PTSD in some individuals. Indeed, the physiologic responses of the Vietnam nurses reported here represent some of the largest responses detected in any trauma-exposed population studied to date with the script-driven imagery technique, including male combat veterans (Orr et al., 1993; Pitman et al., 1987, 1990) and adult female victims of childhood sexual abuse (Orr et al., 1998). As has also been found in some previous studies of PTSD, the Vietnam nurses with PTSD had a higher resting HR level compared with nurses without the disorder (e.g., Keane et al., 1998;

Table 2
Self-Reported Emotional Responses During Personal Vietnam Imagery

	PTSD (n = 17)		Non-PTSD (n = 21)			
Variable	*M*	*SD*	*M*	*SD*	$t(36)$	p
Vividness	10.4	1.8	10.1	2.3	0.5	.65
Emotion dimensions						
Arousal	10.0	2.3	10.3	2.6	−0.3	.73
Valence (pleasantness)	1.0	1.8	0.8	1.1	0.4	.68
Dominance (control)	3.1	3.4	3.9	3.4	−0.7	.50
Discrete emotions						
Happiness	0.1	0.2	0.1	0.3	0.1	.89
Sadness	10.4	1.8	10.4	1.9	0.1	.95
Fear	7.2	3.8	8.5	3.4	−1.1	.28
Surprise	7.3	3.3	6.9	4.6	0.3	.79
Anger	8.3	3.8	8.2	3.6	0.1	.93
Disgust	8.3	3.5	7.1	3.7	1.0	.31
Guilt	7.0	3.8	7.9	3.6	−0.7	.47

Note. Mean scores were on 13-point Likert scales ranging from 0 to 12. (Arousal: 0 = calm/unaroused, 12 = excited/aroused; Valence: 0 = unhappy/displeased, 12 = happy/pleased; Dominance: 0 = submissive/controlled, 12 = dominant/in control; All Discrete Emotions: 0 = none, 12 = a great deal.) PTSD = posttraumatic stress disorder.

Orr et al., 1998; Pitman et al., 1987). The explanation for these higher resting HR levels in PTSD samples is not yet clear. They could reflect tonic elevation in autonomic activation or increased anxiety in anticipation of exposure to reminders of traumatic events (see Prins, Kaloupek, & Keane, 1995).

The present findings of lower resting LF-EMG and C-EMG levels in the PTSD group were unexpected, and the explanation for them is unclear. Two previous studies also have reported significantly lower (Pitman et al., 1990) or a trend toward lower (Shalev et al., 1993) resting LF-EMG levels in their PTSD samples. However, most studies of PTSD (e.g., Keane et al., 1998; Orr et al., 1993; Pitman et al., 1987; Shalev, Peri, Gelpin, Orr, & Pitman, 1997), including a study of PTSD in women (Orr et al., 1998), have not found this, suggesting that lower resting EMG levels are not a robust feature of PTSD.

Although witnessing injury to others has been encoded in the second prong of the *DSM–IV* PTSD A.1 stressor criterion since 1994, prior to the present study its support has derived almost solely from self-reported symptoms. Moreover, most previous investigations did not consider the potentially confounding factor of concurrent personal risk to the witness and thereby may not have addressed the trauma entailed by witnessing per se, as in the study reported here. Nevertheless, the present results are consistent with results of previous nonphysiologic studies that have found a significant risk for PTSD in disaster response workers (Durham, McCammon, & Allison, 1985; Marmar, Weiss, Metzler, Ronfeldt, & Foreman, 1996) and body handlers (Jones, 1985; Ursano & McCarroll, 1990).

The present study cannot rule out the possibility that the danger associated with working in a war zone environment may have contributed in some way to the development of PTSD in the Vietnam veteran nurses. It is theoretically possible that the nurses would not have developed PTSD if they had witnessed the injuries and mutilations in a less threatening environment. However, McVicker noted that "a large part of the troubling memories" 1985, p. 14) reported by Vietnam nurse veterans are related to the nature of the wounds, the young age of the patients, and the number of casualties the nurses observed. On the basis of the reports of nurses during clinical interviews for the present study, it is also our impression that the memories of Vietnam nursing-related experiences provide the primary source of distress, rather than memories of life-threatening situations. Consistent with this impression, when asked to describe their two most traumatic Vietnam-related experiences, 25 of 38 (66%) nurses identified two nursing-related events. Only two individuals did not identify at least one nursing-related event as among their most traumatic. Furthermore, the percentage of nurses with PTSD who identified two nursing-related events as being their most traumatic showed a trend toward being significantly higher than the percentage of non-PTSD nurses. Also, the majority of the nurses told us that even during periods of attack, their primary thoughts and concerns were for the safety of their patients.

Additional support for the likelihood that the present imagery results are related to witnessing episodes, rather than to experiencing life-threatening episodes, is provided by the self-reported discrete emotional responses collected after each imagery trial. In studies where the stressor was more directly attributable to an event of personal threat or danger, the highest rated emotional response reported during imagery typically has been fear or anger. This finding appears to hold true for both male (Orr et al., 1993; Pitman et al., 1987, 1990) and female populations (Orr et al., 1998). However, the highest rated emotional response for the Vietnam nurse veterans was sadness, suggesting that their predominant emotion was sadness, not fear. This difference in emotional response configuration may be reflective of the difference in the A.1 stressor criterion (i.e., witnessing rather than experiencing).

The heightened psychophysiologic responsivity shown by the Vietnam nurses with PTSD cannot simply be attributed to the presence of general psychiatric symptomatology. The group differences in psychophysiologic responsivity to trauma-related im-

agery remained statistically significant after adjusting for the SCL-90-R Global Severity Index score. Furthermore, the heightened responsivity to trauma-related stimuli shown by individuals with PTSD is unlikely to be a consequence of simply having an anxiety disorder, as suggested by the failure of agoraphobic patients to show heightened physiologic responses during imagery of their fear-relevant cues (e.g., Zander & McNally, 1988) and findings that male Vietnam combat veterans with anxiety disorders other than PTSD do not show heightened responsivity to trauma-related imagery (Pitman et al., 1990).

The women who served as nurses in Vietnam have heretofore been a relatively neglected population of trauma-exposed individuals. Although the present sample was of a convenience rather than an epidemiologic nature, the results suggest that PTSD is a significant problem for some of these women. We believe the present psychophysiologic findings and clinical observations testify to the enduring traumatogenicity of the nursing experience in warfare. From a clinical perspective, we found it surprising that even though the Vietnam nurses with PTSD were among the most distressed participants we have encountered during 15 years of PTSD research, they appeared to be highly functional in the domains of education, employment, and freedom from substance abuse. Nearly half of the nurses with PTSD had an advanced college degree; more than 80% were still employed in the nursing profession; over 70% were currently in a long-term relationship; and only one was currently abusing a substance (alcohol). This finding raises the important question about what personal qualities or coping strategies the nurses possess that allow them to maintain their high level of functioning despite relatively severe PTSD symptoms.

It was interesting that the nurses without PTSD reported emotional responses during recollection of their personal Vietnam events that were equally as strong as the nurses with PTSD; however, the non-PTSD participants showed dramatically less associated physiologic arousal. We have previously observed this dissociation between self-reported and physiologic measures of emotion in male PTSD versus non-PTSD combat veterans of the Korean War and WWII (Orr et al., 1993). On the basis of these findings, it appears that it is the physiologic arousal, rather than subjective emotion, that is associated with PTSD. This finding is consistent with current neurophysiologic theories of this disorder (Pitman, Shalev, & Orr, 2000).

The findings of the present study raise the question as to whether some civilian medical and nursing personnel who work in situations that involve repeated exposure to the gruesome injury and death of others (e.g., trauma centers, burn units) might also be at high risk for developing PTSD. Although the circumstances of their employment may be more favorable than the military setting with regard to such potentially modulating factors as social support, fatigue, and exposure intensity, this civilian population that is potentially at risk would appear to warrant more research attention. It would also be of interest to examine the extent to which consequences of routine witnessing of trauma are influenced by such factors as the individual's professional role (e.g., caregiver vs. graves registration), context within which the witnessing occurs (e.g., war zone vs. civilian), and cause of the trauma (e.g., intentional vs. accidental).

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