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Resilience–Recovery Factors in Post-traumatic Stress Disorder Among Female and Male Vietnam Veterans: Hardiness, Postwar Social Support, and Additional Stressful Life Events

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Resilience–recovery factors in post-traumatic stress disorder among female and male Vietnam veterans: Hardiness, postwar social support, and additional stressful life events.

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Abstract

Structural equation modeling procedures were used to examine relationships among several war zone stressor dimensions, resilience-recovery factors, and post-traumatic stress disorder symptoms in a national sample of 1,632 Vietnam veterans (26% women and 74% men). A 9-factor measurement model was specified on a mixed-gender subsample of the data and then replicated on separate subsamples of female and male veterans. For both genders, the structural models supported strong mediation effects for the intrapersonal resource characteristic of hardiness, postwar structural and functional social support, and additional negative life events in the postwar period. Support for moderator effects or buffering in terms of interactions between war zone stressor level and resilience–recovery factors was minimal.

Keywords

resilience & recovery & social support & stressful postwar life events & hardiness & PTSD symptoms, Vietnam veterans

Introduction

Exposure to highly stressful life events may have long-term implications for health and illness. For example, Baum and his associates (Baum, Gatchel, & Schaeffer, 1983; Davidson & Baum, 1986) investigated the aftereffects of Three Mile Island, some 5 years postdisaster, and found higher scores on measures of depression, anxiety, and physical complaints for area residents when compared with a control group. Similarly, Holen (1991) documented marked elevations in the prevalence of psychiatric disorders up to 8 years after the event for survivors of the 1980 North Sea oil rig collapse; and Green, Lindy, Grace, and Leonard (1992) reported symptoms of distress, including depression and post–traumatic stress disorder (PTSD), among survivors of a dam collapse that had occurred 14 years earlier.

For victims of interpersonal violence, a prolonged pathological response has likewise been observed: In one sample of rape victims, Kilpatrick, Saunders, Veronen, Best, and Von (1987) noted a 16.5% PTSD rate an average of 17 years after the incident; in a second sample, the rate was 12.5% after a comparable interval (Kilpatrick & Resnick, 1993). The long-term impact of war-related trauma also is well substantiated, with Kulka et al.'s (1990) National Vietnam Veterans Readjustment Study (NVVRS) indicating a 15.2% PTSD rate among male Vietnam veterans and an 8.5% rate among female Vietnam veterans one to two decades after service. Indeed, the recently completed National Comorbidity Survey (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995) found a 7.8% lifetime prevalence of PTSD across all types of traumatic experiences and, more important, estimated that the condition persists over many years for about one third of all PTSD cases, irrespective of treatment.

Although chronic symptomatology obviously occurs within a significant portion of those exposed to severe stressors, most victims appear to resist or recover. Clearly, then, other factors must come into play. The purpose of the present study was to examine the associations among a selection of these resilience–recovery factors and PTSD for one trauma group, veterans of the Vietnam War. In particular, we conducted a series of structural equation modeling analyses to evaluate relationships involving an intrapersonal resource variable (hardiness), social resources (both structural and functional social support), additional posttrauma stressful life events, and current PTSD symptomatology for those experiencing varying levels of war zone stressors. Data were drawn

from the survey responses of the national sample of female and male theater veterans who participated in the NVVRS (Kulka et al., 1990). In the paragraphs that follow, we briefly introduce each of the principal factors under investigation and set forth the collection of hypotheses that formed the framework for model specification.

Our first resilience–recovery factor, the constellation of personality dispositions that Kobasa (1979) termed *hardiness,* has three primary components: (a) a sense of control over one's life, (b) commitment in terms of the meaning ascribed to one's existence, and (c) an openness to viewing change as challenge. Each of these components, in turn, may motivate adaptive coping behaviors in response to stressors. In the present study, hardiness was hypothesized to be directly related to current PTSD, owing to prior evidence for its main effect on health and illness (e.g., Kobasa, 1979; Kobasa, Maddi, & Kahn, 1982; Kuo & Tsai, 1986; Nowack, 1986; Sutker, Davis, Uddo, & Ditta, 1995). However, an interaction effect mirroring that reported by Kobasa, Maddi, and Kahn (1982) and Kobasa, Maddi, and Puccetti (1982) was also proposed, so that the association of hardiness and PTSD would be stronger under the condition of high war zone stressor exposure than under the condition of low war zone stressor exposure. Presumably, when circumstances necessitate, more hardy individuals are better able to mobilize coping resources than are less hardy individuals. Also, hardiness was expected to indirectly predict PTSD through its relationship with functional social support; as suggested by Kobasa and Puccetti (1983), Kuo and Tsai (1986), and Blaney and Ganellen (1990), hardy people are simply more likely to take advantage of sustenance and assistance available in the social environment.

In the general stress arena, researchers have demonstrated that *social support* influences the likelihood that individuals will fall prey to stress-related illnesses and affects physical and mental health (e.g., S. Cohen & Wills, 1985; Holahan & Moos, 1981; Norris & Murrell, 1990). Likewise, research on veteran adjustment has focused on the quality and quantity of available social support (e.g., Egendorf, Kadushin, Laufer, Rothbart, & Sloan, 1981; Keane, Scott, Chavoya, Lamparski, & Fairbank, 1985; Z. Solomon & Mikulincer, 1990; Z. Solomon, Mikulincer, & Avitzur, 1988; Z. Solomon, Mikulincer, & Flum, 1989). In line with S. Cohen and Wills's (1985) comprehensive review, the two forms of postwar social support examined in the present study were expected to be related to PTSD in different ways. Support operationalized in terms of size and complexity of the veteran's social network, structural social support, was proposed to be directly related to PTSD as a main effect. Support operationalized in terms of perceived emotional sustenance and instrumental assistance, functional social support, was proposed to directly relate to PTSD but (of greater interest) to interact with war zone stressor exposure. Those exposed to high levels of war zone stressors and high functional social support were hypothesized to exhibit fewer PTSD symptoms than those exposed to high levels of war zone stressors and low functional social support; for those exposed to low levels of war zone stressors, a weaker relationship between functional social support and PTSD would be observed. Moreover, it was anticipated that structural social support would predict functional social support for the mere reason that functional support presupposes a network that can be drawn on.

In recent years, trauma researchers have recognized that stress symptomatology may not be solely the product of a single precipitating event (e.g., Green, 1994; Resnick, Kilpatrick, & Lipovsky, 1991). Rather, what is observed as a stress reaction may be the consequence of a series of highly stressful life events, extending back into one's personal history before the focal traumatic experience or forward in time to the present. Given the high rates of trauma exposure documented in various populations (Breslau, Davis, Andreski, & Peterson, 1991; Kessler et al., 1995; Norris, 1992; Resnick et al., 1991), it is possible that symptoms may be linked to multiple events. Concordant with earlier studies that reported relationships between postwar stressors and PTSD (Green, Grace, Lindy, Gleser, & Leonard, 1990; Z. Solomon et al., 1989), the present study proposed that *additional stressful life events* of varying magnitudes would demonstrate an association with current PTSD symptomatology. Yet, as Z. Solomon, Garb, Bleich, and Grupper (1987) suggested, persons who seem to have successfully adjusted to a traumatic event may carry with them a sensitization to respond dysfunctionally to additional life stressors. Therefore, this interaction effect was likewise addressed. It was hypothesized that veterans exposed to high levels of war zone stressors and a greater number of subsequent stressors would exhibit more PTSD

symptomatology than those exposed to high levels of war zone stressors and fewer subsequent stressors; for those exposed to low levels of war zone stressors, the relationship was expected to be weaker. Additionally, we anticipated that postwar stressful life events would indirectly predict current PTSD through a relationship with functional social support. A negative relationship between stressful life events and social support might ensue when excessive support demands from the veteran–victim produce the withdrawal of support from others (S. D. Solomon, Smith, Robins, & Fischbach, 1987).

In addition to the factors just described, viewed as potentially influencing one's ability to resist or recover from trauma exposure, the study included four war zone stressor dimensions: (a) exposure to traditional combat experiences, (b) exposure to atrocities or episodes of extraordinarily abusive violence, (c) perceptions of threat or harm to personal safety, and (d) the discomfort of the harsh and malevolent environment. D. W. King and King (1991) discussed these stressor representations in their review of validity issues in Vietnam veteran research, and D. W. King, King, Gudanowski, and Vreven (1995) later provided additional justification and operationalized each using items from the NVVRS. Traditional combat and atrocities–abusive violence were viewed as more objective aspects of the Vietnam experience, whereas perceived threat and malevolent environment were viewed as more subjective. Measures of the four dimensions were reliable, their differential relationships to PTSD suggested discriminant validity, and their identification and verification were in keeping with Green's (1990) recommendation that researchers seek finer distinctions among stressors in PTSD inquiry. For the model tested here, patterns of relationships involving the four war zone stressors derived from the previous findings of D. W. King et al. (1995) and D. W. King, King, Foy, and Gudanowski (1996): Atrocities and abusive violence, perceived threat, and malevolent environment were expected to directly relate to PTSD, whereas traditional combat was expected to have an indirect relationship to PTSD through its association with the other three stressors. Paths from atrocities and abusive violence to malevolent environment and from malevolent environment to perceived threat were also a part of the proposed model, again in keeping with prior results.

The Present Study

Figure 1 contains a simplified version of the model that guided the study; further information regarding specific paths is provided in the *Results* section. In a general sense, the model is reminiscent of Aldwin, Levenson, and Spiro's (1994) deviation-amplification model, to explain how the relationship between combat exposure and PTSD is mediated by appraisals of desirable and undesirable effects of military service. The models differ, however, in that we do not expect negative (additional stressful life events) and positive (hardiness and two types of social support) mediators to be independent but, rather, propose several links among them. To reiterate, we hypothesized that hardiness, social support, and additional stressful life events would mediate the relationship between war zone stressors and PTSD. In addition, we examined several moderator or joint effects on PTSD: between war zone stressors and hardiness, between war zone stressors and functional social support, and between war zone stressors and additional stressful life events.

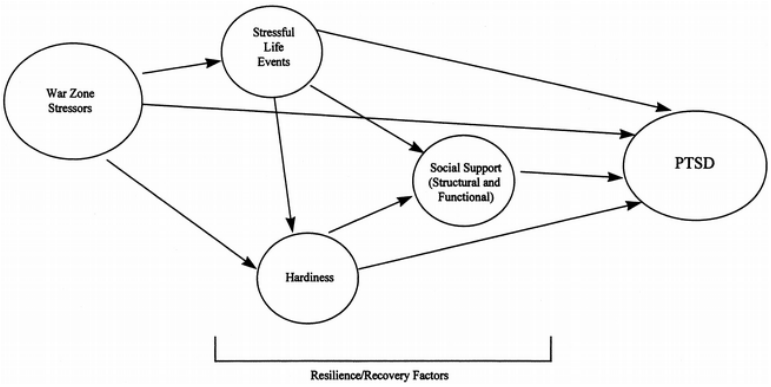

Figure 1. Simplified model of the associations among war zone stressors, resilience–recovery factors, and post–traumatic stress disorder (PTSD)

Method

Data Source

The data for this study came from the component of the NVVRS (Kulka et al., 1990) known as the National Survey of the Vietnam Generation. We used the responses of the 1,632 theater veterans who served in and around Vietnam as part of the war effort sometime between August 5, 1964, and May 7, 1975. Women (mostly registered nurses), African American and Hispanic American men, and those with service-connected disabilities were oversampled. Of the full theater veteran group, 432 (26%) were women, and 1,200 (74%) were men. The distribution of race–ethnicity for male veterans was 25% African American, 24% Hispanic American, and 51% White or other; for female veterans, less than 3% reported minority status. Each of these veterans was interviewed for an average of 5 hr on a broad array of topics ranging from prewar background to postwar functioning and personal circumstances. The response rates for the overall sample, women, and men were 83%, 86%, and 82%, respectively. More information about sampling strategies and characteristics of the sample is available in a number of other sources (e.g., Jordan et al., 1991; Kulka et al., 1990; Schlenger et al., 1992).

Measures

Hardiness

Eleven items from the NVVRS interview served as indicators of hardiness. They were chosen from among a larger pool of items developed by Kobasa and her colleagues (see Funk's, 1992, chronology of the assessment of hardiness). The items reflected the three core elements of hardiness proposed by Kobasa (1979): (a) control (e.g., "No matter how hard I try, my efforts will accomplish nothing"; reverse scored); (b) commitment (e.g., "I really look forward to my work"); and (c) change as challenge (e.g., "I feel uncomfortable if I need to make any changes in my everyday schedule"; reverse scored). Each item was accompanied by a 4-point Likert-type response scale, with options ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Although there is no single hardiness scale available, item sets of similar content, expression, and format (adapted from the unabridged, original collection of hardiness items) have been commonly used and shown to demonstrate both direct and interactive effects with physical and mental health outcomes (again, see Funk, 1992, for a thorough review and listing of findings involving various measures of hardiness).

Postwar social support

Based on S. Cohen and Wills's (1985) conceptual framework, three representations of social support were initially proposed and operationalized: structural social support and the emotional sustenance and instrumental assistance aspects of functional social support. This typology has a fairly well established history in the theoretical and empirical literature (Beehr, 1995). The pool of items from which the measures were constructed was compiled by the NVVRS researchers from several sources, including Veroff, Kulka, and Douvan (1981) and Gottlieb and Green (1984; both for structural social support items); Pearlin, Lieberman, Menaghan, and Mullan (1981) and Cleary and Mechanic (1983; both for functional–emotional sustenance items); and S. Cohen, Mermelstein, Kamarck, and Hoberman (1985) and Vernon and Roberts (1985; both for functional–instrumental assistance items).

Using a rational approach to test construction (Jackson, 1971; Nunnally, 1978), the procedure involved developing formal definitions, screening the interview protocol for items reflecting social support, and then having judges (six senior-level graduate students familiar with the social support literature) sort the items into the three social support categories. After discarding items for which there was disagreement about categorization, item–total correlations were computed for each item set. Final selection of items was based on a consideration of both content breadth and balance and maximization of internal consistency. In the end, 8 items

inquiring about the size and complexity of the veteran's postwar support network constituted the measure of structural social support. A sample item from this scale is “About how many voluntary groups or organizations do you belong to?—like church groups, clubs or lodges, parent groups, etc.?” The functional social support measure assessing perceived emotional sustenance contained 13 items. A sample item is “Does it seem that your family and friends understand you?” The 6-item instrumental assistance aspect of functional social support was assessed by statements referring to tangible aid that the veteran perceived could be made available if necessary. For example, 1 item is “Among your friends and relatives, is there someone who would lend you a car or drive you to a doctor, the airport, shopping, or somewhere else if you really needed it?” Because items within these three measures had different numbers of response options, item scores were transformed to standard scores before they were combined for subsequent analyses.

Additional stressful life events

There were four sources of information on postwar additional stressful life events. First, a contemporaneous stressor index was calculated from responses to 12 inquiries regarding stressful life events that might have occurred in the previous year. These included job interruption, legal or financial difficulties, criminal victimization, and death or serious illness of a relative. Each of the items was scored using a 3-point scale, where 0 was assigned if the event had not occurred, 1 was assigned if it had occurred but had minimal or neutral impact, and 2 was assigned if it had occurred and had a negative impact. A total score was computed as the sum of the item scores. Next, a traumatic stressor index was calculated as a count of the number of extraordinarily stressful events that had occurred anytime after the veteran had returned from the war zone. These included very serious vehicular accidents, natural disasters, physical assaults, and fires and explosions. The count of events allowed for multiple occurrences within the several categories. In addition, the number of marital disruptions (by divorce, separation, or widowhood) experienced by the veteran since returning from the war was obtained, as was a count of the number of deaths of children occurring in the postwar years. Scores on these four measures were converted to standard scores and summed, to provide a single indicator of stressful life events. The items that constituted this variable category closely parallel those on the Potential Stressful Events Interview (Falsetti, Resnick, Kilpatrick, & Freedy, 1994), used in the field trial studies that informed the development of the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 1994).

War zone stressors

The four war zone stressor measures were identical to those used by D. W. King et al. (1995), who provided detailed explanations of item selection and scale refinement, as well as documentation supporting reliability and discriminant and predictive validity. The traditional combat scale consisted of 36 items intended to judge the extent to which the veteran reported being exposed to circumstances or events that would be considered observable, stereotypical warfare experiences. For example, items referred to receiving enemy fire, seeing injured or dead Americans, going on special missions or patrols, and firing weapons. The scale reflecting exposure to atrocities–abusive violence consisted of 9 items designed to elicit reports of observable circumstances or events that might be considered extremely deviant or beyond normal war zone experiences. These items assessed the veteran's exposure to or involvement in the terrorizing, wounding, or killing of noncombatants, mutilation of bodies, and similar circumstances or events. The third scale, perceived threat, contained 9 items that required the veteran to offer an appraisal as to whether war zone circumstances or events were harmful to personal safety (e.g., judgments of fear and degree of danger). The fourth scale, malevolent environment, consisted of 18 items that evaluated the extent to which the veteran rated daily war zone living conditions as particularly bothersome, annoying, or uncomfortable. For example, a number of these items asked how unpleasant the veteran perceived various day-to-day Vietnam situations, such as the lack of privacy, inadequate food, bad climate, insects, disease, and filth. For all four war zone stressor scales, variations in item response format necessitated conversion of raw scores to standard scores before combining across items. Higher scores indicated a stronger endorsement of the stressor.

PTSD

Three measures of current PTSD were used. The first was the Mississippi Scale for Combat-Related PTSD (Keane, Caddell, & Taylor, 1988), a 35-item self-report instrument that uses a 5-point Likert-type response format. The Mississippi Scale has an extensive record for reliable and valid PTSD assessment (see the psychometric studies by Keane et al., 1988; King, King, Fairbank, Schlenger, & Surface, 1993; McFall, Smith, MacKay, & Tarver, 1990). The second PTSD measure was Kulka et al.'s (1990) adaptation of the PTSD module from the Diagnostic Interview Schedule (DIS-PTSD; Robins, Helzer, Croughan, & Ratcliff, 1981). Items were scored dichotomously, with 1 assigned if the symptom was present in the last 6 months and 0 assigned if the symptom was absent in the last 6 months. A total score was computed for each veteran as the number of endorsed symptoms. Last, a predicted probability of PTSD for each veteran also was used in the present study. This composite score, with a possible range from 0 to 1, was derived by the original NVVRS researchers using a logistic regression equation (Kulka et al., 1990).

Overview of Procedures and Analyses

Using the full sample of 1,632 theater veterans, descriptive statistics and estimates of internal consistency reliability, where appropriate, were computed for all measures. The total sample was then divided into three subsets: (a) a mixed-gender 25% stratified sample of 108 women and 300 men; (b) a sample comprising the remaining 324 women; and (c) a sample comprising the remaining 900 men. A sequence of structural equation modeling procedures then ensued. Guided by the recommendations of Anderson and Gerbing (1988), a two-step modeling process was followed, with the measurement model specified on one portion of the data and the structural model evaluated on other portions of the data.

In the initial stage of modeling, the mixed-gender subsample of 408 veterans was used solely for measurement purposes, that is, to stipulate the underlying factor structure or latent variables responsible for scores on the observed or manifest indicators. The measurement model derived from this subset of the data was then replicated on the subsample of 324 women and then on the subsample of 900 men, thus supplying a series of three confirmatory factor analyses in support of the measures used in the study. Before progressing to the evaluation of a structural model, we used a multisample procedure (Jöreskog & Sörbom, 1993) to determine if the replicated measurement model was invariant across the female and male samples. Factor loadings were not invariant across genders, and inspection of the unstandardized factor loadings suggested that the primary source for the discrepancy lay with the indicators of functional social support, especially those related to the provision of instrumental assistance. Hence, subsequent specification and evaluation of a structural model were conducted separately for women and men.

Next, we assessed interactions. For the separate female and male subsamples, high- and low-combat-exposed subgroups were created, using a median split on the traditional combat variable, and multisample modeling procedures were then applied. The concern was the equivalence of relationships between selected variables (hardiness, functional social support, and stressful life events) and PTSD for the high- and low-combat-exposed subgroups.

For all modeling procedures, we used the LISREL 8 (Jöreskog & Sörbom, 1993) software package. Matrices of variances and covariances among observed variables were analyzed using generalized least squares estimation. Across all analyses, observed variables were specified to load on only one latent variable, and covariances among residuals were fixed at 0. Competing, nested models were evaluated using sequential chi-square difference tests (Anderson & Gerbing, 1988). Additional details regarding analytic strategies and their justification are integrated within the *Results* section, to follow.

Results

Descriptive Statistics and Reliability

Table 1 contains means, standard deviations, and estimates of internal consistency reliability, where appropriate, for the 15 measures included in the study. Means for the three PTSD measures are consonant with what one would anticipate for this community-based sample of Vietnam veterans. The mean Mississippi Scale for Combat-Related PTSD score of 72.58 falls well below previously used diagnostic cutpoints, for example, a value of 89 in the NVVRS (Kulka et al., 1990) and a value of 107 earlier endorsed by Keane et al. (1988). Likewise, the average number of symptoms elicited from administration of the DIS-PTSD module is less than 1, and the percentage of individuals with PTSD using the predicted probability function is about 18%. Estimates of internal consistency for those measures comprising a collection of items indicative of a common construct are generally satisfactory, with seven of the nine having values above .80. The lowest internal consistency estimate, .73 for the hardiness scale, exceeds the lower bound of acceptability recommended by Nunnally (1978).

Table 1: Descriptive Statistics and Reliability Estimates for All Measures in the Study

				Coefficient	
Measure	No. items	*M*	*SD*	α	*n*
Resilience-recovery factors					
Hardiness	11	33.66	3.83	.73	1626
Postwar social support					
Structural[a]	8	-0.01[b]	4.27		1587
Functional: Emotional sustenance	13	0.00[b]	7.41	.82	1628
Functional: Instrumental assistance	6	0.01[b]	4.09	.77	1618
Additional stressful life events					
Contemporaneous stressor index[a]	12	2.28	2.64		1630
Traumatic stressor index[a]	9	1.73	1.92		1632
Marital disruptions[c]	1	0.41	0.65		1577
Loss of child[c]	1	0.02	0.17		1632
War zone stressors					
Traditional combat	36	0.00[b]	20.88	.94	1619
Atrocities-abusive violence	9	0.00[b]	6.66	.89	1612
Perceived threat	9	0.00[b]	5.94	.84	1619
Malevolent environment	18	0.00[b]	11.16	.91	1618
PTSD					
Mississippi Scale	35	72.58	21.91	.94	1584
DIS-PTSD symptom count	16	0.78	2.30	.92	1541
Predicted probability of PTSD[c,d]		0.18	.30		1597

Note. PTSD = post-traumatic stress disorder; Mississippi Scale = Mississippi Scale for Combat-Related PTSD; DIS-PTSD = adaptation of PTSD module from the Diagnostic Interview Schedule.

[a] Because there was no reason to expect the items that constitute the scale to covary strongly with one another, an estimate of internal consistency was considered inappropriate.

[b] Means were computed on sums of scores for items that had been transformed to standard scores. Thus, each item had a mean of 0 and a standard deviation of 1. For the structural social support and instrumental assistance measures, the scale mean of exactly zero did not obtain because of missing data when sumrnative scores across items were computed for all respondents.

[c] Measure consisted of a single item; estimate of internal consistency could not be computed.

[d] This measure was a composite score derived from a logistic regression equation developed by the original National Vietnam Veterans Readjustment Study researchers to estimate prevalence rates of PTSD in the

Vietnam veteran population. Explanatory variables included ethnicity, geographic region, number of postwar readjustment problems, exposure to a traumatic event, number of PTSD symptoms experienced since return from the war, and continuous score on the Mississippi Scale for current PTSD. A thorough description of the methods used to compute the predicted probabilities is provided in Appendix E of the Kulka et al.(1990) report (pp. E2-E23).

Structural Equation Modeling

Measurement model

The measurement model contained nine latent variables: the four war zone stressors; the resilience–recovery variables of hardiness, postwar structural and functional social support, and additional stressful life events; and PTSD. For four of these latent variables (exposure to traditional combat, exposure to atrocities–abusive violence, structural social support, and additional stressful life events), the manifest or observed measures were treated as causal indicators, that is, were judged to cause their respective latent variables rather than the more common situation in which latent variables are considered responsible for observed scores (Bollen & Lennox, 1991; Loehlin, 1992; MacCallum & Browne, 1993). These four variables closely resemble P. Cohen, Cohen, Teresi, Marchi, and Velez's (1990) examples of "emergent variables" (p. 184), which they describe as variables whose manifest indicators or "measured variables" (p. 184) are their cause. As pointed out by P. Cohen et al., a major problem in specifying causal indicators using existing computer packages is that solutions may fail to converge because of identification problems. In this case, however, we adhered to P. Cohen et al.'s advice to create unit-weighted composites of the components of causal indicators before undertaking the modeling analyses. Then, as recommended by Jöreskog and Sörbom (1993, p. 176), we fixed the loadings for these variables at 1.00 and specified the residuals to be equal to 0. Accordingly, all solutions converged satisfactorily.

The remaining five latent variables had effect indicators. The indicators for the war zone stressors of perceived threat and malevolent environment were average scores for randomly formed item triplets, three such indicators for the 9-item perceived threat measure and six for the 18-item malevolent environment measure. Similarly, the 11 items constituting the hardiness scale were randomly grouped into three triplets and one pair. The 13 emotional sustenance items produced three triplets and two pairs, and the 6 instrumental assistance items produced two triplets, all of which served as manifest indicators of global functional social support. This practice of creating item "parcels" (MacCallum, Roznowski, & Necowitz, 1992, p. 494; West, Finch, & Curran, 1995, p. 70) was endorsed by P. Cohen et al. (1990) and has precedence in the literature (e.g., Bagozzi & Heatherton, 1994; L. A. King, Mattimore, King, & Adams, 1995; Marsh, 1994).

Finally, PTSD had six effect indicators: the DIS-PTSD symptom count, the predicted probability of PTSD, and four indicators formed by grouping Mississippi Scale for Combat-Related PTSD items and computing average item scores. These four item parcels were based on symptom categories previously examined by L. A. King and King (1994) in a collection of exploratory and confirmatory factor analyses of the Mississippi Scale.

For this nine-factor measurement model applied to the mixed-gender subsample, the discrepancy index between the pooled within-gender observed variance–covariance matrix and the model-based matrix fit to that sample was $\chi^2(394, N = 398) = 819.98$, $p < .01$. Although significant, this value generally conforms to Newcomb's (1994) guideline that the ratio of the degrees of freedom to the chi-square statistic be 2:1 or less. More important, the root-mean-square error of approximation (RMSEA; Steiger, 1990) was .052. This estimate of the difference between the population variance–covariance matrix and the model-based matrix fit to the population, per degree of freedom, approaches the .05 standard indicative of close fit (Browne & Cudeck, 1993). Other fit indices were quite acceptable: the parsimony normed fit index (PNFI; James, Mulaik, & Brett, 1982), .83; the LISREL 8 goodness-of-fit index (GFI; Jöreskog & Sörbom, 1993), .87; the normed fit index (NFI; Bentler & Bonett, 1980), .98; the comparative fit index (CFI; Bentler, 1990), .99; and the incremental fit index (IFI; Bollen, 1989a), .99.

When the measurement model was replicated on the subsample of women and then on the subsample of men, satisfactory solutions were also obtained. For the women, the various indices of fit were $\chi^2(373, N = 316) = 602.50$, $p < .01$; RMSEA = .044; PNFI = .83; GFI = .87; NFI = .96; CFI = .99; and IFI = .99. For the men, these indices were $\chi^2(373, N = 874) = 1{,}164.45$, $p < .01$; RMSEA = .049; PNFI = .84; GFI = .91; NFI = .98; CFI = .99; and IFI = .99. Additionally, across all three solutions (for the mixed-gender, female, and male subsamples), loadings of manifest indicators were quite high; of the 63 loadings that were free to vary, over 85% had *t* values greater than 10.00, and none had values less than 4.00. Tables providing further details on the measurement model may be obtained from Lynda A. King.

Structural model for women

The hypotheses that guided the present study mandated 15 paths among the nine latent variables: 5 paths that describe relationships among the war zone stressors, 3 paths that describe relationships between a war zone stressor and PTSD, 3 paths that describe relationships among the resilience–recovery variables; and 4 paths from each of these variables to PTSD. No links or paths from the war zone stressors to the resilience–recovery factors were represented in the formal hypotheses.

As Newcomb (1994) pointed out, however, it is advisable to initially overfit the model to allow for the possibility that other relationships may be important to explaining the underlying structure of the data. Hence, nine additional potentially plausible but nonhypothesized paths were added. The first two were paths from the more objective war zone stressors of traditional combat and atrocities–abusive violence to additional stressful life events. The logic here derives from the observation that "individuals with a history of exposure to extreme psychological stress appear to have an increased vulnerability to exposure to subsequent stress" (Bremner, Southwick, & Charney, 1995, p. 152). Additionally, four paths, from perceived threat and malevolent environment to both hardiness and functional social support, were added to provide further possible links between experiences in the war zone and aspects of the veteran's intrapersonal and social resources. It seemed conceivable that the more subjective war zone stressors of perceived threat and malevolent environment might deplete the veteran's resilience in the face of future adversity or might have a lasting effect on the veteran's ability to recognize and draw support from others. Using similar reasoning, a path representing a negative relationship between stressful life events and hardiness was added at the outset. The last two added paths were from both hardiness and stressful life events to structural social support; again, nonresilient, less hardy individuals or those whose life is replete with stressors may tend to drive away members of their support network.

Table 2 contains the sequence of hierarchically nested models for the female veterans, with the associated chi-square statistics. In addition, each model is compared with the immediately preceding, more saturated model as well as with the base or measurement model. Commensurate with Bollen (1989b), the criterion was the fit of model-based variance–covariance matrices, not test statistics for individual path coefficients. Model simplification was guided primarily by substantive concerns; as recommended by Jöreskog and Sörbom (1993), a path was removed if its associated *t* statistic was less than an absolute value of 2.00 and only if such action could be conceptually justified. We proceeded by first focusing on the nonhypothesized paths with low *t* values and then the hypothesized paths with low *t* values.

Table 2. Sequential Chi-Square Difference Tests for Structural Models

				Δ from base			Δ from previous			
Model	χ^2	*df*	*p*	χ^2	*df*	*p*	χ^2	*df*	*p*	Cross-validation index

Women (n = 316)										
Base (measurement model)	602.50	373	.00							2.50
Initial structural model (24 paths)	621.95	385	.00	19.45	12	.08				2.48
Delete 4 paths: Traditional combat to stressful life events, perceived threat to hardiness, malevolent environment to functional social support, stressful life events to structural social support (20 paths)	626.51	389	.00	24.01	16	.09	4.56	4	.34	2.47
Delete 1 path: Structural social support to PTSD (19 paths)	627.05	390	.00	24.55	17	.11	.54	1	.46	2.47
Delete 1 path: Malevolent environment to PTSD (final accepted model; 18 paths)	627.48	391	.00	24.98	18	.13	.43	1	.51	2.46
Delete 3 remaining connections between war zone stressors and resilience-recovery factors (15 paths)	658.76	394	.00	31.48	3	.00	56.26	21	.00	2.54
Men (n = 874)										
Base (measurement model)	1164.45	373	.00							1.54
Initial structural model (24 paths)	1206.63	385	.00	42.18	12	.00				1.57
Add 3 paths: Atrocities-abusive violence to hardiness, atrocities-abusive violence to functional social support, perceived threat to structural social support (27 paths)	1177.88	382	.00	13.43	9	.14				1.54
Delete 4 paths: Atrocities-abusive violence to stressful life events, perceived threat to hardiness, perceived threat to functional social support, stressful life events to structural social support (23 paths)	1179.29	386	.00	14.84	13	.32	1.41	4	.84	1.53
Delete 1 path: Malevolent environment to PTSD (final accepted model; 22 paths)	1182.44	387	.00	17.99	14	.21	3.15	1	.08	1.53
Delete 6 remaining connections between war zone stressors and resilience recovery factors (16 paths)	1316.83	393	.00	152.38	20	.00	134.39	6	.00	1.67

Note: PTSD = post-traumatic stress disorder.

The last row of the top half of Table 2 is provided to highlight the important fact that the resilience–recovery variables in this study mediate the relationship between war zone experiences and current PTSD symptomatology for women. As shown there, when the paths connecting war zone stressors to particular resilience–recovery variables (specifically, from atrocities–abusive violence to additional stressful life events, from perceived threat to functional social support, and from malevolent environment to hardiness) were removed from the model, the discrepancy statistic was significantly different from that of the base model and from that of the prior model. Thus, one can surmise that the hardiness, social support, and stressful life events variables must be considered in conjunction with the war zone stressors to explain the covariance structure. Indeed, the standardized regression weights for each of these links are fairly substantial (from Figure 2, .25, −.32, and −.36, respectively), with associated *t* statistics of 3.85, −4.23, and −4.21, respectively.

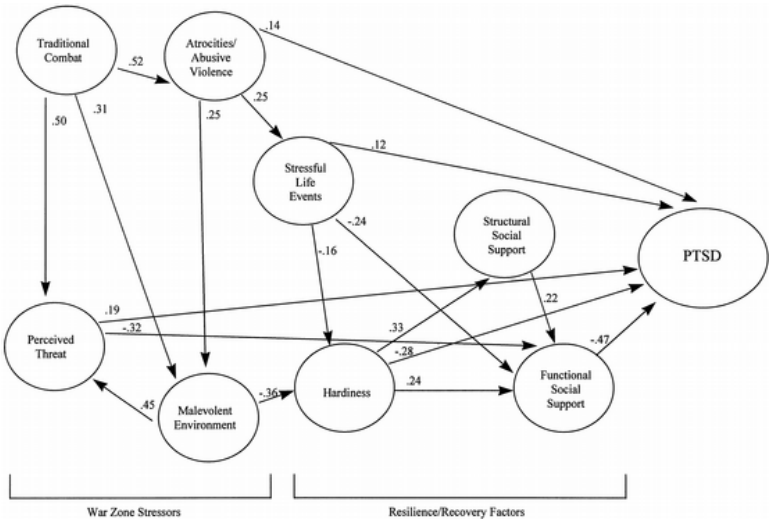

Figure 2. Final structural model of the associations among war zone stressors, resilience–recovery factors, and post–traumatic stress disorder (PTSD) for women

Figure 2 displays the final accepted model for women and gives the LISREL completely standardized coefficients for the 18 inclusive paths. In addition to the chi-square statistic reported in Table 2, the following fit indices resulted: RMSEA = .044, PNFI = .86, GFI = .87, NFI = .96, CFI = .98, and IFI = .98. The accepted model accounted for 73% of the variance in PTSD; the accounted-for variance for each of the resilience–recovery factors was 17%, 11%, 40%, and 6%, for hardiness, structural social support, functional social support, and additional stressful life events, respectively. Finally, Table 3 contains the completely standardized total, direct, and indirect effects of each of the war zone stressors and the other variables on PTSD for female veterans.

Table 3. Total, Direct, and Indirect Effect on PTSD

Latent variable	Total effect	Direct effect	Indirect effect
Women			
Resilience-recovery factors			
Hardiness	-.43	-.28	-.15
Structural social support	-.10		-.10
Functional social support	-.47	-.47	
Stressful life events	.31	.12	.19
War zone stressors			
Traditional combat	.42		.42
Atrocities-abusive violence	.29	.14	.15

Perceived threat	.34	.19	.15
Malevolent environment	.31		.31
Men			
Resilience—recovery factors			
Hardiness	-.39	-.25	-.14
Structural social support	-.15	-.07	-.08
Functional social support	-.42	-.42	
Stressful life events	.16	.07	.09
War zone stressors			
Traditional combat	.62		.62
Atrocities-abusive violence	.26	.09	.17
Perceived threat	.29	.28	.01
Malevolent environment	.32		.32

Note. PTSD = post-traumatic stress disorder. All effects were com-puted from the LISREL 8 standardized solution, and all associated t statistics exceeded 2.00.

Structural model for men

The specification and evaluation of the structural model for men followed the procedures and standards described for the women. We began with the same structural model containing the 15 hypothesized and 9 other paths. When this initial model was fit to the data, the chi-square difference from the base or measurement model for men was significant (see the lowermost portion of Table 2), prompting a search for additional parameters that would ensure a closer model–data fit. The added paths (from atrocities–abusive violence to both hardiness and functional social support and from perceived threat to structural social support) provided additional linkage between the war zone stressors and the other focal variables and reinforced the notion that war-related experiences may have an impact on available intrapersonal and social resources.

Table 2 delineates the process of simplifying this respecified model. The last entry in Table 2 again argues for the viability of the resilience–recovery factors as mediators; it gives the results when the connections from war zone stressors to hardiness, structural and functional social support, and stressful life events were removed. Deletion of these six paths yielded a significant chi-square difference, meaning that, as for the women's model, the set of resilience–recovery factors of interest are probably necessary to fully understand how war-related experiences ultimately impact PTSD symptomatology. As indicated in Figure 3, the standardized coefficients for the six paths ranged from an absolute value of .10 (the negative association between perceived threat and structural social support) to an absolute value of .30 (also a negative relationship between malevolent environment and functional social support). The absolute values of their *t* statistics all exceeded 2.00, ranging from 2.30 to 8.04.

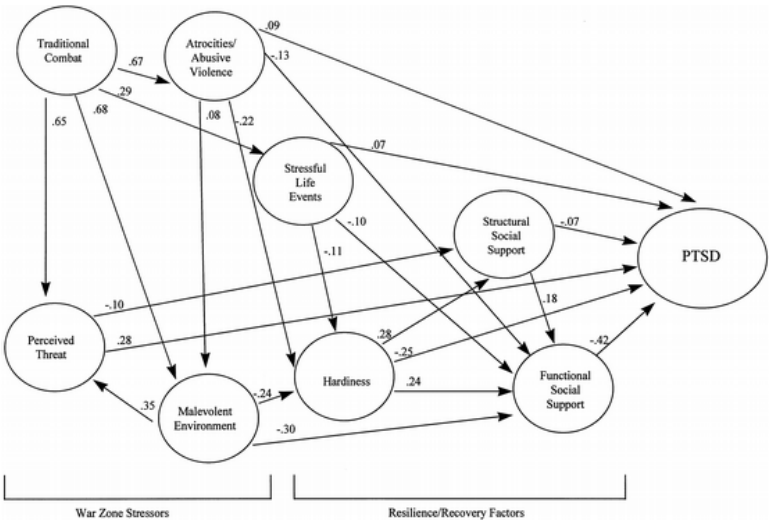

Figure 3. Final structural model of the associations among war zone stressors, resilience–recovery factors, and post–traumatic stress disorder (PTSD) for men

The final accepted model for men is presented as Figure 3, which includes the coefficients for all 22 retained paths. Other fit indices were as follows: RMSEA = .049, PNFI = .87, GFI = .91, NFI = .98, CFI = .99, and IFI = .99. The accepted model accounted for 75% of the variance in PTSD; the accounted-for variance for each of the resilience–recovery factors was 19%, 10%, 40%, and 8% for hardiness, structural social support, functional social support, and additional stressful life events, respectively. Table 3 gives the total, direct, and indirect effects on PTSD.

Tests of interactions

As mentioned earlier, subgroup analyses were used to assess the three interactions hypothesized in the study, with the female and male subsamples each dichotomized at the median traditional combat score (−.048 for women and −.058 for men). This particular war zone stressor was selected to create high- and low-stressor-exposed subgroups because, relative to the other war zone stressor dimensions, it appeared to be the closest to the veteran's objective experiences. Moreover, because the latent variable had a single causal indicator, observed scores on the traditional combat scale could be considered equal to scores on the underlying construct.

Table 4 contains the findings for these subgroup analyses, first the results for women and then the results for men. Chi-square difference tests applied to models specified with the LISREL multisample procedure were used. Here, the base model was one in which the paths from hardiness to PTSD, functional social support to PTSD, and additional stressful life events to PTSD were free to vary between high- and low-combat-exposed subgroups, whereas all other paths were specified as invariant or equivalent across subgroups. In each of three succeeding models, one of these three paths was specified as invariant or equivalent for the two subgroups, and the other two were free to vary. Evidence for an interaction would be a significant chi-square difference between the model of interest and the base model, the conclusion being that each subgroup requires a separate parameter estimate. Thus, the relationship between PTSD and the other variable would not be considered the same across subgroups; the relationship would depend on the level of combat exposure.

Table 4. Chi-Square Difference Tests for Interaction

				Δ from base		
Model	χ^2	*df*	*p*	χ^2	*df*	*p*
Women (n = 316)						

Base: 3 paths free; all others invariant	923.41	763	.00			
Hardiness to PTSD invariant	9.24.73	764	.00	1.32	1	.25
Functional social support to PTSD invariant	923.55	764	.00	0.14	1	.71
Stressful life events to PTSD invariant	923.43	764	.00	0.02	1	.89
Men (n = 874)						
Base: 3 paths free; all others invariant	1460.12	760	.00			
Hardiness to PTSD invariant	1461.64	761	.00	1.52	1	.22
Functional social support to PTSD invariant	1432.65	761	.00	2.53	1	.1
Stressful life events to PTSD invariant	1463.87	761	.00	3.75	1	.05

Note. PTSD = post-traumatic stress disorder.

As can be seen in Table 4, none of the chi-square differences achieved the conventional <.05 level of significance. Hence, there appears to be insufficient support for recognizable interactions between traditional combat and hardiness, between traditional combat and functional social support, and between traditional combat and additional stressful life events in predicting PTSD, and this was consistent for both genders. Please note that the test statistic for the interaction between traditional combat and additional stressful life events for men borders on significance, suggesting that the effect is very likely not null, given contemporary cautions about statistical decision making (J. Cohen, 1994). On the other hand, considering the large sample size, the inability to endorse an interaction at the conventional level leads to the conclusion that the effect is very likely quite small. It is also important to acknowledge that the effects of variables on PTSD are in the context of the other factors associated with PTSD; therefore, covariation among predictors is apt to yield smaller unique partial effects.

Expected cross-validation indices

Further evidence in favor of the final accepted models for the current study may be found in the expected cross-validation indices reported in the last column of Table 2 . Though there is little variability across values for both women and men, the trend favors the models accepted using the chi-square difference testing procedure.

Discussion

In this study, we used data from a national sample of Vietnam veterans to document the role of several posttrauma resilience–recovery factors, along with war zone stressors, in accounting for current PTSD symptomatology. A succession of structural equation modeling procedures was undertaken. First, a nine-factor measurement model (four war zone stressors; the resilience–recovery factors of hardiness, structural and functional social support, and stressful life events; and PTSD) was specified on a mixed-gender subsample of the available data and then replicated on separate subsamples of female and male veterans. Although the pattern of factor loadings was comparable for both women and men, the loadings were not invariant across genders. Thus, structural models for women and men next were specified and evaluated separately, as were several supplemental models that tested for interactions between war-related trauma and resilience–recovery variables.

An initial cluster of hypotheses involved the means by which hardiness operates within the network of relationships among the variables of interest. In keeping with the first of these, hardiness demonstrated a direct negative association with PTSD for both women and men (see Figures 2 and 3 and Table 3). Those who scored higher on items assessing the trio of hardiness dispositions (i.e., control, commitment, and change as challenge) appeared to exhibit fewer PTSD symptoms. This finding supports some existing literature that reports a main effect of hardiness on illness and well-being, for both physical health outcomes (e.g., Kobasa, 1979; Kobasa, Maddi, & Kahn, 1982; Kobasa, Maddi, & Puccetti, 1982; Kobasa & Puccetti, 1983) and mental health outcomes (e.g., Kuo & Tsai, 1986; Nowack, 1986). Moreover, for both women and men, hardiness emerged as a relatively strong direct predictor of PTSD, when compared with the other latent variables, resilience–recovery factors as well as war zone stressors.

Likewise, the hypothesis that hardiness would have an indirect effect on PTSD through the variable of functional social support was upheld. In fact, a substantial amount of the indirect effect of hardiness on PTSD (roughly 67% for the women and 80% for the men) was attributable to the linkage through functional social support. This result is in agreement with the speculation of Kobasa and Puccetti (1983), among others, that the behavioral repertoire of hardy individuals includes ease at seeking out available others for realistic help in times of stress. The remainder of the indirect influence of hardiness derived from the nonhypothesized connection from hardiness to structural social support, again for both genders. It seems that persons high in hardiness may be better able to build for themselves a larger or more complex support network than persons low in hardiness.

Contrary to expectations, however, an interaction between hardiness and exposure to traditional combat was not supported by the data for either women or men. As Blaney and Ganellen (1990) and Funk (1992) noted in their review articles, evidence regarding hardiness as a stress moderator is somewhat equivocal. Blaney and Ganellen further observed that this is especially the case when hardiness is treated as a composite construct, as in the present study.

All in all, the findings related to the hardiness construct suggest that personal strengths and competency variables may have an important role to play in posttrauma adjustment. Future researchers might find it fruitful to survey the pool of other such variables that may operate similarly to hardiness. A number of potential constructs come to mind: perceived self-competence (Harter, 1978, 1982); sense of mastery (Rosenfield, 1992); self-esteem (Rosenberg, 1979; Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995); resilience, as conceptualized and presented by Garmezy (1993; see also Garmezy & Masten, 1990; Masten, Best, & Garmezy, 1991) and Rutter (1985, 1987); ego resilience (Block & Kremen, 1996); and enduring coping style (Aldwin, 1993). Also, if hardiness is to remain a focal construct in future studies, then the ongoing concern (Carver, 1989; Funk, 1992; Hull, Van Treuren, & Virnelli, 1987) regarding how it should be conceptualized needs addressing. Specifically, should it be considered a global unitary entity, or should its subordinate components of control, commitment, and change as challenge be examined separately for differential prediction and possibly synergistic or interactive effects? Hull, Lehn, and Tedlie (1991) recommended an overriding hardiness factor that subsumes separate component measures as a reasonable approach to modeling this multifaceted construct. In the present study, we opted for a global perspective on hardiness, postulated a single hardiness latent variable on one sample, and replicated it on two others. This seemed to work well. Still, Sutker et al.'s (1995) recent finding that only the commitment aspect of hardiness was salient for war-related trauma victims (and the cautions offered by Carver, 1989; Funk, 1992; and Hull et al., 1987) reminds us that a full understanding of what constitutes hardiness has not yet been achieved.

Turning to social support, the hypotheses that structural social support would predict functional social support and that functional social support would predict PTSD were sustained for both the female and male models (again, see Figures 2 and 3). Among the resilience–recovery factors, functional social support had the largest total effect on PTSD for both women and men, and it had the largest total effect among all variables for women (see Table 3). Both of these findings are in keeping with the vast body of accumulated literature that documents the significance of social support to general well-being and recovery from stressful life events (e.g., S. Cohen & Wills, 1985; Holahan & Moos, 1981) and to the postwar mental health status of military veterans, in particular (e.g., Egendorf et al., 1981; Keane et al., 1985; Z. Solomon et al., 1988).

Interestingly, the anticipated direct link from structural social support to PTSD was obtained for men, but this path was not a part of the final accepted model for women. It seems that when competing with the other predictors of PTSD, structural social support for women is not strong enough to be considered a unique contributor, although its indirect effect through functional social support is comparable to that for men (Table 3 's values of −.10 and −.08, respectively). Finally, just as with hardiness, the buffering or interaction hypothesis was not upheld for functional social support for either women or men. This outcome is counter to S. Cohen and

Wills's (1985) speculation on how functional social support might operate but is comparable to what Barrett and Mizes (1988) found in a veteran study using highly similar variables. Perhaps the special combination of the severe stressor as predictor and the stressor-dependent consequence as criterion tends to preclude the moderation or buffering of their relationship.

The hypothesized direct and indirect (through functional social support) effects of additional postwar stressful life events were upheld by the data. For women, the total effect of this variable was somewhat higher (.31) than it was for men (.16); for both groups, the indirect effect proved more potent than the direct effect (Table 3). The indirect effect was not only by means of the hypothesized link with perceived functional social support but also through the mediator of hardiness. These latter two indirect effects are informative with regard to potential mechanisms whereby additional stressors in the posttrauma environment might influence PTSD symptoms. First, the current findings are congruent with those of Z. Solomon and Mikulincer (1990), who found that worrisome life events (e.g., divorce, job loss, accidents, school failure, and arguments with friends) had a strong negative relationship with functional social support, assessed as a combination of both emotional and instrumental support. Stressful life events appear, therefore, to deplete social resources, which, in turn, could exacerbate PTSD symptomatology. Not only may stressful life events deplete social resources by placing an excess demand on them, but many stressful life events in and of themselves are the loss of important interpersonal support resources (e.g., the loss of a spouse through death or divorce).

Also, there is some support in this study to bolster Z. Solomon et al.'s (1989) observation that posttrauma negative life events serve to deplete intrapersonal coping resources. By requiring additional expenditures of personal energy, stressful life events may decrease hardiness (and its accompanying coping strategies), which is then associated with PTSD by means of a direct effect and an additional indirect effect through functional social support (Figures 2 and 3). As with hardiness and functional social support, the interaction of stressful life events with exposure to traditional combat did not attain the customary level of statistical significance. As stated previously, however, there is some suggestion that this interaction effect may exist for men. The common-metric standardized coefficient for the stressful life events-to-PTSD path for men with low exposure to traditional combat was .02 (t = 0.51), whereas the analogous path coefficient for men with high exposure to traditional combat was .13 (t = 3.50). Consequently, one might surmise that prior exposure to war zone stressors could possibly heighten the male veteran's susceptibility to distress when he was faced with negative events in later life.

Relationships among the war zone stressors conformed to the pattern previously documented with this data set (D. W. King, King, et al., 1996; D. W. King, King, et al., 1995). As expected, exposure to traditional combat was a critical factor (Table 3). It emerged as a strong indirect predictor of PTSD, especially for men; for women, its influence was roughly equivalent to that of both hardiness and functional social support. Contrary to expectations, a direct path from malevolent environment to PTSD was not supported in either the female or male model. Malevolent environment was still a potent factor, nonetheless, by virtue of its indirect relationship through perceived threat and hardiness for both genders and through functional social support for men (Figures 2 and 3 and Table 3). Also, it appears that the relationship between perceived threat and PTSD for men is largely direct, with a minimal indirect effect through the social support latent variables.

In summary, the majority of the hypotheses for this study were supported. Two exceptions were the proposed direct association between structural social support and PTSD for women and the proposed direct association between malevolent environment and PTSD for women and men. In addition, the interactions of hardiness, functional social support, and stressful life events with exposure to traditional combat were generally not confirmed by either the female or male data.

A fundamental goal of this endeavor was to gain a better understanding of how posttrauma resilience–recovery factors mediate the relationships between traumatic stressors and PTSD or interact with traumatic stressor level

to predict PTSD. Although there was little support for interactions, mediation effects were clearly implicated. The most telling information in this regard was revealed in the last stage of the model-testing sequences for women and men (see Table 2). Here, for each gender, the deletion of the links between the war zone stressors and the resilience–recovery variables yielded an unacceptable model–data fit when compared with the more saturated models having those links. Hence, a model including paths between these two classes of variables was optimal for both genders. In addition, inspection of all direct effects on PTSD in Table 3 reveals the necessity of incorporating both classes as predictors of PTSD, because each makes a unique contribution. One may conclude, therefore, that a full appreciation of how traumatic stressors produce PTSD symptomatology must take into consideration important resilience–recovery influences.

We would contend that these outcomes have implications for other trauma groups. Certainly, the focal mediator variables—hardiness, structural and functional social support, and additional stressful life events—are not limited to persons exposed to war and its associated traumas. Also, the war zone stressor construct can be taken as but one of several trauma experiences that, unfortunately, characterize contemporary life. We concur with Cook and Campbell's (1979) emphasis on generalizing across persons, setting, and times and hope that this study's explanatory model of trauma, PTSD, and possible resilience–recovery influences is aenable to evaluation and refinement in future studies with other populations.

In closing, we offer a few cautionary comments regarding the viability of the models for women and men produced in this study. It is very important to recognize the retrospective, cross-sectional nature of the NVVRS data. In judging the potential limitations of the data, D. W. King et al. (1996) and D. W. King, King, et al. (1995) noted difficulties with recall for events in the distant past and problems in encoding of detail for events occurring during times of extreme stress. Of special concern is the tendency for one's current psychological state to color how one reports on prior circumstances. This may represent a more liberal model-testing situation, yielding findings of stronger relationships among variables than would obtain if a longitudinal design were in place.

More important, in any retrospective, cross-sectional design, there is no assurance that the putative direction of a relationship is as modeled. An interesting demonstration of this very point is found in comparing a model for predicting PTSD among male veterans from a study by Fontana and Rosenheck (1994) with the model for male veterans in the present study. Using the same NVVRS database, and similarly identified variables with alternative operationalizations, Fontana and Rosenheck reported that low social support was indirectly related to PTSD through the mediation of postmilitary traumas. On the other hand, we hypothesized and found support for paths proceeding from postwar stressful life events to functional social support and then to PTSD. Also, as pointed out by one reviewer, it is certainly not inconceivable that a person's current state of psychological distress (high PTSD) impacts his or her level of reported hardiness, another instance in which direction of causality becomes blurred by virtue of study design. This point is particularly salient given the assertion that what is measured by most hardiness scales may overlap considerably with the concept of general maladjustment or psychopathology (Funk & Houston, 1987).

Strictly speaking, the process of structural equation modeling does not confirm a model. Rather, it simply concludes that there is no available evidence to disconfirm the model. As pointed out by Breckler (1990), Cliff (1983), and Loehlin (1992), it is possible to find other substantively different, even contradictory, models that furnish equivalent fit to the data. These authors and others (e.g., Bollen, 1989b; Jöreskog & Sörbom, 1993) have urged that decisions regarding model specification and acceptance be primarily informed by theory, a premise that we sought to uphold in this study.

Footnotes

[1] Because this first subsample contained both women and men, gender was treated as a fixed exogenous variable, according to Muthén's (1989) prescription for modeling with heterogeneous populations.

[2] Our original intent was to use Kenny and Judd's (1984) procedure for creating and testing interaction effects among latent variables. Kenny and Judd noted, however, that their procedure was derived under the assumption of multivariate normality, an assumption that could not be met with the current data. Indeed, for each subsample in this study, the multivariate tests of skewness, kurtosis, and joint skewness and kurtosis (Mardia, 1985) yielded significant test statistics (all p s < .05). Thus, a somewhat less sophisticated yet more tractable subgroup analysis approach was used (Newcomb, 1990).

[3] Generalized least squares estimation has been judged appropriate when sample size is less than 500 (Hu, Bentler, & Kano, 1992), as was the case for two subsamples in this study. In addition, this form of estimation appears to produce less bias in a number of indicators of model–data fit (Ding, Velicer, & Harlow, 1995).

[4] The search for additional paths was informed by the LISREL modification indices and standardized expected parameter change values (Kaplan, 1995), but with strict attention to substantive considerations. Although respecification of a model based on modification indices or other sample-specific characteristics admittedly introduces the possibility of capitalization on chance, we were encouraged by the findings of MacCallum et al. (1992). These researchers demonstrated that with samples of size 800 or larger (n = 874 for the present analysis), the likelihood of cross-validating the respecified model is greatly enhanced.

[5] Cudeck and Browne (1983) proposed a cross-validation index for structural equation models when two samples, a calibration sample and a validation sample, are available. Briefly, this index is the discrepancy between a fitted variance–covariance matrix for the calibration sample and the observed variance–covariance matrix for the validation sample. Later, Browne and Cudeck (1989) derived an expected cross-validation index, which is computed on a single sample as a function of the RMSEA, and they argued for the superiority of the expected cross-validation index on the grounds that all of the available data can be used in the estimation of the model parameters. The relative sizes of the indices for a sequence of nested models are scrutinized, and the model with the smallest index is the one judged to have the greatest "predictive validity" (Cudeck & Browne, 1983, p. 152).

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