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SHORT REPORTS

Posttraumatic Stress Disorder in a National Sample of Female and Male Vietnam Veterans: Risk Factors, War-Zone Stressors, and Resilience-Recovery Variables

Daniel W. King and Lynda A. King
Boston Veterans Affairs Medical Center
and Boston University School of Medicine

David W. Foy
Pepperdine University

Terence M. Keane
Boston Veterans Affairs Medical Center
and Boston University School of Medicine

John A. Fairbank
Research Triangle Institute
and Duke University Medical Center

Relationships among pretrauma risk factors (e.g., family instability, childhood antisocial behavior), war-zone stressors (e.g., combat, perceived threat), posttrauma resilience-recovery variables (e.g., hardiness, social support), and posttraumatic stress disorder (PTSD) symptom severity were examined. Data from a national sample of 432 female and 1,200 male veterans were analyzed using structural equation modeling. For both genders, direct links to PTSD from pretrauma, war-zone, and posttrauma variable categories were found; several direct associations between pretrauma and posttrauma variables were documented. Although war-zone stressors appeared preeminent for PTSD in men, posttrauma resilience-recovery variables were more salient for women. Researchers, policymakers, and clinicians are urged to take a broad view on trauma and its sequelae, especially regarding possible multiple exposures over time and the depletion and availability of important resources.

Posttraumatic stress disorder (PTSD) is an anxiety disorder observed in persons who have been exposed to an extreme stressor that evokes feelings of "intense fear, helplessness, or horror" (American Psychiatric Association, 1994, p. 428). Symptoms include reexperiencing the event through frightening dreams and intrusive recollections, avoidance of circumstances that might trigger a reexperiencing episode, emotional numbing and retreat from intimate relationships, and increased arousal.

The earliest efforts to elucidate the etiology of PTSD evoked a debate as to whether symptoms were attributable primarily to the trauma (e.g., Figley, 1978) or to a condition that predated exposure (Worthington, 1978). The cumulative research findings over 2 decades emphasize the preeminence of the stressor (e.g., Green, 1994) with an approximate dose-response relationship: Higher levels of exposure are associated with greater symptomatology. Yet the relationship is not perfect, and there has been increasing attention given to risk and resilience factors that appear to exacerbate or mitigate the stress response. Such factors have included pretrauma demographic and psychosocial characteristics (e.g., McCranie, Hyer, Boudewyns, & Woods, 1992) and posttrauma resources and features of the recovery environment (e.g., Solomon, Waysman, & Mikulincer, 1990). Thus, a better explanation for the occurrence or persistence of PTSD in trauma victims may very well lie with the testing of more sophisticated multivariate models.

To this end, we embarked on a series of studies intended to systematically examine a network of potentially explanatory variables associated with PTSD, applying structural equation modeling methodologies to data from the National Vietnam Veterans Readjustment Study (NVVRS; Kulka et al., 1990). A first endeavor (L. A. King & King, 1994) examined the latent structure of PTSD as represented by the NVVRS's primary survey instrument, the Mississippi Scale for Combat-Related PTSD (Keane, Caddell, & Taylor, 1988). Confirmatory factor analysis of Mississippi Scale scores yielded a higher-order global PTSD factor that subsumed the symptom categories of reexperiencing and situational avoidance, withdrawal and numbing, arousal and lack of control, and guilt and suicidality. Items within these categories then served as manifest indicators of the PTSD construct in the later studies.

We next investigated how several war-zone stressor dimensions (exposure to traditional combat events, exposure to atrocities or

Daniel W. King, Lynda A. King, and Terence M. Keane, National Center for Posttraumatic Stress Disorder, Boston Veterans Affairs Medical Center and Boston University School of Medicine; David W. Foy, Graduate School of Education and Psychology, Pepperdine University; John A. Fairbank, Department of Psychiatry and Behavioral Sciences, Research Triangle Institute, Research Triangle Park, North Carolina and Duke University Medical Center.

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Correspondence concerning this article should be addressed to Daniel W. King, Behavioral Science Division, National Center for Posttraumatic Stress Disorder, Boston Veterans Affairs Medical Center, Boston, Massachusetts 02130. Electronic mail may be sent to king.daniel@boston.va.gov.

episodes of extraordinarily abusive violence, subjective or perceived threat, and the general milieu of a harsh or malevolent environment) were differentially associated with PTSD (D. W. King, King, Gudanowski, & Vreven, 1995). An interesting finding was the potency of the malevolent environment latent variable, a relatively low-magnitude but continuous or unremitting stressor encompassing irritations, deprivations, and daily pressures related to life in a war zone; it had both direct and indirect effects on PTSD. Traditional combat made its impact indirectly through the perceived threat stressor, and atrocities–abusive violence demonstrated a direct association with PTSD.

The third and fourth studies in the sequence incorporated this multidimensional representation of war-zone stressors along with prewar risk factors (D. W. King, King, Foy, & Gudanowski, 1996) and postwar resilience and recovery variables (L. A. King, King, Fairbank, Keane, & Adams, 1998), respectively. In both studies, as expected, the war-zone stressors demonstrated a strong association with PTSD, and the model for female veterans differed from the model for male veterans. With regard to salient prewar factors for women, instability within the family of origin had the largest total effect on PTSD, and early trauma history (accidents, assaults, and natural disasters) had a direct link to PTSD. For men, large total effects were found for family instability, childhood antisocial behavior, and age at entry to Vietnam; younger age at entry and early trauma history were directly associated with PTSD. Moreover, early trauma history interacted with war-zone stressor level to exacerbate PTSD symptoms for high combat-exposed male veterans. Thus, prewar risk factors played a role in explaining PTSD, albeit more so for men than for women.

In the study involving postwar variables, the final models for both genders identified robust mediation effects for social support (structural and functional), the intrapersonal resource of hardiness, and additional negative life events following the Vietnam experience. Though the patterns of relationships among war-zone stressors, postwar variables, and PTSD differed for women and men, the most important mediator for both was functional social support, followed by hardiness. Overall, the findings suggested that an appreciation of the mechanisms by which war-zone stressors are related to PTSD should take into consideration important resilience-recovery influences.

The present study formulated and tested an integrated model using all categories of variables: prewar risk factors, war-zone stressors, postwar resilience-recovery variables, and PTSD. Although each of the prior studies addressed important substantive concerns regarding PTSD, our intent here was to simultaneously consider the system of associations among variables within and across the several categories. We postulated that direct relationships to PTSD documented in the earlier studies would be supported in the integrated model. In addition, the testing of the integrated model permitted for the first time the evaluation of relationships between prewar risk factors and postwar resilience-recovery variables. In this regard, we had several specific hypotheses. First, drawing from contemporary perspectives on early disorganized attachment and psychopathology (Jones, 1996; Main, 1996), the prewar factors of relationship with father and family instability were expected to have direct associations with postwar social support and hardiness. Second, childhood antisocial behavior was proposed to directly relate to social support and negative life events in the postwar period. This proposition derived from previous work suggesting that the aggressive, abrasive posture characterizing antisocial behavior leads to relationship difficulties and social isolation (Loeber & Dishion, 1983) as well as susceptibility to a plethora of additional adverse circumstances and misfortunes (Caspi, Elder, & Bem, 1987). Third, early trauma history was hypothesized to have a direct link to postwar negative life events, consistent with Bremner, Southwick, and Charney's (1995) observation that "individuals with a history of exposure to extreme psychological stress appear to have an increased vulnerability to exposure to subsequent stress" (p. 152). Then, following the findings of Green, Grace, Lindy, Gleser, and Leonard (1990), we proposed that war-zone stressors would emerge as the most powerful contributor to PTSD, followed by postwar resilience-recovery variables, and then prewar risk factors.

The first published works from the NVVRS database, emanating from the primary Research Triangle Institute researchers, were largely descriptive in nature: Schlenger et al. (1992) and Weiss et al. (1992) reported prevalence rates for current, lifetime, and partial PTSD for various cohorts and subgroups, and Jordan et al. (1991) provided current and lifetime rates for other psychiatric disorders and related them to war-zone exposure. Prior multivariate analyses of the NVVRS database have also been conducted by Fontana and Rosenheck (1994; a study of PTSD in the male veteran subsample) and Fontana, Schwartz, and Rosenheck (1997; a study of PTSD in the female veteran subsample). They likewise documented the importance of combat exposure, family background, and homecoming and other social supports. Yet, the specific structural equation modeling strategies that they used could have better optimized the potential of the methodology. Many of their endogenous, "down-stream," or dependent variables were simple dichotomies, to which were applied linear regression-based procedures that presuppose continuous dependent variables. A more appropriate approach would involve the use of logistic regression-based procedures designed for dichotomous outcomes (e.g., Agresti & Finlay, 1986; Cohen & Cohen, 1983). Furthermore, in both the model for women and the model for men, very few constructs were formulated as latent variables with multiple manifest indicators. The consequence was a limited ability to capitalize on a major benefit of structural equation modeling, namely, the generation of unbiased parameter estimates or path coefficients in the structural model that derive from the specification of perfectly reliable latent variables (Bollen, 1989; James, Mulaik, & Brett, 1982; Jöreskog & Sörbom, 1993). Our use in the present study of continuous endogenous variables and models that fully use latent variables was intended to enhance the statistical conclusion validity (Cook & Campbell, 1979) of findings from the NVVRS data.

Method

Data Source

Data were taken from the responses of 1,632 (432 women and 1,200 men) veterans who participated in the NVVRS (Kulka et al., 1990). All had served in the Vietnam theater of operations sometime between August 1964 and March 1975. In an extended interview and self-report session, each veteran supplied information on a broad array of topics related to prewar background and functioning, military and war-zone experiences, and postwar circumstances, life events, and mental health status. Further information on the sampling methodology and sample characteristics is

available in a number of other sources (e.g., Jordan et al., 1991; Kulka et al., 1990; Schlenger et al., 1992; Weiss et al., 1992).

Variables and Their Operational Definitions

Table 1 identifies and briefly defines the collection of 15 variables used in the current study. Details on item composition, scoring, and psychometric properties may be found in the references provided in the last column or obtained directly from the first author (Daniel W. King).

Overview of Analyses

In prior work with the NVVRS data (D. W. King et al., 1995; D. W. King et al., 1996; L. A. King et al., 1998), we conducted confirmatory factor analyses and successfully demonstrated and cross-validated the viability of measurement models for all 15 latent variables used in the present study. Accordingly, the analyses for this final study in the series concentrated on the specification and evaluation of the structural model representing a full network of relationships among these latent variables. Moreover, building on our previous findings that demonstrated gender-based differences in the measurement models, we necessarily specified and evaluated separate structural models for female and male veterans (Marsh, 1994). In all analyses, matrices of covariances among observed or manifest indicators were submitted to the LISREL 8 program (Jöreskog & Sörbom, 1993). Generalized least squares estimation was used, and residual covariances for all manifest indicators were fixed at 0.

Results and Discussion

Copies of the matrices that were analyzed and full descriptions of the decision rules for model trimming may be obtained from Daniel W. King. The final accepted model for women yielded $\chi^2(915, N = 423) = 1343.84, p < .001$; for the final model for men, $\chi^2(909, N = 1{,}150) = 2214.97, p < .001$. All other fit indices endorsed the accepted models. For women, the LISREL goodness-of-fit index (GFI; Jöreskog & Sörbom, 1993) was .86; the comparative fit index (CFI; Bentler, 1990) was .99; the parsimony normed fit index (PNFI; James et al., 1982) was .89; and the root mean square error of approximation (RMSEA; Steiger, 1990) was .033. This last value is an estimate of the discrepancy between the population covariance matrix and the fitted covariance matrix for the accepted model; it is well below the .05 standard for close fit (Browne & Cudeck, 1989), with an associated probability approaching 1.00 that its true value falls below this standard. For men, these fit indices were also quite satisfactory; GFI of .91, CFI of .99, PNFI of .90, and RMSEA of .035, again with an associated probability approaching 1.00.

In line with the present study's first proposition, direct relationships to PTSD in these integrated models for women and men generally mirror direct effects found in the prior component studies of prewar, war-zone, and postwar variables. As Figure 1 shows, six variables were directly linked to PTSD for women: the prewar

Table 1
Variables in the Model

Variable	No. of manifest indicators	Description	Source of more detailed information
Prewar risk factors			
Socioeconomic status	3	Father's education, mother's education; veteran's perception of family financial well-being	D. W. King et al. (1996)
Relationship with father	2	Closeness to primary father figure	D. W. King et al. (1996)
Family instability	3	Disruptive family environment; presence of interparental and parent-to-child abuse	D. W. King et al. (1996)
Early trauma history[a]	1	Cumulative index of traumagenic or life-threatening experiences	D. W. King et al. (1996)
Childhood antisocial behavior	5	Disciplinary problems prior to age 15	D. W. King et al. (1996)
Age at entry to Vietnam	1	Veteran's age in years upon arrival in the war zone	D. W. King et al. (1996)
War-zone stressors			
Traditional combat[a]	1	Stereotypical war-zone events (firing a weapon, receiving fire)	D. W. King et al. (1995)
Atrocities–abusive violence[a]	1	War-zone events considered deviant (e.g., mutilation, killing civilians)	D. W. King et al. (1995)
Perceived threat	3	Subjective judgments of fear	D. W. King et al. (1995)
Malevolent environment	6	Day-to-day discomforts (e.g., the heat, poor living facilities)	D. W. King et al. (1995)
Postwar resilience-recovery variables			
Additional stressful life events[a]	1	Highly stressful experiences in the postwar period	L. A. King et al. (1998)
Hardiness	4	Sense of control, commitment to self, viewing change as challenge	L. A. King et al. (1998)
Structural social support[a]	1	Size and complexity of social network	L. A. King et al. (1998)
Functional social support	7	Perceived emotional sustenance and instrumental assistance from others	L. A. King et al. (1998)
PTSD	6	Categories of symptoms formed from Keane et al.'s (1988) Mississippi Scale items; symptom count from the NVVRS's adaptation of the Diagnostic Interview Schedule (Robins, Helzer, Croughan, & Ratcliff, 1981); Kulka et al.'s (1990) predicted probability of PTSD	L. A. King & King (1994); D. W. King et al. (1995)

Note. NVVRS = National Vietnam Veterans Readjustment Study; PTSD = posttraumatic stress disorder.
[a] These variables had causal indicators; all others had effect indicators.

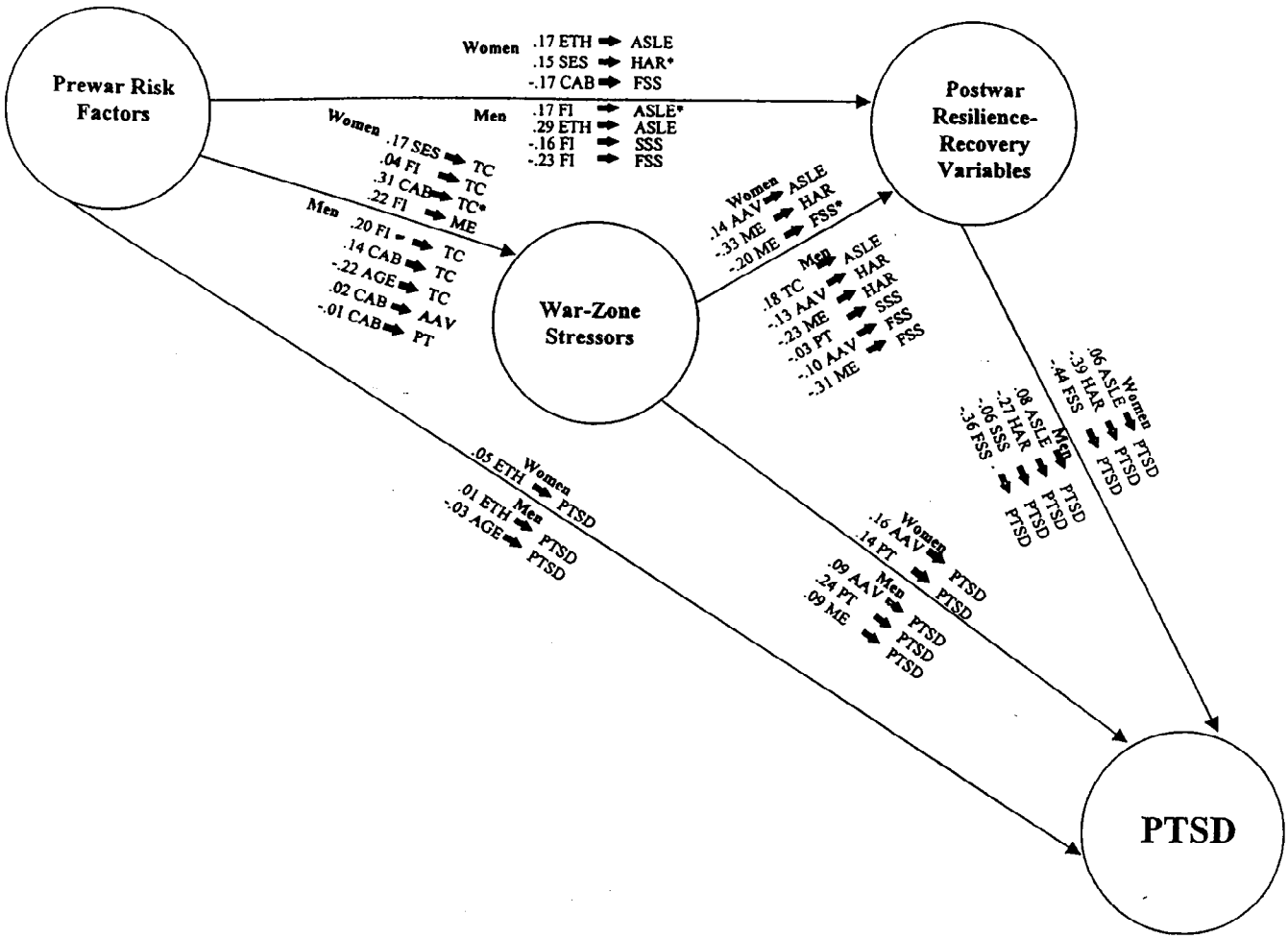

Figure 1. Simplified representation of the structural models of the associations among prewar risk factors, war-zone stressors, postwar resilience-recovery variables, and posttraumatic stress disorder (PTSD). All between-category coefficients for women and men are standardized within genders. SES = socioeconomic status; FI = family instability; ETH = early trauma history; CAB = childhood antisocial behavior; AGE = age at entry to Vietnam; TC = traditional combat; AAV = atrocities–abusive violence; PT = perceived threat; ME = malevolent environment; ASLE = additional stressful life events; HAR = hardiness; SSS = structural social support; FSS = functional social support. Relationships with asterisks were not predicted in this study or observed in the prior component studies.

risk factor of early trauma history, the war-zone stressors of atrocities–abusive violence and perceived threat, and the postwar resilience-recovery variables of additional stressful life events, hardiness, and functional social support. They accounted for 72% of the variance in PTSD. For men, nine variables showed direct relationships to PTSD: the same six as for women, plus the prewar risk factor of age at entry to Vietnam, the malevolent environment war-zone stressor, and the postwar resilience-recovery variable of structural social support. These nine variables accounted for 70% of the variance. The only inconsistency in direct relationships to PTSD over the several studies in the sequence involved the association between malevolent environment and PTSD. In the earlier study of prewar and war-zone variables, this relationship was obtained for both genders. In the prior study of postwar and war-zone variables, the relationship was not observed for either gender, likely as a consequence of multicollinearity between malevolent environment and one or more postwar variables. In the current study, the association was not present in the final model for women, and a rather modest association was retained in the final model for men, with the large majority of malevolent environment's total effect (74%) attributable to its indirect relationship to PTSD through other war-zone stressors and postwar variables.

Support for the specific hypotheses relating prewar risk factors to postwar resilience-recovery variables may be found in the associations that label the horizontal line in the uppermost portion of Figure 1. In the model for women, there were three such associations, two of which were hypothesized and one of which was unanticipated; in the model for men, three of the four associations were hypothesized and one was unanticipated. For both genders, early trauma history was directly linked to additional

stressful life events in the postwar period, thus affirming Bremner et al.'s (1995) commentary that prior life stress predicts later life stress. Also, consistent with Loeber and Dishion (1983), the proposed direct and negative association between childhood antisocial behavior and later functional social support was observed for women. And the hypothesized direct and negative relationships between family instability and both forms of social support were found for men, suggesting that a chaotic family environment characterized by parental dysfunction and disorganized attachment may very well compromise one's ability to build, foster, and benefit from a support network in later years (e.g., Jones, 1996; Main, 1996). In the end, 5 of 20 specific hypotheses regarding prewar–postwar direct relationships were supported. These results are not inconsequential, especially when one considers that the prewar predictors were competing with a rather powerful and salient set of other predictors, the war-zone stressors, and that the prewar risk factors themselves were associated with the war-zone stressors. Thus, given the complex interplay of relationships hypothesized in the model, one would anticipate that some would necessarily diminish in the presence of others.

A final expectation in this study was a hierarchy among the categories of variables contributing to PTSD, with war-zone stressors proposed to be preeminent, followed by postwar resilience-recovery variables, and then prewar risk factors. To address this research issue, we reasoned that the most appropriate index of a single variable's contribution would be its total effect, a composite of its direct effect on PTSD and all indirect effects on PTSD through other variables. Accordingly, we summed the absolute values of total effects of variables within each of the categories to ascertain relative influence. For men, the observed order was consistent with our proposition. The sum of the total effects for war-zone stressors was 1.36; for postwar resilience-recovery variables, the value was .96; and for prewar risk factors, it was .80. For women, however, the order did not conform to our expectation. The sums were 1.10 for the war-zone stressors, 1.33 for the postwar resilience-recovery variables, and .53 for the prewar risk factors. It appears, therefore, that postwar variables are somewhat more important in accounting for PTSD symptomatology in female veterans. These women may have been more adept at marshaling intrapersonal and interpersonal resources in times of need than their male veteran counterparts. On the other hand, one must keep in mind that the war-zone experience for many male veterans was likely more directly life threatening than the experience of women who served in Vietnam. Consequently, war-zone incidents and conditions may be more salient for men.

As with much of the research on stress and trauma, the cross-sectional design of the NVVRS and the retrospective self-report nature of its data necessarily mandate careful interpretation of our findings. The principal concern is ambiguity about the direction of relationships among variables, which may derive from a number of sources: poor recall, particularly for some experiences in an emotionally charged or highly stressful environment (Burke, Heuer, & Reisberg, 1992; Christianson, 1992); an associated tendency to reconstruct events and assign meaning based on one's current psychological state (Metts, Sprecher, & Cupach, 1991; Nisbett & Wilson, 1977); and possible recognition-seeking, compensation-seeking, or the need to present oneself in a socially desirable manner (D. W. King & King, 1991). Many theoreticians and researchers could rightfully argue that paths from PTSD to other constructs in the system might be operating: Level of current PTSD symptomatology may very well influence replies to inquiries about hardiness and perceived support from others. Indeed, a veteran's PTSD symptomatology may work to drive away relatives and friends. In addition, both McFarlane (1992) and Southwick, Morgan, Nicolaou, and Charney (1997) provided empirical support for the proposition that PTSD and associated mood and arousal states may at least partially determine how strongly one endorses memories of prior traumatic experiences. Furthermore, we duly recognize that structural equation modeling does not confirm a model. Rather, as emphasized by Breckler (1990), among others, it simply asserts that there are no available data to disconfirm the model. The best strategy is for putative relationships in any model to be informed by theory and substantive issues, an approach that guided decisions in the present study. We also acknowledge that not all factors potentially associated with PTSD were incorporated into this study, including the comorbid condition (and possible coping mechanism) of substance abuse.

With these cautions in mind, what conclusions may be drawn from this examination of an integrated network of relationships among variables explaining PTSD symptomatology? Without doubt, the findings endorse a multivariate perspective on PTSD. Taken together, all categories of variables (pretrauma, trauma, and posttrauma) appear important to our understanding of individual differences in the display of symptoms. With due regard to possible common method effects, it appears that a large amount of variance (72% for women; 70% for men) was accounted for by the collection of variables that were directly linked to PTSD in the models. Also, each of these variables, drawn from all three categories, yielded a unique contribution to reported symptom severity. Thus, events and circumstances that preceded the focal trauma as well as events and circumstances that characterize the posttrauma environment must be recognized, a conclusion consistent with the work of Fontana and Rosenheck (1994; Fontana et al., 1997).

The pretrauma risk factors in this study—especially (low) socioeconomic status, (poor) relationship with father, family instability, and early trauma history—portray a stress-filled and possibly disadvantaged existence for some veterans even prior to the Vietnam experience. As Green (1994) suggested, current symptomatology may be tied to multiple exposures to stressful life events across time. Evidence for this position lies in the path coefficient for the relationship between early trauma history and PTSD that was retained in the models for both genders; not only are the focal war-related experiences associated with PTSD symptom severity, but so are traumas that preceded such experiences. Also, the underlying mechanism by which the pretrauma factors relate to current PTSD symptomatology may be a depletion of available resources to deal with subsequent stressors, not only those encountered in the war zone but also those characterizing the recovery environment. This possibility is consistent with the tenets of Hobfoll's (1989) conservation of resources conceptualization of stress. Indeed, our examination of the associations between risk factors and resilience-recovery variables supports this assertion, with several documented path coefficients between features of prewar life circumstances (e.g., socioeconomic status and family instability) and postwar intrapersonal and social resources (e.g., hardiness and social support). It should be noted that these prewar–

postwar associations are statistically independent of the influence of war-zone stressors.

In addition, for both women and men, the resilience-recovery variables were quite potent. Particularly relevant were the large associations of hardiness and functional social support with PTSD for both genders. Each of these resource variables may serve to uniquely offset the deleterious consequences of stressors on PTSD. Again, we see the salience of multiple stressful life events across the life span. Continuing the argument for depletion of resources, the additional stressful life events variable was directly related to PTSD but was also negatively associated with both hardiness and functional social support. And of course, one or more of the war-zone stressors likewise had negative direct relationships with hardiness and social support for both women and men. Last, the findings endorsed a multifactorial representation of the traumatic experience itself, in this case, several war-zone stressor dimensions being differentially associated with both pretrauma risk factors and posttrauma resilience-recovery variables.

To reiterate, the study reported here is the culmination of a series of inquiries into possible explanatory variables accounting for chronic PTSD symptomatology following exposure to an identified, potentially traumatizing experience. Perhaps the major lesson to be learned from this examination of a national sample of Vietnam veterans is that responses to highly stressful negative life events may derive from a complex interplay of factors that stretch backward in time from the focal experience and forward in time to the present. Therefore, those interested in the study of trauma and its aftermath and those charged with planning, implementing, and evaluating service delivery to trauma victims need to adopt a broad outlook. We would recommend that this perspective be motivated by two overriding themes. First, exposure to multiple stressful events over an extended period of time, perhaps many years, may drive current symptomatology and mandates more than a narrow investigation of a single traumatic event. Second, access to and activation of intrapersonal, interpersonal, and environmental resources may serve to assuage the occurrence or persistence of reactions to severe stressors and thereby work to neutralize their negative impact on psychological well-being. Of course, our data suggest that these two features of the potential etiological network—revictimization or cumulative trauma and resource availability—are associated with one another: A consequence of any given incident of exposure may be the dissipation of resources, leaving the victim more vulnerable to stress reactions when faced with future traumatic events.

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