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A Causal Model of the Etiology of War-Related PTSD[1]

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Structural equation modeling is used to evaluate a network of causal hypotheses concerning the relationships of premilitary vulnerabilities, military entry conditions, war zone experiences, and dissociative reactions with current symptoms of PTSD and general psychiatric distress. The analyses are directed toward resolving three general issues: (1) the relative contributions of premilitary vulnerabilities and exposure to traumatic events to the development of PTSD, (2) the features of the causal network that are distinctive to the development of PTSD as compared to general psychiatric symptoms, and (3) the major pathways mediating causation among the variables in the model. 381 Vietnam theater veterans who sought treatment from VA's new PTSD Clinical Teams Program and who provided complete data constituted the sample for the study. War zone experiences were the variables that contributed most strongly to the development of both PTSD and general psychiatric symptoms. Combat exposure, however, contributed directly to PTSD symptoms but not to general psychiatric symptoms. The overall fit of the model to the data proved to be quite satisfactory for both PTSD and general psychiatric symptoms, accounting for 59% and 60% of the variance, respectively.

KEY WORDS: PTSD; etiology; causal modeling; Vietnam veterans.

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INTRODUCTION

The etiology of PTSD has been the subject of much debate. Very often this debate has taken on an "either - or" form, with participants arguing that PTSD is due essentially either to pretrauma vulnerabilities (e.g., Atkinson *et al.*, 1982; Borus, 1974; Worthington, 1977) or to exposure to traumatic events (e.g., Figley and Leventman, 1980; Foy *et al.*, 1984; Wilson, 1978). Multiple regression analysis has often been used as a statistical technique in an attempt to determine the predominant set of contributors (e.g., Foy *et al.*, 1984; Green *et al.*, 1990a; Kulka *et al.*, 1988; Yager *et al.*, 1984). This technique has an inherent limitation which precludes a definitive resolution, however; namely, an inability to allocate shared variance with PTSD between vulnerabilities and traumatic events. Multiple regression analysis is less than an optimal analytical strategy for another reason as well. A consensus has begun to emerge around the position that pretrauma vulnerabilities and traumatic events both play causal roles and that the most critical task is to articulate the network of connections among them (e.g., Kulka *et al.*, 1988; Green *et al.*, 1985; Elder and Clipp, 1989).

Structural equation modeling is an extension of multiple regression analysis that is well-suited to the solution of these problems. Statistically, the extension involves the simultaneous solution of all equations and the use of all information in deriving each of the parameter estimates in the model. Total effects can be partitioned into those that are direct or unmediated by any other variable, and those that are indirect or mediated by one or more variables. Conceptually, the extension involves the specification of a model of causation that serves as a map to the selection of variables to be included in each equation. Although the data are cross-sectional and the reporting is retrospective, the variables selected for inclusion in the model have a clear historical temporal ordering. Using this ordering as a logical constraint on the specification of the model, causal paths were hypothesized among variables. Therefore, although structural equation modeling is not designed to test actual causation experimentally, it is a powerful tool for determining the likelihood that causal hypotheses are valid within the limits of nonexperimental data.

In this paper, we apply structural equation modeling to an examination of those associations between premilitary and military experiences on the one hand and psychiatric symptoms on the other that have been reported consistently in the literature as to direction and statistical significance. Specifically, we examine a causal model of PTSD and a parallel model of general psychiatric symptoms, for comparison, in order to determine which causal pathways might be particular to PTSD. The model hypothesizes causal connections among five sets of variables: premilitary

vulnerabilities, military entry conditions, war zone experiences, dissociative reactions to war zone experiences, and symptoms.

Premilitary Vulnerabilities

Five studies have examined the relationship of a composite index of premilitary vulnerabilities to psychiatric symptoms with mixed results. Foy and his colleagues have reported no significant relationship (Foy *et al.*, 1984, 1987; Foy and Card, 1987), while Nace *et al.* (1978) and Vinokur *et al.* (1987) have reported a significant positive relationship. The use of a composite index, a lack of uniformity in its components, and the diversity of symptoms chosen for examination in these studies make it extremely difficult to draw conclusions from them concerning the relationship between specific premilitary variables and particular disorders. We need to look, therefore, to studies which have examined the relationship of individual premilitary variables to PTSD and other psychiatric symptoms.

Several studies have reported higher levels of PTSD or general psychiatric symptoms among veterans with:

(1) a background of academic difficulty (Centers for Disease Control Vietnam Experience Study, 1988; Helzer, 1981; Helzer *et al.*, 1979; Kulka *et al.*, 1988; True *et al.*, 1988; Worthington, 1977; but not Card, 1983);

(2) an unstable or problematic family (Chemtob *et al.*, 1990; Egendorf *et al.*, 1981; Emery *et al.*, 1991; Helzer, 1981; Helzer *et al.*, 1979; Kulka *et al.*, 1988);

(3) physical and/or sexual abuse as a child (Carmen *et al.*, 1984; Kulka *et al.*, 1988; Swett *et al.*, 1990);

(4) a father who had been in combat himself (Kulka *et al.*, 1988) as well as among their children (Harkness, 1989; Rosenheck, 1986; Rosenheck and Nathan, 1985);

(5) psychiatric treatment or hospitalization of one or both parents during one's childhood (Davidson *et al.*, 1989; Helzer, 1981; Helzer *et al.*, 1979; Kulka *et al.*, 1988);

(6) psychiatric treatment or hospitalization as a child oneself (Brill and Beebe, 1955; Kulka *et al.*, 1988; Swank, 1949; Wilson and Krauss, 1985);

(7) problems with authorities and behaviors indicative of a conduct disorder as a child (Helzer, 1981; Helzer *et al.*, 1979, 1987; Kulka *et al.*, 1988; Worthington, 1977, 1978);

(8) illegal drug use before entering the military (Helzer, 1981; Kulka *et al.*, 1988); and

(9) ethnic minority status (Centers for Disease Control Vietnam Experience Study, 1988; Egendorf *et al.,* 1981; Green *et al.,* 1990b; Kulka *et al.,* 1988; Penk *et al.,* 1989; True *et al.,* 1988), although no significant relationship has been reported by Card (1983) and Helzer *et al.* (1987).

Moreover, several studies have found that veterans who were exposed to heavier combat or to greater abusive violence (e.g., atrocities) were those with:

(1) a background of academic difficulty (Helzer, 1981; Helzer *et al.,* 1979; Green *et al.,* 1990a; Kulka *et al.,* 1988; Veterans Administration, 1980);

(2) an unstable family (Helzer *et al.,* 1979; Yager, 1975);

(3) physical and/or sexual child abuse (Kulka *et al.,* 1988; Yager, 1975);

(4) problems with authorities and childhood conduct disorder behaviors (Helzer *et al.,* 1979, 1987; Kulka *et al.,* 1988; Yager, 1975), although no significant relationship has been reported by Green *et al.* (1990a); and

(5) ethnic minority status (Green *et al.,* 1990b).

Military Entry Conditions

Studies are unanimous in reporting more severe PTSD or general psychiatric symptoms in men who:

(1) were younger when they entered the military (Centers for Disease Control Vietnam Experience Study, 1988; Hastings, 1991; Kulka *et al.,* 1988; True *et al.,* 1988; Worthington, 1977); and

(2) joined the military willingly (Worthington, 1978).

In addition, men who were exposed to heavier combat and/or abusive violence were:

(1) younger when they entered the military (Veterans Administration, 1980; Green *et al.,* 1990a); and

(2) joined the military willingly (Yager, 1985; Yager *et al.,* 1984).

War Zone Experiences

With few exceptions, severity of PTSD and general psychiatric symptoms have been found to be associated in veterans of World War II, the Korean War, and the Vietnam War with:

(1) combat exposure (e.g., Archibald *et al.,* 1962; Archibald and Tuddenham, 1965; Breslau and Davis, 1987; Brill and Beebe, 1955; Card, 1983; Egendorf *et al.,* 1981; Elder and Clipp, 1989; Foy *et al.,* 1984; Futterman and Pumpian-Mindlin, 1951; Gallers *et al.,* 1988; Goldberg *et al.,* 1988;

Green *et al.,* 1990a; Hendin *et al.,* 1984; Kulka *et al.,* 1988; Laufer *et al.,* 1984; Swank, 1949; True *et al.,* 1988; Wilson and Krauss, 1985); and

(2) witnessing or participating in abusive violence (Archibald *et al.,* 1962; Breslau and Davis, 1987; Futterman and Pumpian-Mindlin, 1951; Gallers *et al.,* 1988; Green *et al.,* 1990a; Hendin *et al.,* 1984; Kulka *et al.,* 1988; Laufer *et al.,* 1984; Yehuda *et al.,* 1992).

(3) Receiving a disciplinary action, such as a court martial or an Article 15, while in the military has been reported to be related to severity of PTSD (Foy *et al.,* 1984; Gallers *et al.,* 1988) as well as to general psychiatric symptoms (Worthington, 1978), although no significant relationship has been reported by Card (1983).

Bey and Zecchinelli (1974) observed that disciplinary actions for violence were more frequent among combat than among support troops.

Dissociative Reaction

Dissociation as an intrapsychic defense against being overwhelmed psychologically has been noted for many years across a diversity of traumas (e.g., Chu and Dill, 1990; Jaffe, 1968; Noyes and Kletti, 1977; Putnam, 1989; Spiegel, 1988; van der Kolk *et al.,* 1989). Most relevant to the present study are two studies which found that veterans with PTSD reported higher levels of dissociation than did veterans from non-PTSD comparison groups (Bremner *et al.,* 1992; Loewenstein and Putnam, 1988).

GOALS AND HYPOTHESES

In this paper, we seek to answer three questions. First, what are the relative contributions of premilitary vulnerabilities and traumatic war zone events to the development of PTSD? We hypothesized that traumatic events contribute more to the development than do premilitary vulnerabilities.

Second, what are the features of the causal network that are distinctive to the development of PTSD as compared to general psychiatric symptoms? We hypothesized that war zone experiences play a larger role in causing PTSD than general psychiatric symptoms, while premilitary vulnerabilities play a larger role in the causation of general psychiatric symptoms than PTSD.

Third, what are the major pathways mediating causation between variables across the various levels of the model? Although the data (with the exception of symptoms) were collected retrospectively, the sets of variables

were chosen for their clear temporal ordering historically, so that each set is hypothesized to contribute causally to each subsequent set of events and experiences. Thus, we hypothesized that premilitary vulnerabilities affect military entry conditions, war zone experiences, dissociative reactions and symptoms; military entry conditions affect war zone experiences, dissociative reactions and symptoms; war zone experiences affect dissociative reactions and symptoms, and dissociative reactions affect symptoms. Furthermore, within war zone traumas, we hypothesized that combat affects witnessing and participating in abusive violence.

METHOD

Sample

A total of 476 Vietnam theater veterans who sought outpatient treatment from VA's new PTSD Clinical Teams Program during 1990 and 1991 were surveyed extensively as one component of a comprehensive, nationwide program evaluation (cf., Fontana *et al.*, 1990, 1991). Vietnam theater veterans are those who served in Southeast Asia for some period of time from 1964 to 1975. All eligible veterans were entered into the evaluation consecutively during this period. These data were collected at a subset of six sites in the program: Boston, MA, Jackson, MS, Kansas City, MO, New Orleans, LA, Providence, RI, and San Francisco, CA.

The 381 veterans who provided complete data were selected as the sample for this study. Due to the extremely small number of women applying for treatment, only men are represented in the sample. They averaged 42.8 (SD = 2.9) years of age and 13.0 (SD = 2.3) years of education. Forty-seven percent were currently married, 31% were divorced, and 12% were never married. Ethnically, 71% were white, 25% were black, 1% were Hispanic, and 3% were other minorities. Diagnostically, 77.5% met DSM-III-R criteria for current PTSD (American Psychiatric Association, 1987). Veterans from these six sites were comparable to those from the other 38 sites in the program with respect to age, years of education, marital status, PTSD diagnosis, exposure to combat, and participation in and witnessing of abusive violence. Although there was no difference in the percentages of white and minority veterans taken as a whole, the six sites had proportionally more black veterans (25% vs. 16%) and proportionally less Hispanic veterans (1% vs. 11%).

Within the study sample, veterans with complete data were compared to those with missing data on the demographic variables above and the 20

variables comprising the models examined in the study. The groups differed significantly on only two of these: having been physically or sexually abused as a child ($F = 5.71$, df = 1/474, $p < 0.05$) and having witnessed abusive violence in the war zone ($F = 4.39$, df = 1/458, $p < 0.05$). Veterans with complete data reported fewer instances of having been abused in childhood (mean = 0.36, SD = 0.92 vs. mean = 0.63, SD = 1.19) and a greater incidence of having witnessed abusive violence (mean = 0.41, SD = 0.49 vs. mean = 0.29, SD = 0.45).

Measures

The data were obtained by means of the War Stress Interview, a three-section battery of standardized instruments and specially constructed items which consists of two structured interview sections and one self-report questionnaire section. One interview section was administered by clinicians at intake, and the other two sections were administered by specially trained evaluation assistants shortly after intake.

Premilitary vulnerabilities are represented by eight variables.

(1) Frequency of childhood physical or sexual abuse (ABUSED) was measured by structured interview by asking veterans whether they had been physically or sexually abused as a child. If answered affirmatively, they were asked the number of times, up to 3 (mean = 0.36, SD = 0.92). It was left to the veterans' judgment as to whether their experiences constituted abuse. It is likely, therefore, that their reports provided a conservative estimate (cf., Rausch and Knutson, 1991).

(2) Treatment or hospitalization for a psychiatric problem before age 18 (SELF PSY) was measured by questionnaire with the dichotomous item, "Were you ever treated or hospitalized for an emotional or psychological problem" (mean = 0.07, SD = 0.25). This and all other dichotomous items were coded "1" in the direction of the named variable and "0" in the other direction.

(3) Parental hospitalization for a psychiatric problem before the veteran was age 18 (PAR PSY) was measured by questionnaire to the dichotomous item, "Was either of your parents ever hospitalized for an emotional or psychiatric problem" (mean = 0.10, SD = 0.30).

(4) Father's exposure to combat (FATHCOMB) was a dichotomous variable derived from structured interview to two items: "Did your father ever serve in the military during wartime?" and "If yes, was he involved in combat" (mean = 0.40, SD = 0.49).

(5) Family instability (FAM INST) was measured in the questionnaire section by the Family Stability Scale (Kadushin *et al.*, 1981). It is the sum

of 11 dichotomous items covering experiences before the age of 18 such as parental separation, divorce or death, living in a foster home or orphanage, father out of work, family income below the poverty level, getting into trouble with authorities, and having less than a high school education at the time of entry into the military (mean = 3.0, SD = 2.15).

(6) Use of illegal drugs prior to entering the military (DRUG USE) was measured by structured interview on a five-point scale of intensity to the item, "Prior to entering the military, how would you describe your use of illegal drugs" (mean = 0.32, SD = 0.76).

(7) Ethnic minority status (MINORITY) was determined from structured interview and was measured dichotomously as all nonwhite minorities compared to whites (mean = 0.27, SD = 0.44).

(8) Behaviors indicative of a conduct disorder before the age of 15 (CON DIS) were taken from the list of such behaviors compiled by Helzer (1981; Helzer *et al.,* 1987) and were measured by questionnaire. CON DIS is the sum of 11 behaviors endorsed dichotomously as having been engaged in frequently: in trouble with the law or school officials, playing hookey, suspended or expelled from school, doing poorly academically, arrested or sent to juvenile court, running away from home, lying, drinking or using drugs, stealing, destroying property, and starting fist fights (mean = 1.54, SD = 2.08).

Conditions of entry into the military are represented by willingness to join and age at the time of entry.

(9) Willing versus reluctant entry (WILLING) was measured dichotomously by structured interview. Each veteran was asked how he first got into the military. The responses, "Enlisted because I wanted to serve" and "Drafted and was happy to serve" were classified as willing; the responses "Enlisted because I wanted to avoid the draft or to avoid legal consequences" and "Drafted and served because I had to" were classified as reluctant (mean = 0.64, SD = 0.48).

(10) Age at entry (ENTRYAGE) was determined as part of the structured interview and was measured as a continuous variable (mean = 18.93, SD = 1.84).

War zone experiences are represented by four variables.

(11) Combat was measured by two scales: the Revised Combat Scale (REV COMB) (mean = 10.72, SD = 2.74) (Laufer *et al.,* 1981) by structured interview, and the Combat Exposure Scale (COMB EXP) (mean = 28.46, SD = 9.10) (Keane *et al.,* 1989) by questionnaire. These scales measure traditional aspects of warfare that have been considered necessary and appropriate to the legitimate goals of war. They correlated 0.69 with each other in the present study. Therefore, a latent variable of COMBAT was generated in the model to represent this category of trauma.

(12) and (13) Witnessing and participating in abusive violence were measured by structured interview to the item: "During wartime, soldiers are sometimes given orders or pressured into doing things that they thought were morally wrong. Some vets have reported that they either saw or did things that other people would consider to be *excessively* violent or brutal, even in wartime. Did you ever observe or participate yourself in doing any of these kinds of things (e.g., atrocities: torturing prisoners, mutilating enemy bodies, harming civilians)?" Following the convention advocated by Laufer *et al.* (1985), we coded exposure to abusive violence into two mutually exclusive categories: witnessing others only (WITNESS), and participation oneself regardless of witnessing others (PARTICIP). Participation (mean = 0.32, SD = 0.47) and witnessing (mean = 0.41, SD = 0.49) correlated –0.58 with each other.

(14) Having received a disciplinary action (DISCIP) was measured dichotomously by structured interview to the item, "Did you ever receive any disciplinary actions while you were serving in a war zone, such as a demotion, an Article 15 (punishment from the company commander), or a court martial" (mean = 0.22, SD = 0.41).

(15) Dissociation (DISSOC) was measured by structured interview as the mean of five dichotomous items (selected from a longer list of items based upon results from preliminary data. Personal communication from Charles Marmar MD, December, 1989) describing critical aspects of a dissociative reaction. The veteran was asked to recall "the most upsetting thing" that happened to him in the war. Then with regard to the time of that event, he was asked if he lost track of what was going on, if his sense of time changed, if what was happening seemed unreal, if he could not remember aspects of what happened later, and if he felt surprisingly little pain at the time if he was injured (mean = 0.67, SD = 0.28).

(16) PTSD symptoms were measured by two instruments: the Mississippi Scale for Combat-Related PTSD (MISS) (mean = 126.02, SD = 20.74) (Keane *et al.,* 1988) by questionnaire, and the Structured Clinical Interview for DSM-III (SCID) (Spitzer and Williams, 1985) by structured interview. SCID symptoms that were experienced with sufficient persistence, intensity, and change from pre-trauma levels to qualify as markers for PTSD were coded with a value of "2"; symptoms that were experienced at subthreshold levels to qualify as markers for PTSD were coded with a value of "1," and symptoms that were not experienced at even subthreshold levels were given a value of "0". Ratings of the 17 symptoms in the SCID that are criteria for PTSD (American Psychiatric Association, 1987) were summed to yield a continuous score for severity of PTSD symptoms (mean = 26.14, SD = 6.57). MISS and SCID scores correlated 0.65 with each

other in the present study. Therefore, a latent variable of PTSD was generated in the model to represent severity of PTSD symptoms.

General psychiatric symptoms were also measured by two instruments: the Global Severity Index (mean = 2.18, SD = 0.79) of the Brief Symptom Inventory (BSI) (Derogatis and Melisaratos, 1983) by questionnaire, and the psychiatric subscale (mean = 0.56, SD = 0.21) of the Addiction Severity Index (ASI) (McLellan *et al.*, 1985) by structured interview. These two scores correlated 0.58 with each other in the present study. Therefore, a latent variable of PSYCH was generated in the model to represent severity of general psychiatric symptoms.

Data Analyses

The overall model is composed of two measurement models and a structural equation model. The measurement models generate latent variables that are assumed to underlie and to give rise to specific observable indicators that can be measured. In the present model, the two combat scales are specified to be observable indicators of an underlying dimension of COMBAT exposure. Similarly, the two measures of PTSD symptoms are specified to be manifestations of the underlying dimension of PTSD symptoms, and the two general measures of psychiatric symptoms are specified to be observable indicators of an underlying dimension of general PSYCH symptoms.

The structural equation model specifies the causal paths that are hypothesized to exist between exogenous and endogenous variables and among the endogenous variables themselves. In the present model, the eight premilitary vulnerabilities are exogenous variables whose causation lies outside the scope of the model. These variables are hypothesized to affect military entry conditions, war zone experiences, dissociative reactions to war zone traumas, and current symptoms. Noncausal associations among them were included in the statistical evaluation of the model, but, in the interests of clarity of exposition, they are not diagrammed in Figs. 1 and 2. They can be found, however, as components of the correlation matrix in Table I. Military entry conditions, war zone experiences, dissociation, and symptoms are endogenous variables that are hypothesized to have been caused by one or more other variables, some of which are other endogenous variables.

The model is specified solely in terms of main effects among variables. Boulanger (1981) and Helzer (1981) have each suggested that premilitary vulnerabilities interact with traumatic exposure so that the development of symptomatic reactions is conditional upon the level of premilitary vulner-

Table I. Bivariate Correlations among Model Variables[a]

	ABUSED	SELF PSY	PAR PSY	FATHCOMB	FAM INST	DRUG USE	MINORITY	COND DIS	WILLING	ENTRY AGE	REV COMB	COMB EXP	PARTICIP	WITNESS	DISCIP	DISSOC	SCID	MISS	BSI
ABUSED	–																		
SELF PSY	0.13	–																	
PAR PSY	0.19	0.11	–																
FATHCOMB	0.09	-0.02	0.05	–															
FAM INST	0.17	0.19	0.09	-0.05	–														
DRUG USE	0.13	0.07	0.03	-0.01	0.10	–													
MINORITY	-0.09	0.09	-0.10	-0.11	0.12	0.00	–												
COND DIS	0.23	0.17	0.11	0.04	0.62	0.16	-0.08	–											
WILLING	0.06	0.02	0.01	0.06	0.10	-0.10	-0.12	0.10	–										
ENTRYAGE	-0.10	-0.07	-0.02	-0.15	-0.19	0.11	0.04	-0.13	-0.33	–									
REV COMB	-0.10	-0.11	-0.01	0.03	0.03	0.07	-0.03	0.07	0.05	-0.14	–								
COMB EXP	-0.09	-0.13	-0.01	0.01	-0.01	-0.04	-0.03	0.01	0.06	-0.14	0.69	–							
PARTICIP	-0.06	-0.01	-0.10	0.11	0.02	0.00	0.07	0.02	0.12	-0.13	0.26	0.31	–						
WITNESS	0.06	0.08	0.07	-0.04	0.01	0.04	-0.02	-0.02	-0.10	-0.01	0.06	0.00	-0.58	–					
DISCIP	0.03	0.03	0.04	0.07	0.15	0.05	0.07	0.17	-0.03	-0.11	0.03	-0.03	0.04	0.05	–				
DISSOC	-0.01	-0.02	-0.05	0.00	-0.06	-0.05	0.02	-0.06	0.00	-0.10	0.11	0.11	-0.04	0.13	0.06	–			
SCID	-0.10	-0.06	0.02	0.07	0.03	-0.02	-0.05	-0.03	0.01	-0.13	0.28	0.27	0.25	0.07	0.02	0.22	–		
MISS	-0.04	-0.01	0.00	0.16	0.04	-0.07	0.04	-0.02	0.07	-0.23	0.22	0.25	0.26	0.05	0.09	0.24	0.65	–	
BSI	-0.04	0.01	0.00	0.13	0.09	-0.09	0.07	0.00	-0.02	-0.13	0.12	0.15	0.16	0.09	0.13	0.22	0.55	0.81	–
ASI	-0.04	0.01	0.04	0.12	0.12	-0.13	0.07	0.04	0.04	-0.12	0.18	0.10	0.19	0.09	0.15	0.13	0.54	0.56	0.57

[a] $N = 381$; $r = 0.10$ significant at $p < 0.05$.

abilities. In order to evaluate this possibility in our data, we examined the interactions of the eight premilitary vulnerabilities and the two military entry conditions with each of the two indicators of COMBAT and with PARTICIP and WITNESS with regard to each of the two indicators of PTSD and PSYCH. Of the total of 160 possible interactions, approximately eight could have been expected to be significant by chance at the 0.05 level of probability. In fact, only six interactions were significant at this level. Moreover, we also considered only the FAM INST vulnerability examined by Boulanger (1981) and the COND DIS vulnerability examined by Helzer (1981). Of the total of 32 possible interactions involving these two vulnerabilities, one or two could have been expected to be significant at the 0.05 level of probability. In fact, none were significant at this level. There was no evidence from this search that conditional relationships existed among the variables in our data that would necessitate the qualification of causality for any of the relationships as modeled.

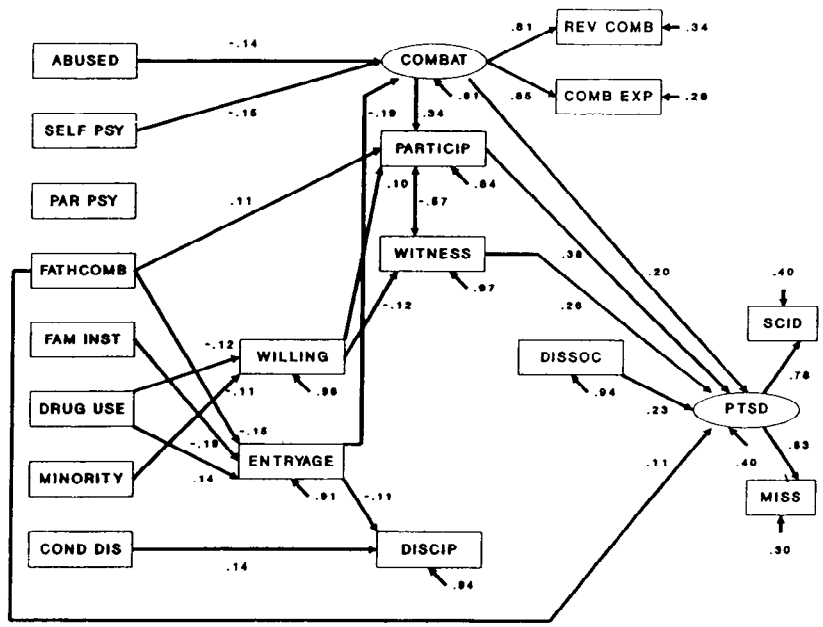

Fig. 1. Causal model for PTSD symptoms.

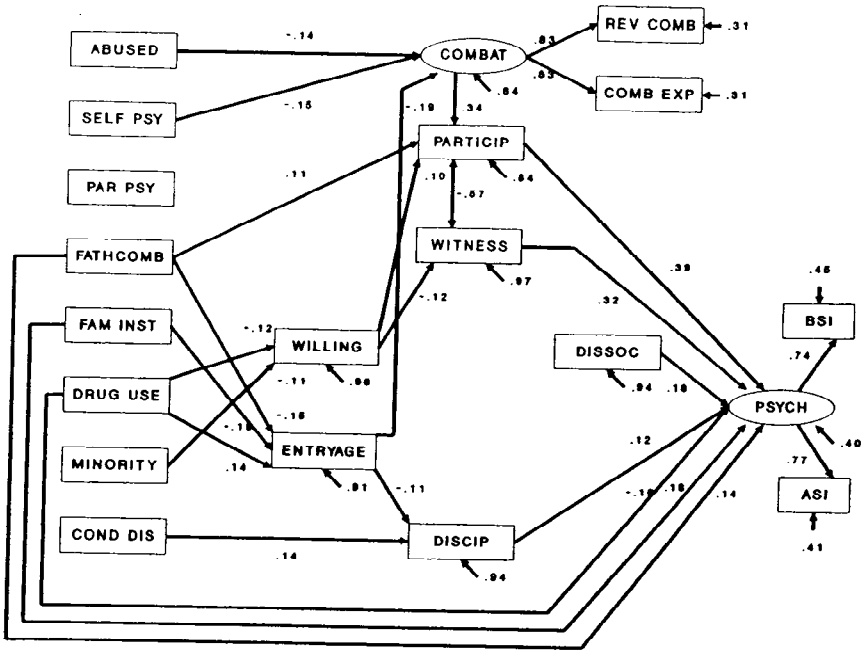

Fig. 2. Causal model for general psychiatric symtpoms.

Model estimation was performed by maximum likelihood estimation according to the CALIS procedure (SAS, 1990). Bivariate correlations among the variables in the model are presented in Table I. All causal paths that were significant at $p < 0.05$ are diagrammed with their standardized regression coefficients (betas) in Figs. 1 and 2.

RESULTS

The overall fit of the model to the data is quite satisfactory for both PTSD and PSYCH. The normed fit index is 0.94 for each. This value compares very favorably with that of 0.90, suggested by Bentler and Bonett (1980) as the minimum for an acceptable fit. The disturbance term is 0.41 for PTSD and 0.40 for PSYCH, indicating that the model accounted for 59% of the variance for PTSD and 60% for PSYCH. The models are diagrammed in Figs. 1 and 2 with the significant paths ($p < 0.05$) presented. The two-headed arrow between PARTICIP and WITNESS indicates a sig-

nificant noncausal association between them due to the mutually exclusive convention used for their coding.

The measurement models indicate that the latent variable, COMBAT, is highly saturated with the variance from both combat scales. Loadings are all in the 0.81 to 0.85 range across the PTSD and PSYCH versions. Similarly, the latent variables for symptoms, PTSD and PSYCH, are highly saturated with variance from their manifest indicators, with loadings all falling within the 0.74 to 0.83 range.

PTSD MODEL

Premilitary Vulnerabilities

The structural equation model for PTSD reveals that there is only one direct, unmediated path from premilitary vulnerabilities to symptoms, namely between FATHCOMB and PTSD. This path (0.11) indicates that veterans whose fathers had been in combat developed more severe symptoms of PTSD. In addition to this direct effect on PTSD, FATHCOMB had indirect effects on PTSD mediated through its effects on ENTRYAGE (–0.15) and PARTICIP (0.11). Veterans whose fathers had experienced combat joined the military at a younger age and were more prone to participate in abusive violence.

Among the other premilitary vulnerabilities, FAM INST, DRUG USE, ABUSED, and SELF PSY all had indirect effects on PTSD: FAM INST through ENTRYAGE (–0.19), DRUG USE through both ENTRYAGE (0.14) and WILLING (–0.12), ABUSED through COMBAT (–0.14), and SELF PSY through COMBAT (–0.15). Veterans raised in unstable families joined the military at a younger age; those who used drugs joined at an older age and joined more reluctantly; and veterans who were abused or who were treated for psychiatric problems as children saw less combat. Veterans who engaged in behaviors indicative of conduct disorders as children (COND DIS) were more prone to receive a disciplinary action (DISCIP) (0.14), but receiving a disciplinary action did not contribute to the development of more severe PTSD symptoms.

Military Entry Conditions

Conditions of entry into the military had no significant direct effects on PTSD. They did have indirect effects, however, mediated through trau-

matic war zone experiences and dissociative reactions: WILLING through PARTICIP (0.10) and WITNESS (–0.12), and ENTRYAGE through COMBAT (–0.19). Veterans who entered the military willingly were more prone to participate in abusive violence and less prone to have witnessed others' abusive violence. Veterans who entered at a younger age saw more combat and were more prone to receive a disciplinary action while in the war zone (–0.11).

War Zone Experiences

Each category of war zone traumas had direct, unmediated effects on PTSD symptoms: COMBAT (0.20), PARTICIP (0.38), and WITNESS (0.26). COMBAT had indirect effects mediated through PARTICIP (0.34) as well. The more combat veterans experienced and the more prone they were to either participate in or have occasion to witness abusive violence, the more severe the PTSD symptoms they developed. Moreover, the more combat they experienced, the more prone they were to participate in abusive violence.

Dissociation

The more veterans dissociated to their traumatic experiences, the more severe the PTSD symptoms they developed (0.23). The fact that there were no significant paths from any of the war zone traumas to dissociation is most probably a result of the measurement procedure for dissociation. We asked veterans to report their reactions to "the most upsetting event" in the war zone without specifying the nature of the event. It is quite likely that these events were distributed among combat and abusive violence, so that no trauma category contributed distinctively to these reactions.

General Psychiatric Model

Results of the model for PSYCH were virtually identical to those for PTSD regarding the effects of premilitary vulnerabilities on both military entry conditions and war zone experiences and the effects of military entry conditions on war zone experiences. There were several differences, however, with regard to direct effects on symptoms.

In contrast to PTSD, there was no direct, unmediated effect on PSYCH from COMBAT. There were additional direct effects on PSYCH, however, from DISCIP (0.12), FAM INST (0.18), and DRUG USE (–0.16).

Table II. Total, Direct, and Indirect Effects on PTSD and General Psychiatric Symptoms

	PTSD			PSYCH		
	Total	Direct	Indirect	Total	Direct	Indirect
Premilitary vulnerabilities						
ABUSED	-0.07	-0.05	-0.02	-0.05	-0.04	-0.01
SELF PSY	-0.03	-0.02	-0.01	-0.0.1	-0.02	0.01
PAR PSY	0.02	0.04	-0.02	0.03	0.04	-0.01
FATHCOMB	0.13	0.08	0.05	0.15	0.11	0.04
FAM INST	0.10	0.09	0.01	0.14	0.13	0.01
DRUG USE	-0.04	-0.03	-0.01	-0.11	-0.12	0.01
MINORITY	0.00	-0.02	0.02	0.07	0.04	0.03
COND BEH	-0.06	-0.07	0.01	-0.04	-0.05	0.01
Sum	0.05	0.02	0.03	0.18	0.09	0.09
Military entry conditions						
WILLING	-0.02	-0.02	0.00	-0.04	-0.03	-0.01
ENTRYAGE	-0.17	-0.08	-0.09	-0.09	-0.02	-0.07
Sum	-0.19	-0.10	-0.09	-0.13	-0.05	-0.08
War zone experiences						
COMBAT	0.35	0.19	0.16	0.19	0.04	0.15
PARTICIP	0.29	0.29	0.00	0.28	0.28	0.00
WITNESS	0.22	0.20	0.02	0.25	0.23	0.02
DISCIP	0.02	0.01	0.01	0.10	0.09	0.01
Sum	0.88	0.69	0.19	0.82	0.64	0.18
Dissociation						
DISSOC	0.18	0.18	0.00	0.13	0.13	0.00

Veterans who had received a disciplinary action in the war zone were more prone to develop psychiatric symptoms in general, as were those who were raised in unstable families and those who were not users of illegal drugs. As in the case of PTSD symptoms, however, PSYCH symptoms were increased by having a father who saw combat (0.14), by having participated in abusive violence oneself (0.39), by having witnessed abusive violence committed by others (0.32), and by having dissociated during one or more war zone traumas (0.18).

SUMMARY OF EFFECTS

These effects on symptom development are summarized in Table II across all pathways in terms of the total, direct, and indirect effects. Total effects across all premilitary vulnerabilities summed to 0.05 for PTSD and 0.18 for PSYCH; across the military entry conditions, to –0.19 for PTSD and –0.13 for PSYCH; and across war zone experiences, to 0.88 for PTSD and 0.82 for PSYCH. Total effects for dissociative reaction were 0.18 for PTSD and 0.13 for PSYCH.

DISCUSSION

The analyses in this paper represent the first attempt to apply structural equation modeling to the question of the etiology of PTSD. As part of this attempt, a comparison was made with the etiology of general psychiatric distress in order to identify the differences between the two. This approach was complicated by the fact that the measures of PTSD and general psychiatric distress are intercorrelated substantially. Such overlap between measures appears to be inevitable, given both the heavy representation of anxious, depressive, and dissociative symptoms in the PTSD syndrome and the heavy concomitance of comorbid disorders with PTSD. A case can be made for modeling them all as manifestations of a higher order, latent construct of psychopathology. Indeed, the distinctiveness of PTSD as a clinical entity continues to be a topic of active debate (e.g., Green *et al.,* 1985; Keane *et al.,* 1987). To have modeled a superordinate construct of psychopathology, however, would have negated both our goal of examining PTSD specifically and our consequent discovery of differences in the causal roles of premilitary vulnerabilities and combat exposure in the development of PTSD specifically and psychiatric distress generally.

Both premilitary vulnerabilities and war zone traumas play a causal role in the etiology of PTSD. As hypothesized, however, premilitary vulnerabilities play a secondary role. The one exception to this secondary role concerns the influence of fathers who had been in combat themselves. Their sons joined the military at a younger age and were more prone to participate in abusive violence than others. Based upon our prior work with the children of combat veterans (Rosenheck, 1986; Rosenheck and Nathan, 1985), we believe that an idealization of combat and war as extensions of the father may be an important mechanism involved in these paths. Such an idealization may either prime young soldiers to engage in destruction as a fulfillment of the heroic image for themselves, or it may result in severe disillusionment in the face of the unromantic realities of war. It is also possible that fathers who were damaged psychologically in combat passed their traumatization on to some of their sons. For these sons, simply being in a war zone may have been sufficient to reactivate the secondary traumatization from their childhood.

Premilitary vulnerabilities play a larger role in the development of general psychiatric symptoms, however, than in the development of PTSD. In addition to having a father who had been in combat, growing up in an unstable family and not using illegal drugs were major contributors to the development of general psychiatric symptoms. Elder and Clipp (1989) reported that men who were high in "ego-resilience" prior to the military were less likely to be bothered by psychiatric symptoms in later years than their less resilient peers. Although we have no data that bear upon this point, it is interesting to speculate that one of the detriments to growing up in an unstable family may be the failure to develop a strong sense of confidence in one's ability to cope with adversity.

The finding that using illegal drugs prior to the military led to developing *less* severe psychiatric symptoms was unexpected, and it suggests that not all of these premilitary variables may actually be vulnerabilities. Drug users were more reluctant to join the military and they joined at an older age than nonusers. The partitioning of effects, however, indicated that the effects for drug use were almost totally direct, ruling these variables out as primary explanations. This finding deserves to be examined further in subsequent research for replication and possible explanation.

In addition to having a father who had been in combat, the other premilitary vulnerabilities, with the exception of conduct disorder, were mediated in their effects on PTSD by either conditions of entry into the military or war zone experiences. The fact that veterans who had been abused as children or who had received treatment for a psychiatric problem were exposed to the lightest combat suggests that they either actively took steps to avoid combat or they otherwise behaved in ways that led their superiors

to remove them as prime candidates for combat. The additional finding that younger troops were exposed to heavier combat suggests that younger troops were those who were most enthusiastic about fighting, and therefore were the ones most likely either to volunteer or to be selected for combat missions.

Younger troops, therefore, are at greater risk for traumatic exposure than older troops. In many ways the most fit of the country's fighting forces, younger troops may not be the most fit in terms of their capacity for coping with their exposure. Other commentators have suggested that troops who are in their teenage years are still in the process of forming an adult identity (Langner, 1971; Laufer, 1985; Wilson, 1978). As adolescents, they lack consolidated conceptions of self and society that are helpful to older people in acknowledging the death and destruction around them without being overwhelmed by them.

Although related to growing up in an unstable family, engaging in conduct disorder behaviors as a child did not have the same effects. People who had disciplinary problems with authorities in civilian life before entering the military also had disciplinary problems with authorities once they were in the military. Moreover, these problems were manifested in the war zone, even though disciplinary controls are typically more lax there (Goldsmith and Cretekos, 1969). Although we have no information concerning the incidents responsible for the disciplinary actions, other reports have indicated that these types of incidents often involved violence committed away from the battlefield and were directed toward one's own troops (Bey and Zecchinelli, 1974). This propensity for antisocial behavior is manifested years after the war in the form of general psychiatric symptoms, although not PTSD.

Ethnic minority status and illegal drug use contributed to reluctance to join the military. The reluctance on the part of minorities may have been generated by alienation springing from our country's failed promises of full racial equality (Parson, 1985). Drug users' alienation may have been even more widespread. In the 1960s, illegal drug use was a major part of a "counter culture" in which all manner of authority, particularly the government, was rejected as legitimate (Roszak, 1969).

Among investigators who examined differences among war zone stressors, Laufer argued most strongly for the need to distinguish between combat and abusive violence, and, within the latter, between witnessing and participating (Laufer, 1985; Laufer *et al.,* 1984). The existence of separate and substantial effects for each of these types of trauma on both PTSD and general psychiatric symptoms in the present study support the importance of these distinctions.

At the same time that these distinctions were maintained in the model, causal priority was hypothesized for combat among the trauma categories themselves. The model specified that exposure to combat leads to witnessing and participating in abusive violence. Two causal explanations are plausible, one predominantly situational and the other predominantly psychological. The situational explanation is that being in combat provides the occasions for one to participate in or observe abusive violence. This explanation suggests that some abusive violence is an inevitable feature of war, and that simply being in combat heightens the chances that one would either witness or participate in it. In contrast, the psychological explanation is that being in combat heightens the occasions for one to be exposed to experiences such as having a buddy killed or seeing the results of abusive violence committed by the enemy. This explanation suggests that such experiences generate rage and the desire for revenge, prompting abusive retaliation. The fact that combat led to greater participation but not to greater witnessing argues for the psychological rather than the situational explanation as the more likely mechanism for the path between combat and participation.

Also of particular interest is the causal role that dissociation played in the development of general psychiatric as well as PTSD symptoms. Some investigators have suggested that dissociation plays a distinctive role in the etiology of PTSD in comparison to most other psychiatric disorders (e.g., Bremner *et al.*, 1992; Loewenstein and Putnam, 1988). Although the effects are somewhat stronger for PTSD than for general psychiatric symptoms in the present data, the presence of significant effects for the latter suggests that substantial dissociation can be expected due to the prominence of psychiatric comorbidity. Further research is needed to determine the extent to which dissociative reactions to trauma contribute uniquely to the development of PTSD and the extent to which they contribute generally to a wide range of psychiatric conditions.

The results also indicate that war zone traumas contribute somewhat more to PTSD than they do to general psychiatric symptoms. The differential contribution for war zone traumas is due almost entirely to combat, where the total effect on PTSD is nearly twice the size of that on general psychiatric symptoms. In an earlier study, we found that the fear of being injured or killed is the subjective traumatic experience that was associated most distinctively with PTSD symptoms as compared to general psychiatric symptoms (Fontana *et al.*, 1992). Wilson and Krauss (1985) also found that the war zone stressor that was related most highly to PTSD symptoms is the danger of injury or death. In combat, veterans were more likely to have been targets of violence and in immediate danger of losing their own lives, and this appears to be central to the etiology of PTSD symptoms.

In addition to providing a comparison for PTSD, the model for general psychiatric symptoms provides some insight into the etiology of the substantial psychiatric comorbidity that has been observed for PTSD (e.g., Green *et al.,* 1989; Helzer *et al.,* 1987; Kulka *et al.,* 1988). Premilitary vulnerabilities, most notably family instability, unmediated by military experiences, played a more prominent causal role in the development of psychiatric symptoms generally than in the development of PTSD specifically. With the exception of combat, however, war zone experiences and dissociative reactions to them contributed almost as much to the causation of general psychiatric symptoms as they did to the development of PTSD symptoms.

Three general points should be made in closing. First, the model has great heuristic potential as a source of questions for further research. At several points, we have speculated on the cognitions and motivations that may be the causes for the paths that we observed among the variables. For instance, we speculated that a major reason that people from unstable families joined the military at a younger age was in order to escape from an unpleasant family environment, or that people who were exposed to more combat participated in more abusive violence because they were seeking revenge for the injury or deaths of their buddies. These and other such speculations need to be tested specifically.

Second, there are a number of questions that need to be answered regarding the generalizability of the model to other populations. The greatest generalizability can be expected for the overall causal patterns, such as the relative contributions of pretrauma vulnerabilities to symptoms in their roles as either direct or indirect causes, aside from the specific content of the variables. Differences can be expected in the specific content of individual variables to the extent that the traumatic events and their sociocultural contexts are different. War is the event which provides the particular traumatic experiences that are the foci of the present study. More research is needed to determine the degree of similarity between the pathogenetic effects of war traumas and civilian traumas. Furthermore, the war under study was the Vietnam War. Differences in its sociocultural context from those of other wars can be expected to affect the relevance of individual variables. For instance, illegal drug use and participation in abusive violence were much less frequent among World War II troops than among those in Vietnam (Fontana *et al.,* 1991).

Another consideration regarding generalizability derives from the fact that the sample in the present study was drawn from the treatment-seeking portion of the Vietnam theater population. It is unknown what selection biases might be operating in determining which veterans seek treatment and which do not, and whether they might affect the etiological pathways

to PTSD. Moreover, the presence of symptoms might lead veterans to accentuate reports of their traumatic exposure and other experiences, while the absence of symptoms might lead them to minimize these reports. Further research is needed to determine the generalizability of the model to the larger population of nontreatment-seeking Vietnam theater veterans.

Third, we have included those variables in our model which have been reported in more than one study to be associated significantly and consistently in the same direction with either PTSD or general psychiatric symptoms. The magnitudes of the regression coefficients obtained in any model depend to a large extent on the particular variables that comprise the model and the causal specifications among them. There are limits to the number of variables that can be estimated in any one model, and there are other variables which will undoubtedly prove to be important components of an ultimate model of etiology. Although achievement of an ultimate model is forever elusive, it is the goal to which science aspires. We offer the current model as a step toward the specification of a model which represents the most comprehensive account of etiology possible.

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