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PTSD and Utilization of Medical Treatment Services among Male Vietnam Veterans

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This study investigated the effect of posttraumatic stress disorder (PTSD) on help-seeking for physical problems. Merging two large data sets resulted in a sample of 1773 male Vietnam veterans from white, black, Hispanic, Native Hawaiian, and Japanese American ethnic groups. Predictors of utilization included PTSD, other axis I disorders, and substance abuse. In analyses that adjusted only for age, PTSD was related to greater utilization of recent and lifetime VA medical services, and with recent inpatient care from all sources. Further analysis showed that the increased utilization associated with PTSD was not merely due to the high comorbidity between PTSD and other axis I disorders. The uniqueness of the association between PTSD and medical utilization is discussed in terms of somatization and physical illness.

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Posttraumatic stress disorder (PTSD) is associated with a range of unfavorable physical health outcomes. Literature reviews (Friedman and Schnurr, 1995; Schnurr and Jankowski, 1999) indicate that most of the data are based on self-reported physical health (*e.g.*, Boscarino, 1997; Taft et al., 1999), but evidence based on laboratory exams (*e.g.*, Boscarino and Chang, 1999) and physician diagnosis (*e.g.*, Beckham et al., 1998; Schnurr et al., 2000b) is accumulating. For example, Boscarino and Chang found that PTSD in male Vietnam veterans was associated with increased risk of atrioventricular conduction defects and infarctions, even after statistical adjustment for anxiety, depression, and risk factors for cardiovascular disease.

Despite this growing evidence of increased physical morbidity in PTSD, only a few investigators have explored whether PTSD is related to medical treatment-seeking. With two exceptions (Druss and Rosenheck, 1997; Hankin et al., 1996), most of these investigators have found that that PTSD is positively associated with utilization of services for physical problems (Kulka et al., 1990; MacDonald et al., 1995; Marshall et al., 1998; McFarlane et al., 1994; Schnurr et al., 2000a; Williams et al., 1998).

The mechanisms responsible for the greater medical utilization among individuals with PTSD are unknown. A possible explanation is the high comorbidity between PTSD and other axis I disorders. Typically, individuals with a psychiatric disorder use more medical treatment relative to individuals without disorder (*e.g.*, Tweed et al., 1998). Medical utilization also is highest for individuals with multiple diagnoses (Tweed et al., 1998).

Most studies of psychiatric disorder and medical utilization have focused on depression, anxiety, and alcohol abuse. Depression is consistently linked to greater utilization and costs of medical services (*e.g.*, Kessler et al., 1987; Patten, 1999; Simon et al., 1995). Similarly, anxiety disorders are associated with greater medical utilization (*e.g.*, Roy-Byrne, 1996). The results are particularly strong for panic disorder, in both community (Klerman et al., 1991) and medical samples (Barsky et al., 1999). Alcohol abuse disorders are associated less consistently with greater utilization (*e.g.*, Kessler et al., 1987) and even may be associated with underutilization (*e.g.*, Armstrong et al., 1998). The inconsistencies may be explained in part by the fact that current alcohol abusers are frequently compared to "abstainers" who often include ex-drinkers, some of whom may have quit drinking for medical reasons (Armstrong et al., 1998). Another explanation is that heavier drinkers may be less attentive to their health and, therefore, less likely to seek primary care (Cherpitel, 1999). Heavier drinkers, however, have been found to use emergency ser-

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vices more often relative to non-heavy drinkers (Cherpitel, 1999).

Thus, is the observed association of PTSD with greater medical utilization due to the fact that PTSD typically is comorbid with other psychiatric disorders? Or is there a unique association between PTSD and utilization? Further research is needed because only one study of PTSD and medical utilization (Marshall et al., 1998) specifically controlled for the effect of comorbid axis I disorders. In the present study, we investigated the role of axis I comorbidity in explaining the association between PTSD and medical utilization by conducting secondary analyses of data from two large studies of Vietnam veterans. The National Vietnam Veterans Readjustment Study (NVVRS; Kulka et al., 1990) is a nationally representative sample of male and female Vietnam veterans that has served as a basis for many important investigations of the predictors and consequences of Vietnam service. The Hawaiian Vietnam Veterans Project (HVVP) was part of the Matsunaga Vietnam Veterans Project (MVVP; Friedman et al., 1997), a Congressionally mandated NVVRS-like study that focused on male Vietnam veterans from Asian/Pacific Islander and American Indian ethnic groups not targeted in the NVVRS (which compared white, black, and Hispanic groups).

Analyses by Kulka et al. (1990) of the NVVRS data set showed that both male and female Vietnam veterans with PTSD were more likely than veterans without PTSD to have used inpatient and outpatient VA services for physical health problems at least once since their military service. Kulka et al. also found that PTSD was associated with a higher likelihood of recent VA and all-source utilization among male veterans but that PTSD was not associated with recent utilization among female veterans. Friedman et al. (1997), who treated PTSD as a covariate rather than as a focus of analysis when examining utilization outcomes, found that PTSD was associated with increased utilization of medical services. However, comorbidity between PTSD and other axis I disorders, which was observed in both samples, was neither examined or controlled for in either study. The failure to include this control makes it impossible to know whether, or to what extent, the observed associations between PTSD and utilization are due to the comorbidity of PTSD with other psychiatric disorders.

The present study was designed to answer this question. Data from male Vietnam veterans from the lay interview component of the NVVRS and the HVVP were used to predict all-source and VA utilization of medical treatment services; only data from male NVVRS veterans were used because the MVVP did not include female veterans. We first examined the association of PTSD with medical service utilization while adjusting only for age, and then examined this association after also adjusting for other axis I psychiatric diagnoses and substance abuse. Substance abuse was coded separately from other axis I disorders due to the different, and possibly opposite, relationship with utilization in each case. In addition, we controlled for presence of a VA service-connected physical disability, which Kulka et al. (1990) found to be a substantial predictor of increased VA utilization in male veterans. We further controlled for ethnicity because Kulka et al. (1990) and Friedman et al. (1997) found differences between ethnic groups in VA utilization for physical health problems: blacks were more likely than whites or Hispanics to use VA services, and Native Hawaiians and Americans of Japanese ancestry were less likely than whites, blacks, or Hispanics to use VA services.

We expected that PTSD would be associated with increased utilization when the effects of other axis I disorders and substance abuse were not controlled. Based on prior findings (Marshall et al., 1998), we expected the association would be maintained even after adjustment for other axis I disorders and substance abuse. Secondary analyses examined whether this association would be maintained after additional adjustment for recent health problems. Based on evidence that PTSD is associated with morbidity (*e.g.*, Boscarino and Chang, 1999), we expected that the effects of PTSD would be decreased. However, given that need, *i.e.*, illness, is only one of many factors that determine utilization (Andersen, 1995), it was possible that PTSD would still be associated with PTSD after accounting for health problems.

Methods

Data Sources

National Vietnam Veterans Readjustment Study. Data for the NVVRS (Kulka et al., 1988, 1990) were collected between 1987 and 1988 to fulfill a Congressional mandate. This epidemiological study drew a national probability sample and employed a two-stage design. In the first stage, lay interviews were conducted with a large number of male and female Vietnam theater veterans, veterans who served during the Vietnam era but not in Vietnam, and civilian counterparts. Participation was very good: 83% for Vietnam veterans, 80% for era veterans, and 70% for civilian counterparts. In the second stage, clinical interviews were conducted with a subsample of Vietnam theater and Vietnam era veterans to permit

more careful clinical diagnosis. Again, participation was very good: 85% for theater veterans and 83% for era veterans. Blacks and Hispanics were oversampled relative to whites, as were women, who were not stratified by ethnic group. Details about the sampling procedure are provided in Kulka et al. (1988).

Hawaiian Vietnam Veterans Project. The Matsunaga Vietnam Veterans Project (Friedman et al., 1997), like the NVVRS, was Congressionally mandated. Data were collected between 1994 and 1996, using a two-stage design and methods very similar to those employed in the NVVRS. The study had two arms: the American Indian Vietnam Veterans Project, which included male Vietnam theater veterans from two tribes, Northern Plains and Southwest; and the Hawaiian Vietnam Veterans Project, which included data from Native Hawaiian and American of Japanese Ancestry male Vietnam veterans. (Data from the American Indian samples are being analyzed by another team of investigators and are not available for study.) Participation in the HVVP was 86% for the lay interview component and 79% for the clinical interview component. Details about the sampling procedures are provided in Friedman et al. (1997). The measures in the HVVP were designed for maximum comparability with the NVVRS, although some were slightly modified to enhance cultural sensitivity.

Measures

Predictors. PTSD was assessed by the Mississippi Scale for Combat-Related PTSD (Keane et al., 1988), a 35-item questionnaire that has excellent sensitivity and specificity for a structured interview diagnosis of PTSD (Kulka et al., 1988). The Mississippi was chosen because it was used in prior analyses of the NVVRS (Kulka et al., 1990) and HVVP lay data (Friedman et al., 1997) and it possessed the best psychometric properties of the measures available from both the NVVRS and the HVVP lay data sets.

As in the original NVVRS and MVVP studies (Friedman et al., 1997; Kulka et al., 1988), a cutpoint score of ≥ 89 was used to distinguish PTSD and no PTSD groups (coded 0 = absent, 1= present). This cutpoint had excellent correspondence with a composite, multimethod diagnosis of current PTSD: sensitivity = .94 and specificity = .80 (Kulka et al., 1988). The utility of this cutpoint for diagnosing lifetime PTSD was not reported. However, Mississippi scores should reflect lifetime PTSD because the time frame for most items is either unspecified or lifetime ("since the military") and Mississippi scores are elevated among military veterans with past only (Keane et al., 1998) or lifetime (Schnurr et al., 1993) PTSD. A prior analysis of the NVVRS data (Schnurr et al., 2000b) found that a cutpoint of 89 yielded .66 sensitivity and .82 specificity for a lifetime diagnosis of PTSD based on the Structured Clinical Interview for DSM-III-R (Spitzer et al., 1987). There also were substantial mean differences between lifetime PTSD (mean = 97.8) and no lifetime PTSD (M = 70.0) groups. Taken together, the existing findings suggest that the Mississippi Scale has acceptable validity as an indicator of lifetime PTSD.

Analyses of the NVVRS lay sample data by Kulka et al. (1990) that examined the effects of PTSD involved an adjustment of univariate table cells for differences in the prevalence estimates based on the Mississippi Scale versus multimethod diagnosis in the clinical data set (Kulka et al., 1988, Appendix D). We did not make this adjustment because it cannot be performed with multivariate analysis, and furthermore, does not apply to the HVVP data.

Other axis I disorders were measured by structured interviews that were designed to be administered by lay interviewers. In the NVVRS, interviews were conducted with the Diagnostic Interview Schedule (DIS; version IIIA) for DSM-III criteria (Robins et al., 1981). In the MVVP, interviews were conducted with the University of Michigan version of the Composite International Diagnostic Interview (CIDI) for DSM-III-R criteria (see Kessler et al., 1995). Although the CIDI content virtually duplicates the DIS, the former has been modified to facilitate administration by lay interviewers (Friedman et al., 1997). Two diagnoses that were originally assessed in the NVVRS were not included in the MVVP due to low prevalence: mania and obsessive compulsive disorder. Axis I diagnoses assessed in both studies included major depression, dysthymia, panic disorder, generalized anxiety disorder, alcohol abuse/dependence, and drug abuse/dependence. To avoid problems of small or empty cells in data analysis, these diagnoses were pooled into two categories of current and lifetime diagnoses: axis I disorder (except drug or alcohol abuse/dependence) and substance abuse (drug or alcohol abuse/dependence). Like PTSD, these categories were coded as 0 = absent and 1 = present.

Covariates in all analyses included age at interview, ethnic group, and presence of a service-connected physical disability. Age at interview was used to facilitate comparison of the NVVRS and MVVP samples, who differed in the average age at which each sample was studied. Ethnic group was represented by four indicator variables (black, Hispanic, Native Hawaiian, and American of Japanese ancestry, with white as the reference category). Service-

connected physical disability was indicator-coded, with 0 = absent and 1 = present.

Number of recent health problems was measured as the number of conditions reported during the prior 12 months. The NVVRS had used a list of 37 items, although we confined our analyses to the 15 items used in the MVVP. These 15 items tended to reflect the most serious items on the NVVRS list, such as hypertension, "heart trouble," cancer, ulcers, deafness, chronic skin problems, permanent stiffness of the hands, and paralysis.

Outcomes. Participants were asked a series of questions about their use of medical care for physical problems. Although the MVVP questions about service utilization were simplified relative to the questions in the NVVRS (see Friedman et al., 1997), the fact that the MVVP was designed to permit direct comparison with the NVVRS meant that utilization information was available in five categories: any recent outpatient (past 6 months), any recent inpatient (past 12 months), VA recent outpatient (past 6 months), lifetime VA outpatient, and lifetime VA inpatient. An additional category, past 6-month use of VA inpatient care, was not sufficiently prevalent to permit multivariate analysis and was deleted from consideration. VA recent outpatient use is a subset of any recent outpatient use, which cannot be divided into VA and non-VA categories because of the way questions were worded across studies.

Data Analysis

T-tests and χ^2 tests were used for comparisons involving descriptive data. Multiple logistic regression was used to examine the association between PTSD and the utilization outcomes. Although sampling weights are available for the NVVRS to reflect the oversampling of blacks and Hispanics, analyses were unweighted due to the unavailability of comparable weights for the HVVP. Note that our unweighted approach is consistent with the approach taken in other secondary analyses of the NVVRS (*e.g.*, Fontana and Rosenheck, 1999; Taft et al., 1999).

To show how each major predictor—PTSD, axis I disorder, and substance abuse—was associated with each outcome, initial regressions were performed between each predictor and outcome, adjusting only for age. Hierarchical regression was used next. PTSD was added at the first step, along with ethnic group and service-connected physical disability. Axis I disorder and substance abuse were added on successive steps. In an attempt to maximize the effects associated with comorbidity, current axis I disorder and current substance abuse were used to predict recent utilization, and lifetime diagnostic measures were used to predict lifetime utilization outcomes. The same measure of PTSD was used to predict all outcomes.

TABLE 1
Sample Description

	NVVRS (N = 1176)	MVVP (N = 597)	Total (N = 1773)	$\chi^2(1)$ or $t(1771)$
Age at interview (Mean)	41.5	50.1	44.4	29.83**
SD	5.3	6.5	7.0	
Ethnic group (%)				
White	50.9	—	33.7	—
Black	25.7	—	17.0	—
Hispanic	23.5	—	15.6	—
Native Hawaiian	—	50.1	16.9	—
Japanese American	—	49.8	16.8	—
Service-connected physical disability (%)	19.9	13.1	17.6	12.75**
Psychiatric diagnoses (%)				
Current PTSD	26.8	17.8	23.7	17.03**
Other current axis I	8.4	4.9	7.2	6.83*
Other lifetime axis I	20.9	12.9	18.2	16.29**
Current substance abuse/dependence	13.9	30.2	19.4	67.85**
Lifetime substance abuse/dependence	43.3	36.3	40.9	7.48*

*$p < .01$; **$p < .001$.

Results

Sample characteristics are presented in Table 1. The NVVRS and HVVP subsamples differed on all of the predictors. Men in the HVVP tended to be older than men in the NVVRS. The NVVRS subsample was more likely than the HVVP subsample to have a service-connected physical disability, other current axis I disorder, other lifetime axis I disorder, and lifetime substance abuse. Only the prevalence of current substance abuse was higher in the HVVP than in the NVVRS participants.

With respect to utilization from any source, 39.6% (N = 703) of the sample reported recent outpatient use and 8.5% (N = 150) reported recent inpatient use. With respect to VA utilization specifically, 4.9% (N = 86) reported recent outpatient use; lifetime utilization was 27.1% (N = 482) for outpatient medical care and 11.7% (N = 208) for inpatient medical care. Table 2 presents the frequencies of each utilization outcome as a function of the diagnostic variables used in the logistic regression analyses.

Table 3 presents the age-adjusted odds ratios (ORs) for each diagnostic variable in relation to the outcomes it was used to predict in multivariate analysis. These ORs provide a quasi-univariate picture of relationships among predictors and outcomes. As expected, PTSD was associated with greater medical utilization in all categories except

TABLE 2
Frequencies of Utilization Outcomes as a Function of Diagnostic Predictors

Diagnosis	Any Recent Outpatient		Any Recent Inpatient		Recent VA Outpatient		Lifetime VA Outpatient		Lifetime VA Inpatient	
	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*
Current PTSD										
No (N = 1352)	40	(542)	7	(98)	3	(39)	21	(285)	7	(89)
Yes (N = 421)	38	(160)	12	(52)	11	(47)	47	(197)	28	(119)
Other Current Axis I										
No (N = 1645)	39	(636)	8	(131)	4	(61)	—		—	
Yes (N = 128)	52	(67)	15	(19)	20	(25)	—		—	
Other Lifetime Axis I										
No (N = 1450)	—		—		—		22	(321)	8	(118)
Yes (N = 323)	—		—		—		50	(161)	28	(90)
Current Substance Abuse										
No (N = 1429)	39	(558)	8	(117)	4	(64)	—		—	
Yes (N = 344)	42	(145)	10	(33)	6	(22)	—		—	
Lifetime Substance Abuse										
No (N = 1047)	—		—		—		24	(254)	9	(89)
Yes (N = 726)	—		—		—		31	(228)	16	(119)

Total N = 1773.

TABLE 3
Age-Adjusted Associations Between Utilization Outcomes and Diagnostic Predictors

Diagnosis	Any Recent outpatient	Any Recent Inpatient	Recent VA Outpatient	Lifetime VA Outpatient	Lifetime VA Inpatient
Current PTSD	1.08	1.98**	5.35**	3.19**	4.76**
	(.86–1.36)	(1.37–2.85)	(3.34–8.55)	(2.52–4.05)	(3.50–6.48)
Other current axis I	2.10**	2.17*	7.69**	—	—
	(1.46–3.04)	(1.28–3.67)	(4.62–13.08)	—	—
Other lifetime axis I	—	—	—	3.37**	3.81**
	—	—	—	(2.61–4.34)	(2.78–5.21)
Current substance abuse	1.15	1.19	1.47	—	—
	(.90–1.46)	(.80–1.79)	(.89–2.43)	—	—
Lifetime substance abuse	—	—	—	1.37*	1.87**
	—	—	—	(1.10–1.69)	(1.39–2.52)

Total N = 1773. Age-adjusted odds ratios are presented with 95% confidence intervals in parentheses underneath. The reference category for each predictor is the absence of a given diagnosis.
*$p < .01$; **$p < .001$.

any recent outpatient care. The analyses also showed that utilization was related to the other diagnostic variables as well. Current axis I disorder was associated with greater likelihood of all types of current utilization, and lifetime axis I disorder was associated with greater likelihood of lifetime VA utilization. Current substance abuse was not associated with any type of current utilization, although lifetime substance abuse was associated with greater lifetime utilization of VA inpatient and outpatient services. PTSD and axis I disorder were comparable in terms of the magnitude of their effects, whereas the effects associated with lifetime substance abuse were smaller. For example, the OR for lifetime axis I disorder as a predictor of lifetime VA utilization was 3.37, whereas the OR for lifetime substance abuse was 1.37.

Table 4 presents the results of hierarchical regression analyses to determine the uniqueness of PTSD as a predictor of utilization. At the initial step, which included PTSD and controlled for age, ethnicity, and service-connected physical disability, the ORs for PTSD were smaller than in the age-adjusted analyses. However, as in the age-adjusted analyses, PTSD predicted greater utilization of all types of care except any recent outpatient care. PTSD remained a significant predictor of these outcomes in subsequent steps, first after adding axis I disorder and then after adding substance abuse. The addition of axis I disorder reduced the odds ratio for PTSD most substantially for lifetime VA inpatient utilization (from 4.41 to 3.36) and current VA outpatient utilization (from 4.16 to 2.78). The addition of substance abuse had little effect on any of the odds ratios for PTSD. Axis I disorder independently predicted all utilization outcomes except any recent inpatient care. Substance abuse was not related to any outcome.

TABLE 4
Hierarchical Logistic Regressions to Predict Utilization Outcomes

Utilization Outcome / Predictor	Step 1		Step 2		Step 3	
	OR[a]	95% CI[b]	OR	95% CI	OR	95% CI
Any current outpatient						
Current PTSD	1.07	.84–1.36	.90	.69–1.16	.89	.69–1.16
Other current axis I			2.23***	1.50–3.31	2.21***	1.49–3.30
Current SA[c]					1.05	.81–1.36
Any current inpatient						
Current PTSD	1.81**	1.24–2.64	1.63*	1.09–2.45	1.61*	1.07–2.43
Other current axis I			1.55	.88–2.76	1.53	.86–2.73
Current SA					1.09	.71–1.69
Current VA outpatient						
Current PTSD	4.16***	2.53–6.85	2.78***	1.60–4.84	2.76**	1.58–4.82
Other current axis I			4.11***	2.20–7.68	4.06**	2.16–7.63
Current SA					1.09	.61–1.97
Lifetime VA outpatient						
Current PTSD	2.92***	2.23–3.82	2.20***	1.65–2.94	2.19***	1.64–2.94
Other lifetime axis I			2.39***	1.76–3.25	2.38***	1.75–2.24
Lifetime SA					1.02	.79–1.33
Lifetime VA inpatient						
Current PTSD	4.41***	3.18–6.12	3.36***	2.36–4.78	3.20***	2.25–4.58
Other lifetime axis I			2.20***	1.53–3.15	2.11***	1.46–3.03
Lifetime SA					1.37	.99–1.91

Total N = 1773. The reference category for each predictor is the absence of a given diagnosis. All estimates are adjusted for age at interview, ethnic group, and presence of service-connected physical disability.
[a]Odds ratio.
[b]Confidence interval.
[c]Substance abuse.
*$p < .05$; **p .01; ***$p < .001$.

Although our primary focus was on PTSD as a predictor of utilization, the statistical models also permitted us to examine variation in utilization as a function of ethnic group. (Results are not displayed in Table 4 in order to enhance readability of the table.) Relative to whites, each minority group differed on at least one outcome. These differences were observed for VA care only, except in the case of Hispanics, who did not differ from whites in use of VA care but who had lower utilization of recent outpatient care from any source (OR = .65, $p < .01$). Blacks had greater utilization of all types of VA care: recent outpatient (OR = 2.34, $p < .01$), lifetime outpatient (OR = 1.96, $p < .001$), and lifetime inpatient (OR = 1.79, $p < .01$). Native Hawaiians had lower lifetime VA outpatient (OR = .47, $p < .001$) and inpatient (OR = .28, $p < .001$) utilization. Japanese Americans had lower utilization of VA outpatient care, both current (OR = .26, $p < .05$) and lifetime (OR = .38, $p < .001$).

Individuals with PTSD reported a greater number of health problems relative to individuals without PTSD (mean = 3.01 *vs.* mean = 2.11, adjusted for age, $F[1,1770] = 150.42$, $p < .001$). To examine the extent to which poor health mediated the relationship between PTSD and the four utilization outcomes with which it was significantly associated, we added number of recent health problems to the final models reported in Table 4. For each outcome, the OR for PTSD diminished but became nonsignificant only for any current inpatient use (1.22, $p = .37$). The ORs for the other outcomes were: current VA outpatient (2.11, $p < .05$), lifetime VA outpatient (1.81, $p < .001$), and lifetime VA inpatient (2.72, $p < .001$). Number of recent health problems was significantly associated with all outcomes; the ORs ranged from 1.21 for lifetime VA inpatient use to 1.32 for lifetime VA outpatient use (all $p < .001$).

Discussion

We found that PTSD in Vietnam veterans was related to greater utilization of medical services, which is consistent with prior investigations on the topic (*e.g.*, Marshall et al., 1998; Williams et al., 1998). As expected, the increased utilization associated with PTSD was not merely due to the high comorbidity between PTSD and other axis I disorders that independently predicted greater utilization as well. Analyses in which the effect of age only was controlled suggested that the relationship between PTSD and utilization was particularly strong for VA sources of care. This pattern was attenuated when additional covariates were included in the statistical

models, but visual inspection still indicated somewhat larger effects of PTSD on VA than all care. Note that our findings are consistent with observations by Rosenheck and Fontana (1995), who used the NVVRS data set and found that veterans with PTSD showed a preference for VA versus non-VA mental health services. The effects of PTSD on utilization may be greatest for VA sources because use of VA care by veterans of all eras is associated with combat exposure, economic disadvantage, and poor health (Rosenheck and Massari, 1993), all of which are related to PTSD as either a presumed cause or an outcome (Kulka et al., 1990).

The only type of utilization that was not related to PTSD was recent outpatient medical care from all sources, which Kulka et al. (1990) found to be greater among veterans with PTSD. Additional analyses (not reported) indicated the similarity between the PTSD and no PTSD groups on this measure was not due to the multivariate statistical procedures we used. We might have observed an effect of PTSD on this outcome if it had been possible to adjust our analyses with the same method used by Kulka et al. As indicated above, we could not use this method because it does not apply to the HVVP data and cannot be performed with multivariate analysis, which was necessary for testing our hypotheses. Our findings thus may underestimate the strength of the association between PTSD and medical utilization.

Data from this study indicate that comorbid psychiatric conditions partially account for the relationship between PTSD and increased utilization. The effect of other axis I disorders on utilization underscores the importance of including measures of psychiatric comorbidity in future investigations of the health effects of PTSD. Depression in particular is related to morbidity from cardiovascular disease in previously healthy populations and to morbidity and mortality among patients with serious medical illness (*e.g.*, Musselman et al., 1998, Silverstone, 1990). Also, the evidence linking anxiety to cardiovascular morbidity and mortality is quite strong (Hayward, 1995). Substance abuse had effects that were confined to lifetime VA utilization in age-adjusted analyses, and controlling for substance abuse did not alter the effect of PTSD. The relatively limited effects of substance abuse are consistent with some studies that have found either no effect of substance abuse on utilization (*e.g.*, Armstrong et al., 1998) or effects that are specific to emergency care (*e.g.*, Cherpitel, 1999). However, substance abuse has known effects on morbidity (McGinnis and Foege, 1999) that need to be considered in future studies.

Our data also indicate that health problems play a role in mediating the relationship between PTSD and utilization. There is increasing evidence that individuals with PTSD have more physical illness relative to individuals without the disorder. Beckham et al. (1998) found effects of PTSD on self-reported health even after controlling for somatization, and PTSD was related to physician-diagnosed illness even though somatization was not. In addition to the work by Beckham, other studies indicate that individuals with PTSD are at increased risk of poor physical health (*e.g.*, Boscarino and Chang, 1999; Schnurr et al., 2000b). More generally, traumatic exposure is associated with increased physical morbidity (*e.g.*, Felitti et al., 1998; Walker et al., 1999), so it makes sense that PTSD would be associated with poor health. PTSD and its correlates may be the mechanism through which traumatic exposure leads to adverse health outcomes (Friedman and Schnurr, 1995; Schnurr and Jankowski, 1999).

Nevertheless, some of the greater utilization associated with PTSD and other psychiatric disorders is unrelated to physical illness. For example, depression is related to increased medical utilization even after statistical adjustment for comorbid medical conditions (Simon et al., 1995), and patients with panic disorder use more medical care relative to patients without panic disorder, despite being healthier (Barsky et al., 1999). Similarly, individuals with PTSD may present to medical settings because they are somatizing their distress, which may explain why PTSD continued to predict most types of utilization even when we controlled for recent illness.

Andersen's (1995) multifactorial model of healthcare utilization provides a useful framework for understanding our findings. According to his model, utilization is influenced not just by need (illness), but also by predisposing characteristics, such as age, gender, education, and ethnicity, and enabling resources, such as income, health insurance, and the availability of care. Also important are characteristics of the healthcare system itself, as well as prior experiences with the system, which may influence subsequent help seeking.

Consistent with Andersen's (1995) model, ethnic differences in utilization were observed. Unlike prior analyses of ethnic differences in utilization by Vietnam veterans (Friedman et al., 1997; Kulka et al., 1990), our analyses controlled for the effect of important influences on utilization (age, service-connected physical disability), as well as psychiatric disorder. With one exception (less frequent use of any recent outpatient care by Hispanic veterans), all of the differences we observed were limited to the domain of VA care. Relative to white veterans, black

veterans were more likely to use the VA for physical health problems, whereas Hawaiian and Japanese American veterans were less likely. These differences would have been obscured had we defined white/nonwhite groups only. Thus, our data illustrate the utility of examining ethnic groups separately whenever possible. Note that our analyses focused on the main effect of ethnicity. Testing interactions between ethnicity and PTSD would have resulted in cells that were too small for meaningful analysis. Future research should examine whether the effect of PTSD is uniform across ethnic groups and other individual characteristics.

Our findings are based on self-reports of utilization because information from hospital records was not available for the data sets we used. Self-reports may imperfectly reflect actual utilization, but they are frequently used (*e.g.*, Druss and Rosenheck, 1997). The frequent use probably stems in part from the difficulty of accessing utilization records, but also because self-report often is the only way to obtain comprehensive utilization information for individuals who receive care from multiple sources (Wallihan et al., 1999), such as veterans who receive VA and non-VA care. Although the accuracy of self-reports has been questioned in some studies (*e.g.*, Roberts et al., 1996), other studies indicate that self-reports have acceptable accuracy (*e.g.*, Golding et al., 1988) and that underreporting is a more common error than overreporting (Wallihan et al., 1999). Another limitation of our utilization measure is that it did not capture amount of utilization, which may vary with PTSD. In fact, the effect of PTSD on the intensity and cost of utilization could be greater than the effect on the probability of utilization. A recent study found that childhood trauma, especially sexual trauma, was associated with increased costs of medical care for women in a large health maintenance organization—in excess of $8,000,000 per calendar year (Walker et al., 1999). Unfortunately, this study did not examine PTSD, but the high prevalence of PTSD among sexually traumatized women (Kessler et al., 1995) suggests that PTSD is likely to be an important factor behind these costs.

A further limitation of our study is that the NVVRS and HVVP data sets do not include a complete spectrum of axis I disorders, and so our results may not generalize to all axis I disorders. However, two of the disorders included in our measure—depression and panic disorder—are known to have substantial effects on care-seeking behavior (*e.g.*, Klerman et al., 1991; Patten, 1999). Given the inclusion of these disorders, along with dysthymia and generalized anxiety disorder, it is likely that our measure sufficiently controlled for the effect of axis I comorbidity on the relationship between PTSD and utilization. A final issue is that our estimates of utilization may not generalize to all Vietnam veterans because of the high number of minority veterans in our sample relative to their prevalence in the U.S. population.

Conclusions

This study documents the contribution of PTSD to utilization of medical service, beyond the effects of other psychiatric disorders. The act of seeking medical care is influenced by multiple factors, including characteristics of both individuals and the healthcare system (Andersen, 1995). It will be useful in future studies to address interrelationships among PTSD and these other factors in order to obtain yet a broader perspective on how PTSD relates to healthcare utilization. Studies should attempt to model amount of utilization and costs, and to estimate the direct and indirect effects of traumatic exposure through PTSD and its comorbid conditions, as well as other reactions to trauma. As indicated by the recent findings on the economic burden associated with childhood abuse (Walker et al., 1999), the effects of trauma and PTSD on society could be greater than previously realized.

References

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

Andersen RM (1995) Revisiting the behavioral model and access to medical care: Does it matter? *J Health Soc Behav* 36:1–10.

Armstrong MA, Midanik LT, Klatsky AL (1998) Alcohol consumption and utilization of health services in a health maintenance organization. *Med Care* 36:1599–1605.

Barsky AJ, Delamater BA, Orav JE (1999) Panic disorder patients and their medical care. *Psychosomatics* 40:50–56.

Beckham JC, Moore SD, Feldman ME, Hertzberg MA, Kirby AC, Fairbank JA (1998) Health status, somatization and posttraumatic stress disorder severity in Vietnam combat veterans with posttraumatic stress disorder. *Am J Psychiatry* 155: 1565–1569.

Boscarino JA (1997) Diseases among men 20 years after exposure to severe stress: Implications for clinical research and medical care. *Psychosom Med* 59:605–614.

Boscarino JA, Chang J (1999) Electrocardiogram abnormalities among men with stress-related psychiatric disorders: Implications for coronary heart disease and clinical research. *Ann Behav Med* 21:227–234.

Cherpitel CJ (1999) Drinking patterns and problems, drug use and health services utilization: A comparison of two regions in the US general population. *Drug Alcohol Depend* 53:231–237.

Druss BG, Rosenheck RA (1997) Use of medical services by veterans with mental disorders. *Psychosomatics* 38:451–458.

Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS (1998) Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The adverse childhood experiences (ACE) study. *Am J Prev Med* 14:245–258.

Fontana A, Rosenheck RA (1999) A model of war zone stressors and posttraumatic stress disorder. *J Trauma Stress* 12:111–126.

Friedman MJ, Ashcraft ML, Beals JL, Keane TM, Manso SM, Marsella AJ (1997) *Matsunaga Vietnam Veterans Project.* White River Junction, VT: VA National Center for PTSD.

Friedman MJ, Schnurr PP (1995) The relationship between trauma, post-traumatic stress disorder, and physical health. In MJ Friedman, DS Charney, AY Deutch (Eds), *Neurobiological and clinical consequences of stress: From normal adaptation to post-traumatic stress disorder* (pp 507–524). Philadelphia: Lippincott-Raven.

Golding JM, Gongla P, Brownell A (1988) Feasibility of validating survey self-reports of mental health service use. *Am J Community Psychol* 16:39–51.

Hankin CS, Abueg FR, Gallagher-Thompson D, Laws A (1996) Dimensions of PTSD among older veterans seeking outpatient medical care. *J Clin Geropsychol* 2:239–246.

Hayward C (1995) Psychiatric illness and cardiovascular disease risk. *Epidemiol Rev* 17:129–138.

Keane TM, Caddell JM, Taylor KL (1988) Mississippi scale for combat-related posttraumatic stress disorder: Three studies in reliability and validity. *J Consult Clin Psychol* 56:85–90.

Keane TM, Kolb LC, Kaloupek DG, Orr SP, Blanchard EB, Thomas RG, Hsieh FY, Lavori PW (1998) Utility of psychophysiological measurement in the diagnosis of posttraumatic stress disorder: Results form a Department of Veterans Affairs Cooperative Study. *J Consult Clin Psychol* 66:914–923.

Kessler LG, Burns BJ, Shapiro S, Tischler GL, George LK, Hough RL, Bodison D, Miller RH (1987) Psychiatric diagnoses of medical service users: Evidence from the epidemiologic catchment area program. *Am J Public Health* 77:18–24.

Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB (1995) Posttraumatic stress disorder in the National Comorbidity Survey. *Arch Gen Psychiatry* 52:1048–1060.

Klerman GL, Weissman MM, Ouellette R, Johnson J, Greenwald S (1991) Panic attacks in the community: Social morbidity and health care utilization. *J Am Med Assoc* 265:742–746.

Kulka RA, Schlenger WE, Fairbank JA, Hough RL, Jordan BK, Marmar CR, Weiss DS (1988) *National Vietnam Veterans Readjustment Study: Description, current status, and initial PTSD prevalence estimates.* Research Triangle Park, NC: Research Triangle Institute.

Kulka RA, Schlenger WE, Fairbank JA, Hough RL, Jordan BK, Marmar CR, Weiss DS (1990) *Trauma and the Vietnam war generation.* New York: Brunner/Mazel.

MacDonald C, Chamberlain K, Long N (1995) Posttraumatic stress disorder (PTSD) and its effects in Vietnam veterans: The New Zealand experience. *N Z J Psychol* 24:63–68.

Marshall RP, Jorm AF, Grayson DA, O'Toole BI (1998) Posttraumatic stress disorder and other predictors of health care consumption by Vietnam veterans. *Psychiatr Serv* 49:1609–1611.

McFarlane AC, Atchison M, Rafalowicz E, Papay P (1994) Physical symptoms in post-traumatic stress disorder. *J Psychosom Res* 38:715–726.

McGinnis JM, Foege WH (1999) Mortality and morbidity attributable to use of addictive substances in the United States. *Proc Assoc Am Physicians* 111(2):109–111.

Musselman DL, Evan DL, Nemeroff CB (1998) The relationship of depression to cardiovascular disease. *Arch Gen Psychiatry* 55:580–592.

Patten SB (1999) Long-term medical conditions and major depression in the Canadian population. *Can J Psychiatry* 44: 151–157.

Robins LN, Helzer JE, Croughan JL, Ratcliff KS (1981) National Institute of Mental Health diagnostic interview schedule: Its history, characteristics, and validity. *Arch Gen Psychiatry* 38: 381–389.

Roberts RO, Bergstralh EJ, Schmidt L, Jacobsen SJ (1996) Comparison of self-reported and medical record health care utilization measures. *J Clin Epidemiol* 49:989–995.

Rosenheck RA, Fontana A (1995) Do Vietnam-era veterans who suffer from posttraumatic stress disorder avoid VA mental health services? *Mil Med* 160:136–142.

Rosenheck R, Massari L (1993) Wartime military service and use of VA health services. *Mil Med* 158:223–228.

Roy-Byrne PP (1996) Generalized anxiety and mixed anxiety-depression: Association with disability and health care utilization. *J Clin Psychiatry* 57(Suppl 7):86–91.

Schnurr PP, Jankowski MK (1999) Physical health and posttraumatic stress disorder: Review and synthesis. *Semin Clin Neuropsychiatry* 4:295–304.

Schnurr PP, Ford JD, Friedman MJ, Green BL, Dain BJ, Sengupta A (2000a) Predictors and outcomes of PTSD in World War II veterans exposed to mustard gas. *J Consult Clin Psychol* 68: 258–268.

Schnurr PP, Friedman MJ, Rosenberg SD (1993) Premilitary MMPI scores as predictors of combat-related PTSD symptoms. *Am J Psychiatry* 150:479–483.

Schnurr PP, Spiro A III, Paris AH (2000b) Physician-diagnosed medical disorders in relation to PTSD symptoms in older military veterans. *Health Psychol* 19:91–97.

Silverstone PH (1990) Depression increases mortality and morbidity in acute life-threatening illness. *J Psychosom Res* 34: 651–657.

Simon GE, VonKorff M, Barlow W (1995) Health care costs of primary care patients with recognized depression. *Arch Gen Psychiatry* 52:850–856.

Spitzer RL, Williams JB, Gibbon M, First MB (1987) *Structured Clinical Interview for DSM-III-R.* New York: Biometrics Research Department, New York State Psychiatric Institute.

Taft CT, Stern AS, King LA, King DW (1999) Modeling physical health and functional status: The role of combat exposure, posttraumatic stress disorder, and personal resource attributes. *J Trauma Stress* 12:3–23.

Tweed DL, Goering P, Lin E, Williams JI (1998) Psychiatric morbidity and physician visits: Lessons from Ontario. *Med Care* 36:573–585.

Walker EA, Unutzer J, Rutter C, Gelfand A, Saunders K, VonKorff M, Koss MP, Katon W (1999) Costs of health care use by women HMO members with a history of childhood abuse and neglect. *Arch Gen Psychiatry* 56:609–613.

Wallihan DB, Stump TE, Callihan CM (1999) Accuracy of self-reported health services use and patterns of self-care among urban older adults. *Med Care* 37:662–670.

Williams W, Weiss TS, Edens A, Johnson M, Thornby JI (1998) Hospital utilization and personality characteristics of veterans with psychiatric problems. *Psychiatr Serv* 49:370–374.