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Outpatient medical and mental healthcare utilization models among military veterans: Results from the 2001 National Survey of Veterans

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Abstract

Using Andersen's (1995) [Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? Journal of Health and Social Behavior 1995;36:1–10] behavioral model of healthcare use as our theoretical framework, we examined predisposing (i.e., sociodemographic), enabling (i.e., access resources), and need (i.e., illness) models of outpatient medical and mental healthcare utilization among a national sample of US veterans. Participants were 20,048 nationally representative participants completing the 2001 National Survey of Veterans. Outcomes were healthcare use variables for the past year, including the number of Veterans Affairs (VA) and non-VA outpatient healthcare visits, and whether VA and non-VA mental health treatment was used. Univariate results demonstrated that numerous predisposing, enabling and need variables predicted both VA and non-VA healthcare use intensity and mental healthcare use. In multivariate analyses, predisposing, enabling and need variables demonstrated significant associations with both types of healthcare use, but accounted for more variance in mental healthcare use. Need variables provided an additive effect over predisposing and enabling variables in accounting for medical and mental healthcare use, and accounted for some of the strongest effects. The results demonstrate that need remains an important factor that drives healthcare use among veterans and does not seem to be overshadowed by socioeconomic factors that may create unfair disparities in treatment access.
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1. Introduction

A wide body of research has examined variables associated with medical and mental healthcare utilization in samples of military veterans. Several demographic, access, and especially health status variables have demonstrated significant associations with health service use in this population. This body of work sheds light into such issues as how treatment resources may be allocated to veterans, and how to address health disparities and barriers veterans

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face in receiving treatment. However, previous work has narrowly examined either small samples of veterans, or larger samples drawn exclusively from a single war era, thus limiting our general understanding into the factors that drive veterans to access treatment.

Previous nationally representative, large-scale studies on military veterans have examined numerous correlates of healthcare use. These findings can be discussed within the context of the behavioral model of healthcare use, a well-validated theoretical framework for understanding determinants of healthcare use, with decades of empirical support (Andersen, 1995). The behavioral model includes three components that affect healthcare use: (1) "predisposing" variables, encompassing historical and sociodemographic characteristics, such as race, gender and education, (2) "enabling" variables, involving access-related factors such as health insurance possession, employment and geographical residence, and (3) "need" variables related to one's physical or mental health illness or impairment, such as patient-rated health functioning or an identified disabling condition.

Specifically, predisposing and enabling variables related to general healthcare use among veterans have included older age (Rosenheck and Massari, 1993), male gender (Hoff and Rosenheck, 1998), minority racial/ethnic status (Rosenheck and Massari, 1993; Schnurr et al., 2000), lower education levels (Rosenheck and Massari, 1993), unmarried status (Rosenheck and Massari, 1993), war zone or combat exposure (Marshall et al., 1998; Rosenheck and Massari, 1993), lower income, unemployment, and lacking health insurance (Rosenheck and Massari, 1993). Need variables predictive of health service use have included health problems (Marshall et al., 1997, 1998; Rosenheck and Massari, 1993), and depression and anxiety (Marshall et al., 1997, 1998; Rosenheck and Fontana, 1995; Schnurr et al., 2000). In addition, a smaller number of studies examined correlates of mental healthcare use among veterans, finding significant associations for predisposing and enabling variables including minority race/ethnicity (Rosenheck and Fontana, 1994), lower income, urban residence (Rosenheck and Fontana, 1995), and one need variable – posttraumatic stress disorder (PTSD) (Rosenheck and Fontana, 1995). However, given that these studies primarily examined either small veteran samples, or larger samples from a single war era (Vietnam), large-scale research with veterans from diverse war eras is lacking.

Some studies have examined differences in using Veterans Affairs (VA) versus non-VA healthcare services, a relevant issue to the VA in appropriating treatment funding. Research has revealed that women veterans prefer using non-VA general health services (Hoff and Rosenheck, 2000). However, racial/ethnic minorities are more likely to use VA (in contrast to non-VA) mental health services (Rosenheck and Fontana, 1994). Finally, carrying a PTSD diagnosis was associated with a 10-fold increase in VA mental healthcare use, compared with only a threefold increase in non-VA mental healthcare use (Rosenheck and Fontana, 1995).

Data from the 2001 US National Survey of Veterans (NSV) (Department of Veterans Affairs, 2003) represents an optimal sample for testing models of medical and mental healthcare use, despite little analysis in the literature. First, it includes veterans from a variety of war eras, thus serving as a more heterogeneous and representative veteran sample than examined in previous studies. The NSV includes some coding of healthcare use through visit counts, allowing for exploration of relationships with service use intensity (a more dynamic indicator of disease burden than simply examining whether services were used). One recent paper examined this dataset for correlates of healthcare use to VA and non-VA settings (Long et al., 2005), but these authors examined treatment utilization as a "use/non-use" variable rather than treatment intensity, and did not explore mental healthcare.

In the present study, we examine the extent to which medical and mental health impairments (i.e., need variables) are associated with outpatient medical and mental health service utilization in the NSV dataset, while adjusting for predisposing and enabling variables (Bland et al., 1997; Elhai and Ford, 2007). We examined VA and non-VA care use, because of differences in healthcare use correlates across these settings (Hoff and Rosenheck, 2000; Marshall et al., 1997, 1998; Rosenheck and Fontana, 1994, 1995; Schnurr et al., 2000). Thus by separating VA and non-VA care analyses, we were able to comprehensively explore healthcare use models and potentially yield results (e.g., a significant association) that could be masked when merely aggregating analyses across VA and non-VA care.

We hypothesized that need variables would be more important than predisposing and enabling access variables in predicting healthcare utilization, with slightly different patterns in predicting VA from non-VA use (e.g., male gender, lack of insurance, and disability status should be more related to VA than non-VA use). These data can be used to understand the most salient associations of healthcare use, possible health disparities in treatment access, and potential barriers to care among contemporary veterans.

2. Method

2.1. Participants

Participants included the 20,048 non-institutionalized veterans who completed the 2001 NSV. The majority of participants were men ($n = 18{,}767$, 93.61%). Age averaged 59.28 years (SD = 14.93). The majority were Caucasian ($n = 16{,}508$, 82.98%) or African American ($n = 1{,}776$, 8.93%), and most were married ($n = 14{,}771$, 73.83%). Nearly two-thirds had at least a college education ($n = 11{,}798$, 58.99%), with 5699 (28.49%) having a high school education/GED with no further education. Nearly half were employed ($n = 9773$, 48.82%), with the remaining primarily either retired ($n = 6576$, 32.80%) or disabled ($n = 2467$, 12.31%). About one-third ($n = 6652$, 33.57%) of veterans were rated with a service-connected health-related disability

from the VA. Most had some form of health insurance ($n = 17,739$, 88.94%), and urban residence was overrepresented ($n = 15,459$, 78.37%).

More than one-third of the sample served during the Vietnam War-era ($n = 7934$, 39.58%), followed by the era between the Korean and Vietnam wars ($n = 5264$, 26.26%), World War II ($n = 4565$, 22.77%), and between the Vietnam War and 1991 Gulf War ($n = 4070$, 20.30%) (percentages do not add to 100%, since answers were not necessarily mutually exclusive). Regrettably, the dataset did not include veterans from more recent conflicts. The sample was primarily composed of veterans of the Army ($n = 10,501$, 52.54%) and Navy ($n = 4,589$, 22.96%). Nearly one-half of participants ($n = 9167$, 46.32%) endorsed serving in combat or a war zone.

2.2. Procedure

Using 300 trained interviewers, the 2001 NSV (Department of Veterans Affairs, 2003) implemented computer-assisted telephone interviewing. Survey collection included (a) random digit dialing (RDD) methodology to identify the majority of veterans, and (b) lists of patients enrolled in VA healthcare or receiving VA compensation or pensions, to identify remaining cases. Participation was voluntary, and responses were confidential. Only those participants consenting to the interview after the procedures were explained were evaluated, and we obtained institutional review board approval for using these data. The survey resulted in 12,956 cases from the RDD sample and 7092 from the patient lists. Undercoverage based on unlisted telephone numbers was nominal, corrected by "raking" procedures using US Census estimates (Department of Veterans Affairs, 2003). Survey data were weighted based on the probability of selection, non-response and household size, thus ensuring that survey responses would generalize to the larger non-institutionalized veteran population. The survey's response rate ranged from 62.8% (patient list) to 76.4% (RDD). The final sample was demographically representative of the known veteran population collected in the 2000 US Census.

2.3. Measures

2.3.1. Sociodemographics

Numerous sociodemographic questions were queried. Those of relevance to the present paper comprised gender, age, race/ethnicity, educational level, marital status, health insurance possession, employment status, health-related disability status, and rural–urban residence status.

2.3.2. Military history

Questions about participants' military histories were gathered. These included inquiries about the branch of military and war era in which respondents served. Additionally, participants were asked if they had served in a war zone or combat.

2.3.3. Healthcare use

Veterans were asked how many "outpatient care" visits in the previous 12 months they made to (a) a VA facility, and (b) non-VA facility, for two separate count indices of outpatient healthcare use. Emergency and inpatient visits were excluded due to their low prevalence. Additionally, respondents were asked "yes"/"no" questions about whether they received "psychological counseling, therapy, alcohol or drug treatment" in the past 12 months from a VA or non-VA facility, for two separate binary variables reflecting mental health treatment use.

2.3.4. Functional impairment

The Health Survey Short Form-12 version 1 (SF-12) (Ware et al., 1996) was administered, assessing physical (PCS) and mental health (MCS) functional impairment (scores ranging from 0 to 100, $M = 50$, $SD = 10$, with lower scores indicating more impairment). PCS and MCS scores evidence adequate reliability and validity against health criteria (Ware et al., 1995, 1996).

2.4. Analyses

2.4.1. Predictor variables

Predisposing predictor variables included gender, age, race (Caucasian or minority), education level (some college education or less), marital status (married or unmarried), and combat exposure (endorsed or unendorsed). Enabling variables included health insurance possession (present or absent), employment status (employed or unemployed), and urban–rural residence. Need variables included health-related disability status (endorsed or unendorsed), and the SF-12 MCS and PCS (see Table 1 for precise categorical variable codings). These variables were defined in a manner consistent with past research.

2.4.2. Outcome variables

Outcome variables related to treatment use over the past 12 months and included (a) the number of VA outpatient healthcare visits, (b) number of non-VA outpatient healthcare visits, (c) whether participants received VA mental health treatment, and (d) whether participants received non-VA mental health treatment.

All analyses included the survey's sampling weights. Infrequent missing continuous variable responses were replaced with series means (age and SF-12 items), generally appropriate in large samples (here, roughly 20,000 subjects). Missing categorical data resulted in the listwise exclusion of only 5% of participants in multivariate analyses. Analyses were two-tailed, performed with Stata 9 software.

2.4.3. Univariate and multivariate analyses

We used logistic regression to examine univariate and multivariate associations between predictor variables and the use of VA and non-VA mental health treatment ("yes"/"no" variables).

Table 1
Zero-inflated negative binomial regression, predicting 12-month VA and non-VA outpatient healthcare visit counts: univariate and final multivariate models

Variables	VA								Non-VA							
	Univariate				Multivariate				Univariate				Multivariate			
	b	SE	*z* (*p*)	exp(*b*) (CI)	*b*	SE	*z* (*p*)	exp(*b*) (CI)	*b*	SE	*z* (*p*)	exp(*b*) (CI)	*b*	SE	*z* (*p*)	exp(*b*) (CI)
Predisposing variables																
Gender	.27	.13	2.04* (.04)	1.31 (1.00–1.70)	.06	.15	.43 (.66)	1.06 (.80–1.42)	.40	.06	6.24*** (<.001)	1.49 (1.31–1.69)	.47	.08	5.80*** (<.001)	1.60 (1.37–1.89)
Age	−.02	.00	−5.00*** (<.001)	.98 (.97–.99)	−.01	.00	−3.06** (.002)	.99 (.98–1.00)	.01	.00	3.81*** (<.001)	1.01 (1.00–1.01)	.01	.00	3.21** (.001)	1.01 (1.00–1.10)
Race	−.17	.12	−1.47 (.14)	.84 (.67–1.06)	.08	.08	.98 (.33)	1.08 (.92–1.28)	−.04	.09	−.42 (.67)	.96 (.81–1.14)	.05	.08	.65 (.51)	1.05 (.90–1.22)
Education	.05	.11	.49 (.62)	1.05 (.85–1.30)	−.03	.08	−.34 (.74)	.97 (.82–1.15)	.13	.05	2.49* (.01)	1.14 (1.03–1.27)	.18	.05	3.59*** (<.001)	1.20 (1.09–1.33)
Married	−.67	.11	−6.26*** (<.001)	.51 (.42–.63)	−.43	.09	−4.89*** (<.001)	.65 (.55–.74)	−.05	.06	−.82 (.41)	.95 (.85–1.07)	.03	.06	.22 (.83)	1.03 (.90–1.14)
Combat	.32	.09	3.34** (.001)	1.38 (1.14–1.65)	.11	.08	1.44 (.15)	1.12 (.96–1.30)	.02	.04	.47 (.64)	1.02 (.94–1.11)	.03	.05	−.57 (.57)	1.03 (.89–1.07)
Enabling variables																
Health insurance	−.48	.15	−3.16** (.002)	.62 (.46–.83)	−.29	.09	−3.10** (.002)	.75 (.62–.90)	.11	.12	.94 (.35)	1.12 (.88–1.41)	.17	.10	1.69 (.09)	1.19 (.97–1.45)
Employed	−.67	.10	−6.83*** (<.001)	.51 (.42–.62)	−.58	.10	−6.02*** (<.001)	.56 (.46–.68)	−.37	.04	−9.28*** (<.001)	.69 (.64–.74)	−.28	.05	−5.29*** (<.001)	.76 (.68–.84)
Urban	.18	.11	1.68 (.09)	1.20 (.97–1.48)	.05	.10	.49 (.62)	1.05 (.87–1.27)	.09	.05	1.88 (.06)	1.09 (1.00–1.20)	.12	.05	2.52* (.01)	1.13 (1.03–1.23)
Need variables																
Disabled	.77	.11	7.17*** (<.001)	2.16 (1.74–2.65)	.56	.08	6.61*** (<.001)	1.75 (1.48–2.06)	.36	.06	6.31*** (<.001)	1.43 (1.28–1.59)	.22	.04	5.06*** (<.001)	1.25 (1.15–1.36)
Mental health component	−.04	.01	−6.06*** (<.001)	0.96 (.95–.98)	−.01	.01	−1.80 (.07)	.99 (.98–1.00)	−.02	.00	−4.45*** (<.001)	.98 (.97–.99)	−.01	.00	−3.55*** (<.001)	.99 (.98–.99)
Physical health component	−.05	.01	−9.95*** (<.001)	.95 (.94–.96)	−.03	.00	−6.38*** (<.001)	.97 (.96–.98)	−.03	.00	−11.16*** (<.001)	.97 (.96–.97)	−.03	.00	−10.60*** (<.001)	.97 (.96–.97)

Note: *b*, unstandardized regression coefficient; SE, standard error of *b*; *z*, *z* test for significance of *b*; *p*, exact *p* value for *z* test; exp(*b*), factor change in the dependent variable given a one unit increase in the predictor (i.e., rate ratio); CI, 95% confidence interval for exp(*b*); categorical variables were dummy coded: gender (1 = "male," 2 = "female"), race (1 = "Caucasian," 0 = "racial minority"), education (1 = "at least some post-high school education," 0 = "high school education or less"), married (1 = "currently married", 0 = "not married"); for combat exposure, health insurance, employed, disabled status and urban (1 = "presence", 0 = "absence").

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Because of substantial problems using general linear models (e.g., ordinary least squares regression) for count data (Gardner et al., 1995), we used zero-inflated negative binomial regression (ZINB) (Hall and Zhengang, 2004; Long, 1997) to examine univariate and multivariate associations between predictor variables and the numbers of VA and non-VA healthcare visits. ZINB is a maximum-likelihood count regression analysis, specifically designed for non-normal (skewed and heteroscedastic) count data with an excess of zero values. ZINB estimates two latent groups, an "always zero" group (with 0 visit counts), and a "not always zero" group (with 0 or more visit counts). Cases are weighted based on such group status to determine the prediction of visit counts (0 or higher) using negative binomial regression. ZINB outperforms other statistical methods in modeling such count data as healthcare use intensity (Bao, 2002; Elhai et al., in press; Hall and Zhengang, 2004). Specifically, data transformations are typically unsuccessful in normalizing such data, and conducting two-part models (i.e., predicting healthcare users from non-users, subsequently predicting use intensity only among service users) often still results in extremely skewed count data (Elhai et al., in press). For recent reviews of count regression models, and advantages of their use with count data, see Afifi et al. (2007) and Elhai et al., in press.

Univariate analyses were first conducted to assess predictor–outcome relationships in isolation. For multivariate regression analyses, we entered predisposing and enabling predictor variables in the first step, and assessed the additive effect of need variables in the second step. That is, unlike the univariate analyses, multivariate analyses allowed for (1) an overall test of need above and beyond predisposing and enabling variables for the given outcome variable, and (2) tests of specific need variables when adjusting for predisposing, enabling and other need variables for the given outcome variable. While multicollinearity is a contraindication for these regression methods, Stata's algorithms automatically check for this problem, which was not found in the multivariate analyses.

3. Results

3.1. Descriptive analyses

The number of VA outpatient healthcare visits in the past year among the 19,996 participants with valid data varied from 0 to 364. Of those, 14,395 reported no visits in the past year (72.10%), and 3560 (17.80%) reported between 1 and 5. The number of non-VA outpatient healthcare visits in the past year among the 19,873 participants with valid data varied from 0 to 365. Of those, 6797 reported no visits in the past year (34.20%), and 8,689 (43.72%) reported between 1 and 5. Regarding any outpatient healthcare (VA or non-VA), 4470 reported no visits in the past year (22.30%), and 8908 (44.48%) reported between 1 and 5. Thus, these variables were severely skewed (both skewness >10) and kurtotic (both kurtosis >200) (skewness and kurtosis values are abnormal if >1–2), and thus traditional linear regression analyses were contraindicated.

Of the 20,031 participants with valid data for the use of VA mental health services, most had not sought such services in the past year ($n = 18{,}797$, 93.84%). Of the 20,021 participants with valid data for the use of non-VA mental health services, most too had not sought such services in the past year ($n = 19{,}044$, 95.12%). Regarding any mental healthcare (VA or non-VA), 17,989 (89.90%) had not sought services.

MCS values ranged from 14.01 to 69.13 ($M = 46.19$, $SD = 6.69$) in the sample. PCS values ranged from 17.60 to 65.38 ($M = 45.06$, $SD = 7.97$).

3.2. Univariate analyses

3.2.1. Outpatient healthcare

Table 1 presents univariate associations between the predictor variables and VA and non-VA outpatient healthcare visit counts, using ZINB regression (see table notes for information on interpreting the tables' findings). Results indicate that VA outpatient healthcare use intensity was individually associated with female gender, younger age, non-married status, combat exposure, lack of health insurance, unemployment (predisposing/enabling variables), having a disability rating, and poorer mental and physical health functioning (need variables), with the strongest effects (based on z test values) for physical health impairment and disability. Non-VA outpatient healthcare use intensity was individually associated with female gender, older age, having a college education, unemployment (predisposing/enabling variables), disability rating, and poorer mental and physical health functioning (need variables), with strongest effects for physical health impairment and unemployment.

3.2.2. Mental health treatment

Table 2 presents univariate associations between predictor variables and binary mental healthcare use variables, using univariate logistic regression analyses. Results indicate that using VA mental health treatment was individually associated with female gender, younger age, minority race, unmarried status, combat exposure, lack of health insurance, unemployment (predisposing/enabling variables), disability rating, and poorer mental and physical health functioning (need variables), with the strongest effects for physical health impairment and disability. Non-VA mental health treatment use was individually associated with female gender, younger age, minority race, having a college education, unmarried status, lack of health insurance, urban residence (predisposing/enabling variables), disability rating, and mental and physical health impairments (need variables), with strongest effects for age and physical health impairment.

Table 2
Logistic regression, predicting 12-month VA and non-VA outpatient mental healthcare use (use = 1, non-use = 0): univariate and final multivariate models

Variables	VA								Non-VA							
	Univariate				Multivariate				Univariate				Multivariate			
	b	SE	*z* (*p*)	exp(*b*) (CI)	*b*	SE	*z* (*p*)	exp(*b*) (CI)	*b*	SE	*z* (*p*)	exp(*b*) (CI)	*b*	SE	*z* (*p*)	exp(*b*) (CI)
Predisposing variables																
Gender	.43	.16	2.71** (.01)	1.54 (1.13–2.09)	.23	.19	1.21 (.23)	1.26 (.87–1.81)	1.03	.13	7.81*** (<.001)	2.80 (2.16–3.62)	.45	.15	2.95** (.003)	1.57 (1.16–2.10)
Age	−.02	.00	−8.47*** (<.001)	.98 (.98–.99)	−.03	.00	−7.53*** (<.001)	.97 (.97–.98)	−.04	.00	−15.75*** (<.001)	.96 (.96–.97)	−.05	.00	−14.71*** (<.001)	.95 (.94–.96)
Race	−.79	.10	−7.76*** (<.001)	.45 (.37–.55)	−.15	.13	−1.17 (.24)	.86 (.67–1.11)	−.35	.11	−3.15** (.002)	.70 (.57–.88)	.24	.12	1.95 (.05)	1.27 (1.00–1.63)
Education	−.06	.09	−.64 (.52)	.95 (.80–1.12)	.14	.11	1.29 (.20)	1.15 (.93–1.41)	.34	.09	3.60*** (<.001)	1.40 (1.17–1.69)	.34	.11	3.09 ** (.002)	1.40 (1.13–1.73)
Married	−1.02	.09	−11.85*** (<.001)	.36 (.30–.42)	−.57	.10	−5.67*** (<.001)	.57 (.46–.69)	−.63	.09	−6.81*** (<.001)	.53 (.44–.64)	−.35	.10	−3.38** (.001)	.70 (.58–.86)
Combat	.67	.09	7.73*** (<.001)	1.96 (1.65–2.32)	.37	.11	3.45** (.001)	1.45 (1.17–1.76)	−.04	.09	−.47 (.64)	.96 (.80–1.15)	.18	.10	1.70 (.09)	1.20 (.97–1.47)
Enabling variables																
Health insurance	−1.67	.09	−17.62*** (<.001)	.19 (.16–.23)	−.99	.12	−7.98*** (<.001)	.37 (.29–.47)	−.59	.14	−4.37*** (<.001)	.55 (.42–.72)	.18	.16	1.12 (.26)	1.20 (.87–1.66)
Employed	−1.10	.10	−11.16*** (<.001)	.33 (.27–.40)	−1.01	.13	−7.64*** (<.001)	.36 (.28–.47)	.01	.09	.08 (.93)	1.01 (.85–1.20)	−.50	.13	−4.01*** (<.001)	.61 (.47–.77)
Urban	−.02	.10	−.23 (.81)	.98 (.80–1.19)	.03	.11	.24 (.81)	1.03 (.82–1.28)	.39	.12	3.25** (.001)	1.48 (1.16–1.84)	.39	.12	3.13** (.002)	1.48 (1.16–1.88)
Need variables																
Disabled	2.30	.09	25.20*** (<.001)	10.00 (8.36–11.95)	1.74	.11	16.08*** (<.001)	5.70 (4.62–7.07)	.55	.09	5.89*** (<.001)	1.73 (1.44–2.08)	.08	.11	.76 (.45)	1.08 (.88–1.34)
Mental health component	−.10	.01	−16.22*** (<.001)	.90 (.89–.91)	−.06	.01	−8.69*** (<.001)	.94 (.93–.95)	−.06	.01	−8.19*** (<.001)	.94 (.93–.95)	−.04	.01	−4.84*** (<.001)	.96 (.94–.98)
Physical health component	−.11	.01	−21.18*** (<.001)	.90 (.89–.91)	−.06	.01	−9.48*** (<.001)	.94 (.93–.95)	−.05	.00	−10.26*** (<.001)	.95 (.94–.96)	−.06	.01	−9.11*** (<.001)	.94 (.93–.96)

Note: *b*, unstandardized regression coefficient; SE, standard error of *b*; *z*, *z* test for significance of *b*; *p*, exact *p* value for *z* test ; exp(*b*), probability of change in the dependent variable given a one unit increase in the predictor (i.e., odds ratio); CI = 95% confidence interval for exp(*b*); categorical variables were dummy coded: gender (1 = "male," 2 = "female"), race (1 = "Caucasian", 0 = "racial minority"), education (1 = "at least some post-high school education", 0 = "high school education or less"), married (1 = "currently married", 0 = "not married"); for combat exposure, health insurance, employed, disabled status and urban (1 = "presence", 0 = "absence").

* $p < .05$.

** $p < .01$.

*** $p < .001$.

3.3. Multivariate analyses

3.3.1. Outpatient healthcare

Multivariate ZINB regression analyses demonstrated that the predisposing/enabling model was significantly related to VA healthcare visit counts, $\chi^2(9, N = 18{,}875) = 122.45$, $p < .001$, accounting for a modest amount of variance (McFadden's adjusted $R^2 = .05$). The need model was significantly associated with VA healthcare visit counts, $\chi^2(12, N = 18{,}875) = 264.43$, $p < .001$, adding a modest, but significant amount of variance over the first model, $\chi^2_{\text{change}}(3, N = 18,875) = 141.98$, $p < .001$ ($R^2_{\text{change}} = .05$). The final model ($R^2 = .10$) yielded several significant associations with VA healthcare visit counts, including younger age, unmarried status, lack of health insurance, unemployment (predisposing/enabling), disability rating, and poorer mental and physical health (need), with strongest effects for disability, physical health impairment and unemployment.

Multivariate ZINB regression analyses also demonstrated that the predisposing/enabling model was significantly related to non-VA healthcare visit counts, $\chi^2(9, N = 18{,}798) = 145.56$, $p < .001$, accounting for only a small amount of variance (McFadden's adjusted $R^2 = .02$). The need model was significantly associated with non-VA healthcare visit counts, $\chi^2(12, N = 18{,}798) = 452.78$, $p < .001$, and contributed incrementally over the first model, $\chi^2_{\text{change}}(2, N = 18,798) = 307.22$, $p < .001$, but added only a small amount of variance ($R^2_{\text{change}} = .01$). The final model ($R^2 = .03$) yielded several significant associations with non-VA healthcare visit counts, including female gender, older age, having a college education, unemployment, urban residence (predisposing/enabling), disability rating, and poorer mental and physical health (need), with the most robust effect for physical health impairment.

3.3.2. Mental health treatment

Multivariate logistic regression analysis revealed that the predisposing/enabling model was significantly related to the use of VA mental healthcare services, $\chi^2(9, N = 18{,}927) = 613.44$, $p < .001$, accounting for a moderately large amount of variance (McFadden's adjusted $R^2 = .13$). The need model was significantly associated with VA mental healthcare use, $\chi^2(12, N = 18{,}927) = 1075.05$, $p < .001$, and incrementally added a moderately large amount of variance over the first model, $\chi^2_{\text{change}}(3, N = 18927) = 461.61$, $p < .001$ ($R^2_{\text{change}} = .13$). In the final model ($R^2 = .26$), VA mental health treatment use was associated with younger age, unmarried status, combat exposure, lack of health insurance, unemployment (predisposing/enabling), disability rating, and poorer mental and physical health functioning (need), with the strongest effects for disability and physical health impairment.

Multivariate logistic regression analysis also revealed that the predisposing/enabling model was significantly related to the use of non-VA mental healthcare services, $\chi^2(9, N = 18{,}921) = 377.04$, $p < .001$, accounting for a modest amount of variance (McFadden's adjusted $R^2 = .07$). The need model was significantly associated with non-VA mental healthcare use, $\chi^2(12, N = 18{,}921) = 476.38$, $p < .001$, and added a small amount of variance over the first model, $\chi^2_{\text{change}}(2, N = 18,921) = 99.34$, $p < .001$ ($R^2_{\text{change}} = .03$). In the final model ($R^2 = .10$), non-VA mental health treatment use was associated with female gender, younger age, having a college education, unmarried status, unemployment, urban residence (predisposing/enabling), and poorer mental and physical health functioning (need), with the most robust effects for age and physical health impairment.

4. Discussion

Our results revealed that a variety of predisposing, enabling and need variables were individually associated with healthcare use intensity and mental healthcare use in univariate models, despite some discrepancies between VA and non-VA analyses. In multivariate analyses, predisposing/enabling models significantly predicted medical and mental healthcare use across analyses, and need models contributed statistically significant, additive effects. The incremental contribution of need models is consistent with extant literature demonstrating that need factors are more salient determinants of healthcare use (Bland et al., 1997; Elhai and Ford, 2007). Importantly, however, need models did not contribute more variance than the predisposing/enabling models; in fact in VA analyses, need factors contributed equal amounts of variance as did predisposing/enabling models, and in non-VA analyses need factors contributed slightly smaller amounts of variance.

It was not surprising to find physical health functioning as one of the strongest predictors of healthcare use intensity. However, physical health functioning was also one of the strongest predictors of mental healthcare use, and its effect was more robust than that of mental health functioning. Furthermore, for VA services, another need variable – disability – was one of the most robust predictors of healthcare and mental healthcare utilization. Although two predisposing variables – younger age and unemployment – had relatively strong effects in some analyses, they were overshadowed by the mental and physical health need variables in general across analyses. Thus, these findings suggest that need (especially physical health and disability) remains an important factor that drives both medical and mental healthcare use among veterans, and that level of need does not seem to be overshadowed by factors related to socioeconomic status (e.g., predisposing and enabling variables) that may create unfair disparities in treatment access.

Interestingly, in multivariate models, predicting mental healthcare use was associated with stronger overall effects than predicting medical care intensity, and predicting VA care use was associated with stronger effects than predicting non-VA care use. Surprisingly, some of these predictor models accounted for relatively small amounts of variance

(e.g., 3% in non-VA healthcare use intensity), raising the question of which variables do account for treatment use – a question that should be investigated in subsequent studies.

4.1. Healthcare use intensity

Numerous univariate associations were found with VA and non-VA healthcare use intensity among this heterogeneous veteran sample, mostly corroborating previously found associations for predisposing, enabling and need variables with healthcare use (compared to non-use) primarily among Vietnam veteran samples (Marshall et al., 1997, 1998; Rosenheck and Fontana, 1995; Rosenheck and Massari, 1993; Schnurr et al., 2000). However, we found a few deviations from past research. First, we found that female gender was related to both VA and non-VA healthcare use, inconsistent with research finding that women veterans receiving mental health treatment avoid using VA services (Hoff and Rosenheck, 2000). This finding is important since women are being increasingly deployed in combat support roles, and has implications for the VA's treatment resource allocation to ensure adequate treatment for women veterans. Second, in contrast to previous research linking older age to general healthcare use among veterans (Rosenheck and Massari, 1993), we found this to be the case only for non-VA use; younger age was related to VA healthcare use, perhaps reflecting more favorable attitudes toward the VA among younger veterans, or greater accessibility to non-VA services among older veterans. Third, having a college education was related to non-VA healthcare use (but not VA care use), in contrast to previous research linking lower education levels with general healthcare use (Rosenheck and Massari, 1993). Fourth, while previous research revealed that lacking health insurance (an enabling variable) was related to veterans' general healthcare use (Rosenheck and Massari, 1993), we corroborated this finding only for VA care use, suggesting that veterans without private health insurance appear to be utilizing the services offered by the VA.

However, in comparing our findings with those of Rosenheck and colleagues', two important issues should be noted that can account for the discrepancies. First, Rosenheck and colleagues' studies were published before the US Congress passed the Veterans' Health Care Eligibility Reform Act of 1996, which greatly streamlined and expanded eligibility for VA care, and placed more emphasis on medical need in determining enrollment for care. Implementation of this legislation could therefore account for such discrepancies in findings. Second, the discrepancy in findings regarding age as a predictor of healthcare use may not be surprising since the veteran population was considerably older when the NSV was conducted than when the previous studies were conducted.

Our multivariate results for healthcare use intensity portray a slightly different healthcare use pattern to that found in univariate analyses. In multivariate models that accounted for other variables, gender, combat exposure, and mental health impairment were no longer associated with VA healthcare use intensity. It is possible that the lack of multivariate association for mental health impairment is due to shared variance between mental health and physical health impairments. Multivariate results for non-VA healthcare use mirrored their comparable univariate results quite well. However, urban residence was significant in multivariate analyses (but not in univariate analyses). Such accessibility variables as rural–urban status are important, since rural residents account for 20% of the US population but have significant access barriers to healthcare services (New Freedom Commission on Mental Health, 2004).

4.2. Mental healthcare use

Univariate associations with mental healthcare use among our heterogeneous veteran sample primarily support results from the few previous large-scale studies exclusively comprising Vietnam veterans (Rosenheck and Fontana, 1994, 1995). Interestingly, while having a college education was associated with non-VA mental healthcare use, no such relationship was found for VA mental healthcare use. Additionally, combat exposure and unemployment were related to VA mental healthcare use, but not non-VA mental healthcare use. These results (i.e., education and employment) suggest that higher socioeconomic status affords veterans the option to utilize non-VA mental healthcare.

Multivariate models predicting VA mental healthcare use differed from univariate models in that gender and race were no longer significant treatment correlates. These findings again counter claims that women veterans avoid using VA services (Hoff and Rosenheck, 2000). Additionally, the non-significance for race in multivariate analyses supports recent research revealing few racial disparities in VA mental health treatment use (Grubaugh et al., 2006). Multivariate and univariate models predicting non-VA mental health treatment use differed from each other on several variables. While minority race, lack of health insurance and having a disability rating were significant in univariate models, these associations disappeared in multivariate analyses, suggesting that they may not be as important as other variables included in multivariate models.

It should be acknowledged that the VA and non-VA results presented here demonstrated a somewhat different pattern from each other, but the discrepancies were mostly limited to predisposing and enabling variables. Need variables demonstrated a more stable pattern of significance across VA and non-VA analyses, further supporting the importance of need and illness factors in understanding healthcare use.

This study has a number of limitations worth noting. First, healthcare use queries were based on self-report, which have been found to underestimate visit counts documented in medical records (Roberts et al., 1996). Second, the mental healthcare use variables did not adequately assess psychopharmacological intervention. Third, these

results may not generalize to US veterans returning from more recent deployments, especially the current conflicts in Afghanistan and Iraq, since the present sample did not include veterans from deployments later than 2001. This is especially relevant given the high rates of self-reported problems, as well as patterns of service use, in this growing population (Hoge et al., 2006). Fourth, several variables that may predict service use were not available from the current dataset, including more sophisticated measures of health needs (i.e., mental disorders), predisposing and enabling/access variables.

Despite these limitations, our findings suggest that predisposing demographic, enabling, and need models were more strongly associated with mental health service use (accounting for less variance in general healthcare use). However, it is possible that more variance was accounted for in mental healthcare because general healthcare was measured in terms of visit counts, whereas mental healthcare use was measured as a dichotomous variable. Thus, the variables examined may more logically account for the use/non-use of mental health services rather than intensity of healthcare visits.

In conclusion, this study adds information on understanding general and mental healthcare use correlates among veterans, in a large sample of veterans from diverse war eras, thus making this study relatively unique in the literature. These findings suggest that, reassuringly, those veterans who are most ill (especially physically ill) tend to use physical and mental health services the most, and several variables historically viewed as barriers to care (e.g., minority race/ethnicity and lack of health insurance) may not in fact be associated with disparities in obtaining treatment. In fact, the existence of VAs themselves probably accounts for why socioeconomically disadvantaged veterans do not face the same level of healthcare shortages that non-veterans face. However, the robust findings regarding VA mental health service use suggest that veterans who are young, combat exposed, ill, and lacking in resources are more likely to rely on the VA. In light of the increasing number of veterans returning from Afghanistan and Iraq who will likely meet this demographic profile, these data corroborate existing legislative concerns regarding how the VA will allocate resources and meet the healthcare needs of this new generation of veterans.

Conflict of interest

The authors report no competing interests with this paper.

Contributors

Jon Elhai initiated the idea for this paper, including the preliminary analytic plan, and conducted all analyses. Anouk Grubaugh and Don Richardson developed the analytic plan and models explored, and developed the Introduction and rationale for the study. Leonard Egede developed much of the text throughout the paper, and provided thoughtful revamping of the study's discussion. Mark Creamer provided a senior mentorship role, revamped the analytic plan from the initial plan to include the VA/Non-VA analyses and added several important predictor variables and their justification, and wrote substantial portions of the discussion section.

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References

Afifi AA, Kotlerman JB, Ettner SL, Cowan M. Methods for improving regression analysis for skewed continuous or counted responses. Annual Review of Public Health 2007;28:95–111.

Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? Journal of Health and Social Behavior 1995;36:1–10.

Bao Y. Predicting the use of outpatient mental health services: do modeling approaches make a difference. Inquiry 2002;39:168–83.

Bland RC, Newman SC, Orn H. Help-seeking for psychiatric disorders. Canadian Journal of Psychiatry 1997;42:935–42.

Department of Veterans Affairs. 2001 National Survey of Veterans: design and methodology; 2003.

Elhai JD, Ford JD. Correlates of mental health service use intensity in the National Comorbidity Survey and National Comorbidity Survey Replication. Psychiatric Services 2007;58:1108–15.

Elhai JD, Calhoun PS, Ford JD. Statistical procedures for analyzing mental health services and costs data. Psychiatry Research [in press].

Gardner W, Mulvey EP, Shaw EC. Regression analyses of counts and rates: poisson, overdispersed poisson, and negative binomial models. Psychological Bulletin 1995;118:392–404.

Grubaugh AL, Frueh BC, Elhai JD, Monnier J, Knapp RG, Magruder KM. Racial differences in psychiatric symptom patterns and service use in VA primary care clinics. Psychiatric Services 2006;57:410–3.

Hall DB, Zhengang Z. Marginal models for zero inflated clustered data. Statistical Modelling 2004;4:161–80.

Hoff RA, Rosenheck RA. Female veterans' use of Department of Veterans Affairs health care services. Medical Care 1998;36:1114–9.

Hoff RA, Rosenheck RA. Cross-system service use among psychiatric patients: data from the Department of Veterans Affairs. The Journal of Behavioral Health Services & Research 2000;27:98–106.

Hoge CW, Auchterlonie JL, Milliken CS. Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. Journal of the American Medical Association 2006;295:1023–32.

Long JS. Regression models for categorical and limited dependent variables. Thousand Oaks (CA): Sage Publications; 1997.

Long JA, Polsky D, Metlay JP. Changes in veterans' use of outpatient care from 1992 to 2000. American Journal of Public Health 2005;95:2246–51.

Marshall RP, Jorm AF, Grayson DA, Dobson M, O'Toole BI. Help-seeking in Vietnam veterans: post-traumatic stress disorder and other predictors. Australian and New Zealand Journal of Public Health 1997;21:211–3.

Marshall RP, Jorm AF, Grayson DA, O'Toole BI. Posttraumatic stress disorder and other predictors of health care consumption by Vietnam veterans. Psychiatric Services 1998;49:1609–11.

New Freedom Commission on Mental Health. Subcommittee on rural issues: background paper. Rockville (MD): Department of Health and Human Services; 2004.

Roberts RO, Bergstralh EJ, Schmidt L, Jacobsen SJ. Comparison of self-reported and medical record health care utilization measures. Journal of Clinical Epidemiology 1996;49:989–95.

Rosenheck RA, Fontana A. Utilization of mental health services by minority veterans of the Vietnam era. Journal of Nervous and Mental Disease 1994;182:685–91.

Rosenheck RA, Fontana A. Do Vietnam-era veterans who suffer from posttraumatic stress disorder avoid VA mental health services? Military Medicine 1995;160:136–42.

Rosenheck RA, Massari L. Wartime military service and utilization of VA health care services. Military Medicine 1993;158:223–8.

Schnurr PP, Friedman MJ, Sengupta A, Jankowski MK, Holmes T. PTSD and utilization of medical treatment services among male Vietnam veterans. Journal of Nervous and Mental Disease 2000;188: 496–504.

Ware JE, Kosinski M, Keller SD. How to score the SF-12 Physical and Mental Health Summary Scales. Boston (MA): New England Medical Center, Health Institute; 1995.

Ware JE, Kosinski M, Keller SD. A 12-item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. Medical Care 1996;34:220–33.