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# Racial and Socio-Demographic Disparities in Internet Access and eHealth Intervention Utilization among Veteran Smokers

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# Abstract

**Introduction**—Access to the internet at home may be an important barrier to electronic health (eHealth) smoking cessation interventions. The current study explored possible socio-demographic disparities in access to the internet at home among veteran smokers.

**Methods**—Data from participants proactively recruited and enrolled in a randomized smoking cessation effectiveness trial (N= 408) that compared a web-based smoking cessation intervention to VA usual care were used to examine the demographic attributes of smokers with and without internet access at home. Multivariable logistic regression was used to examine associations between demographic factors and home internet access. Data from patients randomized to the internet arm of the study (N= 205) were used to ascertain correlates of utilization of the intervention website.

**Results**—While the majority of the sample (82%) endorsed access to the internet at home, veterans who were African American, older, and not married were significantly less likely to have home internet access. Veterans who were African American, older, less educated , had longer travel times to the nearest VA facility, and increased nicotine dependence were less likely to access the internet on a daily basis. While several socio-demographic variables (e.g., age, race, education,

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ETHICAL APPROVAL: All procedures performed in studies involving human participants were in accordance with the ethical standards of the Durham VA Medical Center Institutional Review Board.

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employment) were related to utilization of a free membership to a commercial, web-based smoking cessation intervention in bivariate analyses, only access to the internet at home was related to use of the smoking cessation site in adjusted results.

**Conclusion**—These results highlight gaps in internet access and use among veterans, and additionally underscore the importance of improving accessibility of eHealth interventions for low-income, minority, and socially disadvantaged veteran populations.

#### **Keywords**

racial disparities; health disparities; smoking cessation; internet; eHealth; veterans

## INTRODUCTION

Smoking is the leading cause of preventable illness, disability, and death in the United States[1], where it is responsible for 1 in 5 deaths[2]. This rate is disproportionately higher among veterans[3]. Data collected from a national stratified sample of veterans using Department of Veterans Affairs (VA) healthcare suggest that 50% of veterans who served during military operations in Afghanistan (Operation Enduring Freedom; OEF) or Iraq (Operation Iraqi Freedom; OIF) have a lifetime history of smoking and 24% remain current smokers[4]. Unfortunately, effective smoking cessation treatments do not reach most smokers and the use of smoking cessation aids is limited[5]. There is a clear need for new approaches that increase the reach of cost-effective smoking cessation interventions.

Studies of the general population indicate that African American smokers are less likely than Caucasian smokers to quit successfully[6-10]. This disparity is accounted for in part by the fact that African-Americans are less likely to be screened for tobacco use, receive cessation advice, and prescribed nicotine replacement therapy (NRT) than White smokers[9, 11, 12]. Among veterans using VA healthcare, however, there are not racial differences in screening and utilization of current smoking cessation services[13]. Specialty VA clinic-based tobacco cessation programs appear to effectively reduce smoking for all veterans.

Although VA clinic-based care is highly efficacious, these programs are infrequently attended, which limits their impact on prevalence, disease impact, and economic costs of smoking[14]. There is potential to leverage the internet to improve reach of smoking cessation interventions by avoiding barriers that limit participation in specialty care. Smoking cessation treatment may be particularly well suited to delivery *via* the internet through online chat groups, bulletin boards, email contacts with experts, individually tailored information and feedback regarding behavioral skills, problem solving training, and advice regarding medication usage. Treatment can be provided in "real time" and at the convenience of the user for as long as he/she needs it which may help prevent relapse[15].

Recognizing the potential of the internet as a source of medical information, the VA implemented a web-based portal in 2003 called *My Healthe Vet* that provides evidenced-based health information, access to medical records, patient-directed reminders and secure messaging[16]. While the internet could be used to help decrease smoking among veterans, one limiting factor may be veterans' access to the internet. There are relatively few studies

on the use of the internet by veterans[17-20]. A study of over 7,000 veterans collected in 2010 suggested that 66% of veterans using VA healthcare use the internet[17]. Consistent with prior surveys of access to the internet among veterans[20], there was evidence of a racial disparity in internet access where African American veterans were significantly less likely than other racial groups to access the internet[17]. A recent survey of Afghanistan/Iraq era veterans using VA healthcare, however, suggested internet access among younger OEF/OIF veterans was nearly universal (97%)[21].

While the majority of veterans report using the internet[17, 21], relatively little is known about access to the internet at home. Access to the internet in the home, may be particularly important for the success of web-based self-management interventions. A 2010 study of VA users with diabetes found that 59% of respondents reported having access to the internet at home[16]. Home access to the internet was associated with several socio-demographic variables including younger age, higher income, and more education[16].

No previous study has examined internet access in the home among VA healthcare users that smoke. Access to the internet at home may be an important barrier to electronic health (eHealth) and mobile health (mHealth) smoking cessation interventions. The current study explored possible racial and other socio-demographic disparities in access to the internet at home among veteran smokers. The specific goals of the current investigation were to (1) describe the socio-demographic characteristics of veteran smokers with and without home internet access, (2) assess factors associated with internet utilization and (3) ascertain demographic correlates of utilization of a guideline-concordant, state-of-the-art web-based smoking cessation intervention.

## METHODS

#### **Participants and Procedure**

Data were collected as part of a randomized smoking cessation effectiveness trial (N=408) that compared a web-based smoking cessation intervention to a facilitated referral to VA specialty clinic-based smoking cessation treatment[22]. The methods and outcomes for the parent trial are fully described elsewhere [22]. Veterans with tobacco use were identified from electronic medical records (EMR) based on the presence of ICD-9 code for nicotine dependence or identification of current smoking status based on results of required annual screening. VA EMR smoking data has been well validated [23]. Veterans were sent an introductory letter that described the study and included a toll-free opt-out number. Those who did not decline were proactively recruited by telephone between 2010 and 2014 and asked if they were currently smoking tobacco and willing to quit smoking in the next 30 days. Eligible patients included current smokers (any tobacco use in the past month including cigarettes and cigars) who: a) were enrolled at the Durham VA Medical Center for primary care and b) were willing to make a quit attempt in the next 30 days. Patients were not excluded if they did not have access to the internet. In total, 2756 veterans were mailed an invitation letter. Eighteen veterans called to opt-out of the study and were not recontacted; 1,516 were called by telephone (maximum calls was 9) to determine eligibility (e.g., current smoking, willingness to make a quit attempt in the next 30 days) and

willingness to participate; of these 1,103 were excluded (395 did not meet study criteria; 578 declined participation; 130 unable to contact); and 413 were enrolled.

Participating veterans completed a baseline survey that included demographic data, smoking characteristics, mental health screens, and access to the internet. A dichotomous measure of home-based internet access was used: "Do you have access to the Internet at your home?". Additional items queried frequency of use. Participants randomized to the internet smoking cessation intervention were provided a free, lifetime membership to the full, enhanced version of QuitNet® (www.QuitNet.com). They were provided with information on how to register on-line *via* a QuitNet® home page branded for the study. Participants were encouraged but not required to register and use the site. Study staff discussed options for accessing the Internet (e.g., public library, medical center) with those who reported a lack of internet access. For those randomized to receive the internet intervention (*n*=205), objective data on utilization of the website (e.g., contact time, page views, number of sessions, use of expert systems) were provided by QuitNet®. Any utilization of the site was monitored for a period of 12-months.

Perceived utility of the site was assessed with a single item on a 7-point Likert scale, "On a scale from 1-7, where one means "not at all useful" and 7 means "very useful", how useful was the QuitNet® program in helping you to try to quit smoking?" Similarly satisfaction was assessed by "On a scale from 1 to 7, where one means "not at all satisfied" and 7 means "very satisfied", how satisfied are you with the QuitNet® information and services?" An additional item measured how difficult the site was to understand; "On a scale from 1 to 7" where one means "not easy to understand" and 7 means "very easy to understand" how easy was the information/advice from the QuitNet® program to understand?" Participants were also asked if they would recommend QuitNet® to a friend.

Nicotine dependence was assessed with the 6-item Fagerström Test for Nicotine Dependence[24]. Depressive symptoms were measured using the 10-item version of the Center for Epidemiological Studies Depression Scale [CES-D 10; [25]], which has been used extensively in epidemiologic studies[26]. A score of 10 or higher indicated probable depression[25, 27]. The Primary Care PTSD screen [[28]; PC-PTSD] was used to screen for clinically significant PTSD symptoms. The PC-PTSD has demonstrated good reliability and validity[28]. A score of 3 or more was used to indicate probable PTSD[29]. Alcohol misuse was assessed with the well validated AUDIT-C[30, 31]. Scores of > 5 for men and > 4 for women were used to indicate probable alcohol abuse[31].

#### Analyses

Descriptive statistics were calculated to characterize demographic attributes of smokers with and without a home internet access. Logistic regression analyses were used to test bivariate associations between demographic and clinical factors and access to a home internet connection. Multivariable logistic analyses were conducted to examine the unique association between home internet access and each predictor while adjusting for all other demographic and clinical variables. A similar approach was used to examine frequency of internet use and use of the web-based smoking cessation intervention. These latter models were also adjusted for home internet access (0=no, 1=yes). The following variables were

dichotomized to avoid problems with small cell sizes: marital status (married or living together as married vs. non-married), employment status (employed full-time/part-time vs. other), education (more than high school vs. high school or less), and era of service (OEF/OIF vs. other eras). In models examining use of the internet smoking cessation intervention (n=205), race was additionally dichotomized (African American vs. White/ Other). All statistical analyses were performed using SAS, Version 9.4.

# RESULTS

The mean age of the sample was 43 years (*SD*=13.9), 51% were White, 39% African-American, 16% were female, and 48% served during the Afghanistan/Iraq era. Many participants screened positive for probable PTSD (41%), depression (44%), and alcohol abuse (29%). The majority of participants (82%) reported having home internet access (see *Table 1*). Seventy percent of smokers used the internet daily, 80% used the internet at least on weekly basis and 13% percent of participants reported they never used the internet.

Table 2 shows both unadjusted and adjusted effect sizes of demographic and clinical variables associated with having home internet access. In this sample of veteran smokers, older age and African-American race were significantly associated with reduced odds of having internet access at home. Higher levels of education, being married, and being currently employed were all associated with increased likelihood of home internet access. Higher levels of nicotine dependence, screening positive for PTSD, and screening positive for alcohol misuse were also positively associated with access to the internet at home in bivariate results. Adjusted results from the multivariable logistic regression model indicated that smokers who were younger, married, and White (compared to African-American) were more likely to have home access to the internet. Only seventy-two percent of African-American veteran smokers reported having a home internet connection compared to 88% of White veterans.

Adjusted results examining using the internet on a daily basis (see *Table 3*) indicated that older Age, African-American race, and lower education were associated with lower odds of using the internet on a daily basis. Longer travel times to a VA medical center were also associated with reduces odds of daily internet use as were higher levels of nicotine dependence. Not surprisingly, having access to the internet at home was strongly related to using the web on a daily basis. Factors associated with never using the Internet were largely the same, but in the opposite direction. Older age, less education, and a lack of home internet access were all significantly associated with reports of never accessing the internet (*Table 3*).

Among those randomized to the web-based smoking cessation intervention, 84% had access to the internet at home and the majority (69%) used the web on daily basis. Only half (50%) of those who were given free access to the full version of QuitNet®, actually registered for and used the website. As shown in Table 4, several socio-demographic factors were associated with using the site in bivariate results. Older age and African-American race, were associated with significantly lower odds of using the site while being employed, being married, and increased education were all associated with increased odds of registering and using the website during a quit attempt. Those who had access to the internet at home were

significantly more likely to go online and register on QuitNet®, although 19% of those who did not have internet access at home (*n*=32), still registered and used the site. In fully adjusted analyses, only internet access at home was uniquely associated with using the site. None of the other socio-demographic variables were significantly related to use of the site after controlling for internet access at home. Among those who registered on the site, there were no differences in the level of utilization (e.g., number of sessions, time online, page views) as a function of age, education, employment, marital status, or race.

An analysis of items used to evaluate the perceived utility, ease of understanding, and satisfaction revealed few socio-demographic associations. Overall, participants reported the web-based intervention was moderately useful (mean = 3.77, *s.d.*,= 2.03), easy to understand (mean = 5.84, s.d.=1.68), and were satisfied with the intervention (mean = 5.22, s.d.=1.95). Eight-six percent of respondents said they would recommend the intervention to a friend. Although older age was associated with less use of the site in bivariate results, older participants tended to rate QuitNet as more useful (*r*=.25, *p*=.015). There were no other statistically significant socio-demographic associations with perceptions of the site.

## DISCUSSION

Smoking is disproportionally higher among veterans. Among veterans the prevalence of smoking is even higher among those that use VA healthcare and those with lower socioeconomic status[17, 19, 16]. To our knowledge, this is the first study to examine internet use among a sample of veteran smokers who use VA healthcare. The majority of smokers (82%) reported having access to the internet at home. Although results of the current study suggest increased penetration of internet use compared to previous studies[17, 19, 16], we found evidence of significant socio-demographic disparities in access and use of the internet among VA users who smoke. Veterans who were African-American, older, less educated, had longer travel times to their nearest VA facility, and who were more nicotine dependent were significantly less likely to use the internet on a daily basis. Compared to 88% of White veterans, only 72% of Black veterans reported having access to the Internet at home. Even after adjusting for other socio-demographic and clinical variables, race remained significantly associated with home internet access. Socio-demographic disparities in internet access and use may exacerbate health-related disparities associated with smoking as eHealth interventions are widely disseminated.

Among those participants randomized to receive free access to a guideline concordant, stateof-the-art smoking cessation website, there were significant bivariate associations between use of the QuitNet® intervention and age, race, marital status, education, employment, and service era. Older age and African-American race were associated with lower odds of using the site while being married, more educated, currently employed, and serving during OEF/OIF increased the odds of using the website during a quit attempt. In adjusted analyses, however, only access to the internet at home was uniquely associated with use of the webbased smoking cessation intervention. These results indicate that access to the internet at home is an important barrier to the uptake of web-based smoking cessation interventions. Indeed, none of the socio-demographic variables were significantly associated with the intensity of the use of the site (e.g., contact time, page views, use of expert systems) among

those who registered. Similarly, race and education were not significantly associated with perceived utility, ease of understanding, or satisfaction with the site.

Consistent with national data showing increasing penetration of internet use over the last fifteen years[32], the rate of internet use among the current sample of smokers using VA healthcare (87%) is higher than previous reports of internet access among veterans[17, 19, 16]. Rates of home access to the internet were also higher than a sample of VA users with diabetes[16] recruited earlier from the same medical center as the current study. Despite increasing access levels, significant disparities in access and use of the internet continue to exist.

Nationally, smoking rates are significantly higher among those with less education and income. The burden of tobacco-related morbidity and mortality is disproportionately higher among low income, less educated and underserved racial/ethnic minority populations[33, 34]. Disparities in access to web-based and mHealth interventions may exacerbate current disparities in health care outcomes. Several of these variables could be readily addressable. For example, efforts to increase access to technology and the internet among low-income and ethnic-minority populations could increase utilization of eHealth resources. For example, based on promising pilot data[35, 36], we are currently examining the effectiveness and cost-effectiveness of a mHealth smoking cessation intervention that involves giving smokers internet-capable smart phone devices during the intervention period. In the VA, a program could be developed that would provide surplus computers to veterans paired with computer training and tutorials on how to use the Internet to access health information[16].

Consistent with previous work[17], veterans screening positive for mental health conditions in the current study were as likely to have home internet access as other veterans. Internetbased and eHealth interventions could be a promising modality to increase the reach of mental health treatment for veterans. There is increasing evidence to support eHealth and mHealth interventions aimed at treating anxiety, depression and substance misuse[37-39].

There are a number of limitations associated with the study. First, while the trial from which these data were collected[22] used proactive recruitment methods to maximize generalizability of results, participants were limited to veteran smokers who used VA healthcare and who reported they were willing to make a quit attempt in the next 30 days. Thus, the sample may not be representative of all veteran smokers. We provided participants with free access to the paid, full version of QuitNet®. If smokers had been asked to bear the costs associated with a commercial intervention, one might expect even greater socioeconomic disparities in utilization. While we encouraged veterans to register on the specially branded internet site, we were unable to send them an email or text link to the site due to VA privacy rules. It is possible that socioeconomic disparities may have been smaller if the process to register and use the site was made as simple and user-friendly as possible. We did not collect qualitative data on barriers or reasons participants chose not to register and use the internet smoking cessation site. More research is needed to examine other potential barriers to the use of web-based smoking cessation interventions.

In conclusion, although the majority of veteran smokers enrolled in a large smoking cessation trial reported having access to the internet at home, sociodemographic variables including race, age, and education were associated with the frequency of internet use. The VA and other large healthcare systems must remain aware that there are disparities in use and access to the internet, and that these gaps in access must be addressed to minimize racial and socio-demographic health disparities.

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Differences between Smokers with and without a Home Internet Connection

	Total (N=408)	Home Internet Access (n=336)	No Home Internet Access ( <i>n</i> =72)	<i>p</i> -value
Mean age, years (SD)	42.9 (13.9)	41.5 (13.4)	49.6 (14.7)	< 0.0001
Age category (%)				< 0.0001
21-34 years	153 (38)	138 (90)	15 (10)	
35-49 years	109 (27)	94 (86)	15 (14)	
50-64 years	116 (28)	85 (73)	31 (27)	
65+ years	30 (7)	19 (63)	11 (37)	
Sex, n (%)				0.21, <i>n.s.</i>
Male	344 (84)	282 (82)	62 (18)	
Female	64 (16)	54 (84)	10 (16)	
Race, n (%)				< 0.0001
Caucasian/White	207 (51)	182 (88)	25 (12)	
African American/Black	159 (39)	115 (72)	44 (28)	
Other	42 (10)	39 (93)	3 (7)	
Marital status, n (%)				
Married or living as married	221 (54)	198 (90)	23 (10)	< 0.0001
Not married	185 (45)	136 (74)	49 (26)	
Education, n (%)				0.036
High school or less	97 (24)	73 (75)	24 (25)	
More than high school	311 (76)	263 (85)	48 (15)	
Employment, n (%)				0.0002
Full or Part Time	180 (44)	159 (88)	21 (12)	
Unemployed	98 (24)	69 (70)	29 (30)	
Student	46 (11)	43 (93)	3 (7)	
Disabled	84 (21)	65 (77)	19 (23)	
Era of Service, n (%)				0.0009
OEF/OIF/OND	197 (48)	175 (89)	22 (11)	
Other	211 (52)	161 (76)	50 (24)	
Mean Travel time (min) to VA (SD)	76.5 (60.3)	76.3 (61.5)	77.7 (54.7)	0.86, <i>n.s.</i>
Mean Nicotine Dependence (SD)	3.5 (2.4)	3.6 (2.4)	3.0 (2.2)	0.041
Depression				0.88, <i>n.s.</i>
Negative for Depression	230 (56)	190 (83)	40 (17)	
Positive for Depression	178 (44)	146 (82)	32 (18)	
PTSD				0.03
Negative for PTSD	242 (59)	191 (79)	51 (21)	
Positive for PTSD	166 (41)	145 (87)	21 (13)	
Alcohol Misuse				0.04
Negative for Alcohol Misuse	288 (71)	230 (80)	58 (20)	
Positive for Alcohol Misuse	120 (29)	106 (88)	14 (12)	
Frequency of Internet Use				< 0.0001

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	Total (N=408)	Home Internet Access (n=336)	No Home Internet Access (n=72)	<i>p</i> -value
Daily	287 (70)	277 (97)	10 (3)	
Weekly	40 (10)	31 (78)	9 (12)	
Monthly	29 (7)	14 (48)	15 (52)	
Never	52 (13)	14 (27)	38 (73)	

Note: OEF/OIF/OND = Operation Enduring Freedom/Operation Iraqi Freedom/Operation New Dawn; VA= closest Veterans Affairs medical facility.

Veteran smokers access to a Home Internet Connection (n=408)

	Unadjusted		Adjusted <sup>†</sup>	
Variable	OR	(95% CI)	OR	(95% CI)
Age	0.96****	(0.94-0.98)	0.97*	(0.95-0.99)
Male	1.19	(0.57-2.46)	0.73	(0.31-1.69)
Race				
Black/African-American	0.36	(0.21-0.62)	0.42 ***	(0.23-0.78)
Bi-racial/Other	1.79	(0.51-6.21)	1.35	(0.36-5.14)
White				
Married	3.10****	(1.81-5.33)	3.29****	(1.78-6.08)
Education	1.80*	(1.04-3.14)	1.64	(0.85-3.16)
Employed	2.18 ***	(1.26-3.79)	1.59	(0.85-2.96)
Travel Time to VA (hours)	0.98	(0.76-1.26)	0.96	(0.71-1.30)
OEF/OIF Era	2.47 **	(1.43-4.26)	1.24	(0.58-2.65)
Nicotine Dependence	1.12*	(1.00-1.26)	1.15*	(1.01-1.31)
Depression	0.96	(0.58-1.60)	0.55	(0.28-1.08)
PTSD	1.84 *	(1.06-3.20)	1.88	(0.91-3.86)
Alcohol Misuse	1.91 *	(1.02-3.58)	2.02	(1.00-4.06)

Note: PTSD= Posttraumatic Stress Disorder; VA= closest Veterans Affairs medical facility.

 $^{\dagger}\!Adjusted$  for all other variables shown.

\* P < .05

\*\* P < .01

\*\*\* p<.001

## Variables associated with Daily use of the Internet

	Access the Internet Daily		Never use the Internet	
Variable	Adj OR	(95% CI)	Adj OR	(95% CI)
Age	0.93	(0.91-0.96)	**** 1.11	(1.06-1.16)
Male	1.27	(0.52-3.09)	0.78	(0.18-3.47)
Race				
Black/African-American	0.48 *	(0.25-0.93)	1.53	(0.60-3.94)
Bi-racial/Other	0.41	(0.15-1.13)	5.09	(0.98-26.31)
White				
Married	0.99	(0.97-1.02)	0.83	(0.32-2.10)
Education	3.26 ***	(1.69-6.29)	0.23 ***	(0.09-0.59)
Employed	0.92	(0.49-1.72)	0.76	(0.29-2.01)
Travel Time to VA (hours)	0.74 *	(0.56-0.98)	1.16	(0.75-1.80)
OEF/OIF Era	0.55	(0.25-1.20)	1.05	(0.30-3.69)
Nicotine Dependence	0.86*	(0.76-0.99)	1.00	(0.82-1.22)
Depression	0.53	(0.26-1.08)	1.99	(0.75-5.31)
PTSD	1.03	(0.49-2.15)	0.74	(0.26-2.12)
Alcohol Misuse	0.83	(0.41-1.67)	1.10	(0.37-3.25)
Home Internet Access	40.29 ****	(16.89-96.09)	0.03	(0.01-0.09)

Note: PTSD= Posttraumatic Stress Disorder; VA= closest Veterans Affairs medical facility Each variable is adjusted for all other variables shown

\* P < .05

\*\*\* p<.001

\*\*\*\* p<.0001

Variables associated with Using a Web-Based Smoking Cessation Site (n=205)

	Unadjusted		Adjusted $^{\dagger}$	
Variable	OR	(95% CI)	OR	(95% CI)
Age	0.97 **	(0.95-0.99)	0.99	(0.96-1.02)
Male	1.24	(0.58-2.68)	1.24	(0.50-3.07)
African-American Race	0.52*	(0.29-0.92)	0.77	(0.40-1.51)
Married	1.81*	(1.03-3.17)	1.69	(0.87-3.30)
Education	2.20*	(1.17-4.16)	1.99	(0.97-4.06)
Employed	2.08 **	(1.19-3.64)	1.54	(0.80-2.95)
Travel time to VA (hours)	1.26	(0.95-1.67)	1.33	(0.97-1.80)
OEF/OIF Era	2.34 **	(1.34-4.11)	1.69	(0.79-3.62)
Nicotine Dependence	0.95	(0.85-1.07)	0.95	(0.82-1.09)
Depression	0.77	(0.44-1.34)	0.90	(0.42-1.94)
PTSD	0.94	(0.54-1.64)	0.77	(0.36-1.67)
Alcohol Misuse	1.06	(0.58-1.93)	0.92	(0.46-1.84)
Internet Access at Home	5.40 ***	(2.12-13.79)	4.06 **	(1.45-11.41)

Note: PTSD= Posttraumatic Stress Disorder; VA= Veterans Affairs

 $^{\dagger}$ Adjusted for all other variables shown

\* P < .05

\*\*\* p<.0001