Perceived Insufficient Rest or Sleep among Veterans: Behavioral Risk Factor Surveillance System 2009

Paul M. Faestel, M.D., M.P.H.¹; Christopher T. Littell, D.O., M.P.H.¹; Michael V. Vitiello, Ph.D.²; Christopher W. Forsberg, M.S.³; Alyson J. Littman, Ph.D., M.P.H.^{3,4}

¹Department of Preventive Medicine, Madigan Healthcare System, Tacoma, WA; ²Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA; ³Seattle Epidemiologic Research and Information Center, VA Puget Sound Health Care System, Seattle, WA; ⁴Department of Epidemiology, University of Washington, Seattle, WA

Study Objectives: Sleep problems are of particular concern among the active duty military population as factors such as inconsistent work hours and deployment may compromise adequate sleep and adversely impact performance. However, few prior studies have investigated whether the prevalence of sleep problems differ between Veterans and demographically similar non-Veterans. The purpose of this study is to investigate whether self-reported insufficient rest or sleep varies in relation to Veteran status and to identify high-risk groups of Veterans.

Methods: This study used data from the 2009 Behavioral Risk Factor Surveillance System (analyzed in 2011), a state based national telephone survey of non-institutionalized US adults. Insufficient rest was assessed in 411,313 adults aged 21 and older, of whom 55,361 were Veterans. Sleep duration was assessed in 6 states (n = 4,936 Veterans and 30,983 non-Veterans). Model-based direct rate adjustment was used to estimate the prevalence of insufficient rest or sleep while controlling for confounding. Multivariable logistic regression was used to estimate odds ratios of insufficient sleep or rest in subgroups of Veterans.

Results: After multivariable adjustment, insufficient rest or

sleep (22.7% vs. 21.1%, $p < 0.001$) and short sleep duration (< 7 h/night, 34.9% vs. 31.3%, $p = 0.026$) were more common among Veterans than non-Veterans. When the Veteran group was further divided among newly transitioned (≤ 12 months) and longer-term Veterans (> 12 months), the overall test for a difference was not statistically significant between groups, mainly because there was little difference in sleep between the two groups of Veterans. High-risk Veteran subgroups included those who were 21-44 years of age (vs. 65-74), women, non-whites, current smokers, obese, unable to work, and those in poor health.

Conclusions: This study suggests that Veterans have a high burden of sleep problems and identifies subgroups that should be targeted to receive interventions and enhanced education regarding insufficient sleep.

Keywords: Insufficient sleep, Veterans health, Behavior Risk Factor Surveillance System

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Sleep insufficiency is a common disorder that is associated with poor quality of life,¹ depression,² and chronic disease.³ Nevertheless, many US adults continue to obtain insufficient sleep. Approximately 25% of individuals in a recent national sample felt they obtained insufficient rest or sleep on more than half of the preceding 30 days,⁴ while an additional nationally representative sample revealed 28% of adults sleep ≤ 6 h per night.⁵ To address this common and detrimental condition, increasing the proportion of adults who get sufficient sleep is a goal of Healthy People 2020.⁶

Sleep problems are of particular concern among the active duty military population. These personnel may be exposed to several factors that compromise adequate sleep including inconsistent work hours,⁷ frequent shift work,⁸ uncomfortable sleep conditions in the field,⁹ and deployment.¹⁰ Since 2000, there has been an exponential increase in the incidence of insomnia among this population serving in the armed forces.¹¹ Whether these trends persist once active duty personnel transition to Veteran status at the end of their service obligation has not been well characterized.

Several studies utilizing selected samples have found that sleep disorders may be a problem in Veterans. A Veterans

BRIEF SUMMARY

Current Knowledge/Study Rationale: Few prior studies have investigated whether the prevalence of sleep problems differ between Veterans and demographically similar non-Veterans. Further description of the prevalence of insufficient rest or sleep among Veterans may help to identify high-risk groups to target for interventions.

Study Impact: Veterans are more likely to report frequent insufficient rest or sleep compared to their non-Veteran counterparts. Specific subsets of this population which require particular attention when addressing this component of the clinical encounter include younger Veterans, those who are unable to work, and those who are experiencing frequent mental distress.

Affairs-based study of 886 patients found that 40% of respondents self-reported symptoms suggestive of insomnia.¹² In a community-based sample (n = 158) of Australian Vietnam-era Veterans, fully 90% reported clinically significant sleep disturbances.¹³ Though the reasons for the increased prevalence of insufficient sleep in this study were unclear, factors associated with their military experience were postulated to explain the sleep problems. Disturbed sleep appears to be a core feature of

mental health conditions such as posttraumatic stress disorder (PTSD)¹⁴ and may be chronic in nature, affecting Veterans up to 20 years after combat exposure.¹⁵ These concerns remain timely, as 37% of Iraq and Afghanistan Veterans entering VA health care from 2002 to 2008 were diagnosed with mental health conditions, while 22% were diagnosed with PTSD.¹⁶ These newly transitioned Veterans may experience high levels of stressors as they make the transition to new employment and a change in lifestyle, thereby potentially altering their sleep patterns. However, no large-scale studies of sleep health in either newly transitioned or longer-term Veterans, compared to demographically similar non-Veterans, have been conducted.

The purpose of this study is to investigate whether sleep problems differ among a population-based national sample of Veterans relative to those without any military service history. The first aim of this study is to describe and compare the prevalence of perceived insufficient rest or sleep among Veterans and non-Veterans, and explore factors associated with this outcome among Veterans. The second aim of this study is to describe and compare reported sleep duration in this same paired comparison. Description of the prevalence of insufficient sleep among a national sample of Veterans may provide a better understanding of this important component of health and determine whether there are long-term effects of military service on sleep, as well as identify high-risk groups to target for interventions.

METHODS

A cross-sectional study was performed utilizing data from the 2009 Behavioral Risk Factor Surveillance System (BRFSS) and analyzed in 2011. This state-based, random-digit-dialed telephone survey of the non-institutionalized US adult population was conducted by state health departments in concert with the Centers for Disease Control and Prevention (CDC).¹⁷ The BRFSS obtained information on preventive health factors and health risk behaviors associated with chronic diseases, injuries, and preventable infectious diseases.¹⁸ Adults aged 18 years and older residing in all 50 states, the District of Columbia, Guam, Puerto Rico, and US Virgin Islands were contacted via a landline telephone during both daytime and evening hours and during each calendar month. The questionnaire comprised a standard set of core questions which queried each respondent about their current health status, including conditions such as diabetes, tobacco use, and demographic characteristics. Optional modules on specific topics such as arthritis management, prostate cancer screening, immunizations, and sleep were included by select states. Twenty-nine optional modules were supported by CDC in 2009; each optional module was included by as few as 2 and as many as 38 states.

The primary exposure evaluated in this study was a history of prior active military service. Individuals were asked the question, "Have you ever served on active duty in the United States Armed Forces, either in the regular military or in a National Guard or military Reserve unit?" Respondents who answered yes were asked whether they were currently on active duty, on active duty during the last 12 months but not at the time of the interview, or on active duty in the past but not during the last 12 months. Respondents who answered "no" were asked if they were in a training status for the Reserves or National Guard. In-

dividuals were classified as newly transitioned Veterans if they reported a history of active duty military service during the last 12 months but not at the time of the interview, while individuals on active duty in the past but not during the last 12 months were classified as longer-term Veterans. Non-Veterans, defined as individuals without a history of active duty military service, served as the comparison group. Respondents with missing age or between the ages of 18 and 20 were excluded in order to reduce residual confounding by age given the presence of a 100-fold difference in the number of respondents in this age range among comparison groups. Respondents on active duty at the time of the survey were also excluded, as the data were not considered representative of this population, as BRFSS does not sample individuals residing in on-post, government housing nor those in a deployed or field environment. These factors limited the generalizability among this segment of the population. Individuals who refused to answer the question, were unsure of their status, or had a missing response, as well as those who reported a training status only without ever having received active duty orders were also excluded.

The primary outcome of interest was frequent sleep insufficiency and was assessed with the response to the core question, "During the past 30 days, for about how many days have you felt you did not get enough rest or sleep?" Responses were recorded as whole numbers between 0 and 30. Due to a non-normal distribution with multiple modes, responses were dichotomized into < 14 and ≥ 14 days. In agreement with previous research, frequent sleep insufficiency was defined as occurring ≥ 14 days in the past month.¹ The secondary outcome was self-reported average sleep duration and was assessed with the response to the question, "On average, how many hours of sleep do you get in a 24-hour period? Think about the time you actually spend sleeping or napping, not just the amount of sleep you think you should get." The number of hours of sleep in whole numbers was then entered, rounding ≥ 30 min up to the next hour. Responses were dichotomized into < 7 and ≥ 7 h.¹⁹ This question was an optional module and was answered in 6 states (Georgia, Hawaii, Illinois, Louisiana, Minnesota, and Wyoming).

Sociodemographic, anthropometric, health, and behavioral characteristics were also elicited during the BRFSS interview, including level of education, marital status, employment status, alcohol consumption, and smoking status. Binge drinking has been associated with short sleep duration⁵ and was defined as having ≥ 5 drinks on one occasion in the past 30 days for men, and having ≥ 4 drinks on one occasion in the past 30 days for women. Body mass index (kg/m^2) as a measure of adiposity was calculated based on self-reported height and weight. Individuals were classified as normal weight ($< 25 \text{ kg}/\text{m}^2$), overweight ($25\text{--}29.9 \text{ kg}/\text{m}^2$), obese class I ($30\text{--}34.9 \text{ kg}/\text{m}^2$), or obese class II ($\geq 35 \text{ kg}/\text{m}^2$).²⁰ Categories of self-reported general health status were collapsed (excellent/very good, good, fair/poor).⁷ Subjects were also asked about the presence of stress, depression, and problems with emotion, and were classified as having frequent mental distress if they reported symptoms of poor mental health ≥ 14 days during the past month.¹

BRFSS survey weights were applied in order to account for unequal probabilities of selection and oversampling. The CDC assigned each respondent a final sampling weight that took into account the overall probability of selection as well as a

post-stratification factor used to adjust for non-coverage and non-response errors. This process allowed for the weighted frequencies to equal the state's population estimates.

Model-based direct rate adjustment was used to estimate the prevalence of insufficient rest or sleep while controlling for confounding.²¹ This method utilized weights from a logistic regression model in order to adjust the outcome measures in the comparison population, using Veterans as the standard population. In order to evaluate whether differences in the prevalence of insufficient rest or sleep and sleep duration between Veterans and non-Veterans were statistically significant, Pearson χ^2 tests corrected for the survey design were conducted.²² These were converted to an *F* statistic utilizing STATA 11 (StataCorp LP, College Station, Texas).

To determine the extent to which observed differences were due to differences in demographic and other characteristics, we created nested multivariable models; initial analyses were unadjusted. Subsequent analyses were adjusted for age, sex and race/ethnicity (Model 1); Model 1 factors plus employment and income (Model 2); Model 2 factors plus smoking status (Model 3); and Model 3 factors plus mental health status (Model 4). Age, sex, and race/ethnicity were included as confounders given their associations with varying rates of insufficient sleep,⁴ as well as the differences in these characteristics between Veterans and non-Veterans.²³ Prior studies have detected associations between employment status, income and insufficient sleep⁴; consequently, these variables were included as confounders *a priori* given the differences in employment status and income between Veterans and non-Veterans. Given its association with insufficient sleep²⁴ and military service,²⁵ smoking was also included as a confounder. We adjusted for mental health given the potential for significant sleep disturbances related to such disorders as PTSD. Odds ratios were calculated in order to assess how the outcome measure differed among Veterans (pooling newly transitioned and longer-term) by various characteristics. The Veteran groups were combined to better assess factors associated with poor sleep among all Veterans in order to assist with public health interventions in this population. This study was reviewed and approved by the University of Washington Human Subjects Institutional Review Board.

RESULTS

The median response rate, defined as the percentage of persons who completed interviews among all eligible persons for the 2009 BRFSS survey was 52.5% (range among states: 37.9% to 66.9%).²⁶ The median cooperation rate, defined as the percentage of persons who completed interviews among all eligible persons who were contacted, was 75.0% (range: 55.5% to 88.0%).²⁶

A total of 432,607 individuals completed the 2009 BRFSS survey. We excluded individuals for the following reasons: between 18 and 20 years of age (*n* = 5,878); refusal to answer the question pertaining to military status, were unsure of their status, or had a missing response (*n* = 5,512); active duty at the time of the survey (*n* = 1,923); in a training status (*n* = 4,433), and those with missing age (*n* = 3,548), leaving 411,313 for analyses.

Selected characteristics for this study sample of 2,350 newly transitioned Veterans, 53,011 longer-term Veterans, and

355,952 non-Veterans are shown in **Table 1**. Veterans were more likely to be older, male, married, have more education, and be former smokers, as compared to non-Veterans. Veterans were also more likely to be retired and to report their general health status as fair or poor. A smaller proportion of Veterans were racial/ethnic minorities or from households with children present. The 2 groups were similar with respect to current smoking status, binge drinking, and self-reported poor mental health in the past month.

Table 2 shows the frequency of insufficient rest or sleep among newly transitioned Veterans, longer-term Veterans, and non-Veterans. In unadjusted analyses, newly transitioned Veterans were more likely than both longer-term Veterans and non-Veterans to report frequent insufficient rest or sleep. Following adjustment for sociodemographic factors, this difference was no longer statistically significant, though Veterans reported about a 2-percentage point greater prevalence of sleep problems. A larger proportion of Veterans (both newly transitioned and longer-term) than non-Veterans reported frequent insufficient rest or sleep (22.7% vs. 20.4 %). Further adjustment for employment, income, smoking status, and mental health did not appreciably change this relationship.

Based on data from the 6 states that included the optional module on sleep duration (*n* = 4,936 Veterans and 30,983 non-Veterans), Veterans were more likely to report sleep duration less than the recommended 7 h in a 24-h period than their non-Veteran counterparts (34.9% vs. 31.3%) after adjustment for age and gender (data not tabulated).

Table 3 presents the associations of frequent insufficient rest or sleep and selected demographic and other characteristics among both newly transitioned and longer-term Veterans. Insufficient rest or sleep was most strongly associated with age < 65 (compared to those age 65-74), inability to work, decreased income, and frequent mental distress. In addition, current smokers (vs. never smokers) and persons who reported binge drinking on at least one occasion over the past 30 days were also more likely to report frequent insufficient rest or sleep.

DISCUSSION

To our knowledge, this is the first study describing the prevalence of insufficient rest or sleep among a population-based, national sample of Veterans relative to those without any military service history. The results corroborate previous research^{12,13} that has identified a high prevalence of insufficient rest or sleep in this population and suggest the continuing need for provider and patient education about sleep hygiene. Even though the overall test for a difference across the three groups (the two groups of Veterans and non-Veterans) was not statistically significant, this was mainly due to the fact that multivariable-adjusted estimates of insufficient rest or sleep in the two groups of Veterans were similar. When considered as a single group, Veterans (newly transitioned and longer-term) were found to have a 23% frequency of insufficient rest or sleep occurring on at least 14 days in the past month. Following adjustment for sociodemographic variables, the difference remained, with Veterans more likely to report frequent insufficient rest or sleep than their non-Veteran counterparts.

Table 1—Selected demographic and behavioral characteristics in Veterans and non-Veterans, BRFSS, 2009

Characteristic	Veteran ^a				Non-Veteran	
	Newly transitioned ≤ 12 months N = 2,350		Longer-term > 12 months N = 53,011		N = 355,952	
	N ^b	Weighted prevalence	N ^b	Weighted prevalence	N ^b	Weighted prevalence
Age (years)						
21-44	726	56.4	4,519	19.4	96,397	49.4
45-54	418	15.9	6,078	15.0	78,367	20.9
55-64	496	12.4	13,703	23.6	78,489	14.4
65-74	377	6.9	13,820	19.8	56,967	8.3
≥ 75	333	8.3	14,891	22.2	45,732	6.9
Sex						
Male	1,268	71.8	49,034	92.8	102,844	42.1
Female	1,082	28.2	3,977	7.2	253,108	57.9
Race/ethnicity						
Non-Hispanic white	1,851	71.1	44,495	78.3	277,495	68.0
Non-Hispanic black	248	10.8	3,332	9.7	28,806	9.8
Hispanic	114	11.7	1,811	6.7	26,680	15.5
Other, non-Hispanic	110	6.4	2,733	5.3	19,680	6.7
Highest educational level						
Less than high school	176	6.8	3,347	5.3	35,363	11.0
High school or equivalent	687	26.9	15,852	29.0	105,462	26.9
Some college or more	1,485	66.3	33,706	65.7	214,093	62.1
Marital status						
Married or living as married	1,423	68.8	34,451	73.8	206,705	66.6
Divorced/separated/widowed	671	16.9	14,981	19.7	108,993	17.4
Never married	248	14.4	3,428	6.5	39,126	15.9
Employment status						
Employed	1,238	63.5	19,426	44.3	185,523	60.1
Unemployed	127	9.0	2,175	5.8	21,058	8.7
Retired	705	16.8	27,658	42.5	87,471	13.7
Unable to work	132	4.2	3,019	5.6	24,959	5.6
Student/homemaker	132	6.4	580	1.8	35,587	11.9
Income (\$)						
< 15,000	184	4.9	3,423	5.2	37,508	9.6
15,000-24,999	309	12.4	8,339	13.2	55,133	14.2
25,000-34,999	253	10.9	6,783	11.2	36,585	9.2
35,000-49,999	339	13.0	8,683	15.5	46,305	12.3
≥ 50,000	975	50.1	20,386	44.6	133,304	42.7
Missing/refused	290	8.9	5,397	10.3	47,120	12.0

BRFSS, Behavioral Risk Factor Surveillance System. ^aIndividuals who were discharged from the military in the previous 12 months were classified as Veterans ≤ 12 months (newly transitioned), whereas individuals who were discharged from the military > 12 months prior were classified as longer-term Veterans. ^bUnweighted sample size. Categories may not sum to survey total because of missing responses. ^cNever smokers were defined as those who had smoked < 100 cigarettes in lifetime. ^dBinge drinking was defined as ≥ 5 or ≥ 4 alcoholic drinks for men and women, respectively, on one occasion in past 30 days. ^eResponse to question: "On average, how many hours of sleep do you get in a 24-hour period?" Optional module that included this question was used in six states only (Georgia, Hawaii, Illinois, Louisiana, Minnesota, and Wyoming). ^fEstimates are not presented because of small cell sizes (< 100) and high imprecision.

Table 1 continues on the following page

This study also demonstrated that Veterans were less likely to obtain the recommended 7 h of sleep per night when compared to demographically similar non-Veterans. Short sleep duration is associated with limitations in daily activities such as difficulty concentrating¹⁹ and may be a novel risk factor for numerous metabolic conditions including obesity, metabolic syndrome, hypertension, and cardiovascular disease.²⁷ Chronic sleep loss may also exacerbate depressive symptoms.¹ Addressing sleep

health during the clinical encounter for these conditions is an important aspect of comprehensive medical care.

The prevalence of insufficient rest or sleep varied by age in this study, a finding corroborated by research utilizing a similar, national database.¹⁹ Younger Veterans were at a higher risk of insufficient rest or sleep than those 65-74 years of age. As active duty military transition to civilian life, they may be faced with varying challenges including changes in environment, type of

Table 1 (*continued*)—Selected demographic and behavioral characteristics in Veterans and non-Veterans, BRFSS, 2009

Characteristic	Veteran ^a				Non-Veteran	
	Newly transitioned ≤ 12 months N = 2,350		Longer-term > 12 months N = 53,011		N = 355,952	
	N ^b	Weighted prevalence	N ^b	Weighted prevalence	N ^b	Weighted prevalence
Smoking status ^c						
Never	1,147	49.8	18,096	36.1	198,844	58.4
Former	790	29.6	26,339	46.0	97,145	23.4
Current	402	20.6	8,272	18.0	57,704	18.1
Binge drinking ^d						
No	1,978	78.3	45,966	86.5	309,412	84.9
Yes	309	21.7	5,377	13.5	36,614	15.1
Body mass index (kg/m ²)						
Normal	650	28.8	14,104	25.3	122,319	36.0
Overweight	1,001	48.5	23,729	44.7	119,742	35.8
Obese, class I	418	16.1	10,165	21.2	59,705	17.4
Obese, class II	204	6.7	4,341	8.8	37,303	10.7
Children in household						
None	1,641	56.5	45,905	77.0	246,243	55.0
One	285	14.8	3,128	9.5	42,416	16.9
≥ 1	421	28.6	3,901	13.5	66,464	28.1
Self-reported health						
Excellent/very good	1,199	58.7	23,179	46.9	178,140	53.7
Good	723	28.5	17,572	33.1	107,833	30.1
Fair/poor	418	12.8	11,917	20.0	68,032	16.2
Poor mental health (days in past month)						
< 14	2,085	90.6	47,782	90.8	312,761	89.0
≥ 14	235	9.4	4,394	9.2	37,568	11.0
Sleep duration (h) in a 24-h period ^e						
< 7	— ^f	— ^f	1,525	34.5	10,202	35.2
≥ 7	— ^f	— ^f	3,251	65.5	20,632	64.8

BRFSS, Behavioral Risk Factor Surveillance System. ^aIndividuals who were discharged from the military in the previous 12 months were classified as Veterans ≤ 12 months (newly transitioned), whereas individuals who were discharged from the military > 12 months prior were classified as longer-term Veterans. ^bUnweighted sample size. Categories may not sum to survey total because of missing responses. ^cNever smokers were defined as those who had smoked < 100 cigarettes in lifetime. ^dBinge drinking was defined as ≥ 5 or ≥ 4 alcoholic drinks for men and women, respectively, on one occasion in past 30 days. ^eResponse to question: "On average, how many hours of sleep do you get in a 24-hour period?" Optional module that included this question was used in six states only (Georgia, Hawaii, Illinois, Louisiana, Minnesota, and Wyoming). ^fEstimates are not presented because of small cell sizes (< 100) and high imprecision.

work, and loss of camaraderie.²⁸ Younger Veterans might also have more children in the household than their older counterparts, a factor that may compromise sleep.²⁹ Finally, younger Veterans would be expected to be closer in time to any significant service-related stressor, such as deployment to a combat zone, which may affect sleep quality and duration.^{7,10} The recognition of these potential risk factors may help clinicians who treat younger Veterans as well as identify those who may benefit from improved sleep hygiene.

A Veteran's employment status following their military service and this association with frequent insufficient rest or sleep in this study was also noteworthy, especially among those unable to work. Strong associations have been described between overall sleep problems and disability retirement, particularly among individuals with disability related to mental health disorders and musculoskeletal injury.³⁰ In addition, there is a delay in the return to work among patients with self-reported sleep

disturbance.³¹ Given the strong association of insufficient sleep and lack of employment, Veterans who are injured as a result of service and who may be limited in their ability to work may benefit from improved education. These methods include addressing mental health problems as well as avoiding tobacco and alcohol in the evening.¹⁹

In this study, frequent mental distress was also strongly associated with insufficient rest or sleep. Veterans may represent a segment of the population in which this facet of health and its effect on sleep is of particular concern due to the prevalence of mental health disorders, especially among recent Veterans of the wars in Iraq and Afghanistan.¹⁶ Furthermore, the recognition that sleep disorders are a core feature of mental illnesses such as PTSD¹⁴ may assist in earlier screening and treatment.

This study was subject to several limitations. The sleep data were obtained via self-report and may not be comparable to

Table 2—Frequency of insufficient rest or sleep in Veterans and non-Veterans, adjusted for selected combinations of sociodemographic and behavioral characteristics

Adjustment factors ^a	Percentage reporting ≥ 14 days of insufficient sleep or rest in the previous month			p ^a	p ^b
	Veterans		Non-Veterans		
	Newly transitioned ≤ 12 months	Longer-term > 12 months			
Model 0: Nothing	30.2	22.4	27.9	< 0.0001	< 0.0001
Model 1: Age, sex, and race/ethnicity	21.3	22.4	20.1	0.26	< 0.0001
Model 2: Model 1 factors + employment and income	21.8	22.4	19.8	0.19	< 0.0001
Model 3: Model 2 factors + smoking status	21.9	22.4	20.3	0.30	< 0.0001
Model 4: Model 3 factors + mental health	22.7	22.4	20.8	0.34	0.0003

^aLonger-term Veterans are the reference population. p values are equivalent to a comparison of differences across the 3 groups. ^bVeterans are the reference population (actual percentages are not shown). p value represents the comparison of Veterans (both newly transitioned and longer-term) and non-Veterans.

Table 3—Prevalence and adjusted odds ratio of frequent insufficient rest or sleep among Veterans, by various characteristics, BRFSS, 2009

Characteristic	Weighted ^a prevalence of insufficient rest or sleep	Adjusted odds ratio	95% CI
Age (years) ^b			
21-44	35.3	4.16	(3.63, 4.78)
45-54	29.6	3.08	(2.72, 3.49)
55-64	22.6	1.87	(1.68, 2.08)
65-74	14.4	1.00	Ref
≥ 75	13.1	0.91	(0.81, 1.02)
Sex ^c			
Male	21.7	1.00	Ref
Female	24.6	1.84	(1.62, 2.10)
Race/ethnicity			
Non-Hispanic white	20.7	1.00	Ref
Non-Hispanic black	25.2	1.42	(1.21, 1.68)
Hispanic	22.1	1.52	(1.18, 1.94)
Other, non-Hispanic	22.3	1.36	(1.11, 1.66)
Highest educational level			
Less than high school	22.5	1.17	(0.98, 1.41)
High school or equivalent	23.1	1.15	(1.04, 1.27)
Some college or more	20.5	1.00	Ref
Marital status			
Married or living as married	20.4	1.00	Ref
Divorced/separated/widowed	23.5	1.20	(1.08, 1.34)
Never married	26.3	1.52	(1.28, 1.80)
Employment status			
Employed	24.4	1.00	Ref
Unemployed	27.2	1.09	(0.90, 1.31)
Retired	12.7	0.40	(0.37, 0.44)
Unable to work	45.3	2.55	(2.19, 2.97)
Student/homemaker	27.2	1.11	(0.81, 1.50)

BRFSS, Behavioral Risk Factor Surveillance System. CI, confidence interval. ^aAdjusted for age and gender unless otherwise specified. ^bAdjusted for gender. ^cAdjusted for age. ^dNever smokers were defined as those who had smoked < 100 cigarettes in lifetime. ^eBinge drinking was defined as ≥ 5 or ≥ 4 alcoholic drinks for men and women, respectively, on one occasion in past 30 days. ^fOptional module that included this question was used in six states only (Georgia, Hawaii, Illinois, Louisiana, Minnesota, and Wyoming).

Table 3 continues on the following page

studies in which sleep was directly measured with methods such as actigraphy or polysomnography. When compared to these objective measurements, subjective assessment underestimates total sleep duration.³² The cross-sectional nature precludes as-

sessments of the temporal association between characteristics such as employment and sleep problems. The terms “rest” and “sleep” were also used interchangeably. This may have contributed to measurement error as these terms may have differ-

Table 3 (continued)—Prevalence and adjusted odds ratio of frequent insufficient rest or sleep among Veterans, by various characteristics, BRFSS, 2009

Characteristic	Weighted ^a prevalence of insufficient rest or sleep	Adjusted odds ratio	95% CI
Income (\$)			
< 15,000	27.8	1.67	(1.42, 1.95)
15,000-24,999	22.9	1.22	(1.08, 1.38)
25,000-34,999	20.3	0.97	(0.85, 1.11)
35,000-49,999	20.6	1.03	(0.89, 1.18)
≥ 50,000	20.5	1.00	Ref
Smoking status ^d			
Never	19.4	1.00	Ref
Former	19.3	0.95	(0.87, 1.05)
Current	32.6	2.04	(1.80, 2.31)
Binge drinking ^e			
No	20.7	1.00	Ref
Yes	26.7	1.35	(1.18, 1.56)
Body mass index (kg/m ²)			
Normal	19.6	0.98	(0.88, 1.10)
Overweight	19.6	1.00	Ref
Obese, class I	23.9	1.37	(1.22, 1.55)
Obese, class II	31.1	1.93	(1.68, 2.21)
Children in household			
None	18.1	1.00	Ref
One	28.6	2.05	(1.78, 2.35)
≥ 1	33.1	2.62	(2.28, 3.00)
Self-reported health			
Excellent/very good	16.1	1.00	Ref
Good	20.7	1.38	(1.24, 1.54)
Fair/poor	33.9	2.70	(2.42, 3.00)
Poor mental health (days in past month)			
< 14	17.8	1.00	Ref
≥ 14	58.0	6.50	(5.66, 7.47)
Sleep duration (h) in a 24-h period ^f			
< 7	41.4	6.36	(4.74, 8.52)
≥ 7	9.4	1.00	Ref

BRFSS, Behavioral Risk Factor Surveillance System. CI, confidence interval. ^aAdjusted for age and gender unless otherwise specified. ^bAdjusted for gender. ^cAdjusted for age. ^dNever smokers were defined as those who had smoked < 100 cigarettes in lifetime. ^eBinge drinking was defined as ≥ 5 or ≥ 4 alcoholic drinks for men and women, respectively, on one occasion in past 30 days. ^fOptional module that included this question was used in six states only (Georgia, Hawaii, Illinois, Louisiana, Minnesota, and Wyoming).

ent meanings among study respondents.⁴ In addition, the 2009 BRFSS survey was conducted among households with land-line telephones and the findings may not generalize to wireless-only households, who represented an estimated 23.9% of adults in 2009.³³ Although significant health risk differences may exist when comparing these two populations,³⁴ we have no reason to believe the prevalence of wireless-only households varies significantly by Veteran status.

We were also unable to categorize Veterans into groups that may have helped delineate potential causal factors of their poor sleep. Additional knowledge regarding recent deployment, combat exposure, specific mental health conditions, or the presence of service-connected injury preventing employment would have been helpful in this regard. In addition, there was likely a large amount of heterogeneity among Veterans who served at different time periods. Veterans from specific periods or con-

flicts may have been exposed to varying military cultures that may have affected their sleep patterns.³⁵ More in-depth knowledge of these military specific factors would have improved our ability to determine potential reasons for poorer sleep among Veterans in this study.

From a public health perspective, the results of this study suggest that specific subsets of the Veteran population require particular attention when addressing insufficient sleep. Younger Veterans appear to be at higher risk than older Veterans, as well as those who are unable to work or who are experiencing frequent mental distress. Future prospective studies are needed in order to further assess the effects of sleep disorders during the immediate transition period from active service to civilian life, especially among Veterans with a history of musculoskeletal or mental health conditions potentially limiting employability. Given the association with chronic diseases such as diabetes,

obesity, and vascular disease, insufficient rest or sleep should be regularly screened for as part of the clinical encounter. Viewing sleep insufficiency as a chronic illness worthy of attention, research, and prevention is necessary.

REFERENCES

1. Strine TW, Chapman DP. Associations of frequent sleep insufficiency with health-related quality of life and health behaviors. *Sleep Med* 2005;6:23-7.
2. Patel SR, Malhotra A, Gottlieb DJ, White DP, Hu FB. Correlates of long sleep duration. *Sleep* 2006;29:881-9.
3. Shankar A, Syamala S, Kalidindi S. Insufficient rest or sleep and its relation to cardiovascular disease, diabetes and obesity in a national, multiethnic sample. *PLoS One* 2010;5:e14189.
4. CDC. Perceived insufficient rest or sleep among adults - United States, 2008. *MMWR Morb Mortal Wkly Rep* 2009;58:1175-9.
5. Krueger PM, Friedman EM. Sleep duration in the United States: a cross-sectional population-based study. *Am J Epidemiol* 2009;169:1052-63.
6. US Department of Health and Human Services. Healthy People 2020. 2010; Available from: <http://www.healthypeople.gov/2020/topicsobjectives2020/pdfs/SleepHealth.pdf>.
7. Seelig AD, Jacobson IG, Smith B, et al. Sleep patterns before, during, and after deployment to Iraq and Afghanistan. *Sleep* 2010;33:1615-22.
8. Caldwell JL, Gilreath SR. Work and sleep hours of U.S. Army aviation personnel working reverse cycle. *Mil Med* 2001;166:159-66.
9. Caldwell JA. Fatigue in aviation. *Travel Med Infect Dis* 2005;3:85-96.
10. Peterson AL, Goodie JL, Satterfield WA, Brim WL. Sleep disturbance during military deployment. *Mil Med* 2008;173:230-5.
11. AFHSC. Insomnia, Active Component, U.S. Armed Forces, January 2000-December 2009. *MSMR* 2010;17:12-5.
12. Mustafa M, Erokwu N, Ebose I, Strohl K. Sleep problems and the risk for sleep disorders in an outpatient veteran population. *Sleep Breath* 2005;9:57-63.
13. Lewis V, Creamer M, Failla S. Is poor sleep in veterans a function of post-traumatic stress disorder? *Mil Med* 2009;174:948-51.
14. Spoomaker VI, Montgomery P. Disturbed sleep in post-traumatic stress disorder: secondary symptom or core feature? *Sleep Med Rev* 2008;12:169-84.
15. Neylan TC, Marmar CR, Metzler TJ, et al. Sleep disturbances in the Vietnam generation: findings from a nationally representative sample of male Vietnam veterans. *Am J Psychiatry* 1998;155:929-33.
16. Seal KH, Metzler TJ, Gima KS, Bertenthal D, Maguen S, Marmar CR. Trends and risk factors for mental health diagnoses among Iraq and Afghanistan veterans using Department of Veterans Affairs health care, 2002-2008. *Am J Public Health* 2009;99:1651-8.
17. CDC. Behavioral Risk Factor Surveillance System Survey Data. Atlanta GA: CDC, 2009.
18. CDC. 2009 BRFSS Overview. Atlanta GA: CDC, 2009.
19. CDC. Effect of short sleep duration on daily activities--United States, 2005-2008. *MMWR Morb Mortal Wkly Rep* 2011;60:239-42.
20. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults--The Evidence Report. National Institutes of Health. *Obes Res* 1998;6 Suppl 2:51S-209S.
21. Rosenbaum PR. Model-based direct adjustment. *Am Stat Assoc* 1987;82:387-94.
22. Rao JNK, Scott AJ. On chi-squared tests for multiway contingency tables with cell proportions estimated from survey data. *Ann Stat* 1984;12:46-60.

23. Department of Veterans Affairs. Profile of Veterans: 2009 Data from the American Community Survey. Available from: http://www.va.gov/vetdata/docs/SpecialReports/Profile_of_Veterans_2009_FINAL.pdf.
24. Sabanayagam C, Shankar A. The association between active smoking, smokeless tobacco, second-hand smoke exposure and insufficient sleep. *Sleep Med* 2011;12:7-11.
25. Koepsell T, Reiber G, Simmons KW. Behavioral risk factors and use of preventive services among veterans in Washington State. *Prev Med* 2002;35:557-62.
26. CDC. 2009 Summary Data Quality Report. Atlanta, GA; 2009:32-3.
27. Knutson KL. Sleep duration and cardiometabolic risk: a review of the epidemiologic evidence. *Best Pract Res Clin Endocrinol Metab* 2010;24:731-43.
28. Pranger T, Murphy K, Thompson JM. Shaken world: coping with transition to civilian life. *Can Fam Physician* 2009;55:159-61.
29. Medina AM, Lederhos CL, Lillis TA. Sleep disruption and decline in marital satisfaction across the transition to parenthood. *Fam Syst Health* 2009;27:153-60.
30. Lallukka T, Haaramo P, Lahelma E, Rahkonen O. Sleep problems and disability retirement: a register-based follow-up study. *Am J Epidemiol* 2011;173:871-81.
31. Salo P, Oksanen T, Sivertsen B, et al. Sleep disturbances as a predictor of cause-specific work disability and delayed return to work. *Sleep* 2010;33:1323-31.
32. McCall C, McCall WV. Comparison of actigraphy with polysomnography and sleep logs in depressed insomniacs. *J Sleep Res* 2012;21:122-7.
33. Blumberg SJ, Luke JV, Ganesh N, Davern ME, Boudreaux MH, Soderberg K. Wireless substitution: state-level estimates from the National Health Interview Survey, January 2007-June 2010. *Natl Health Stat Report* 2011;1-26, 28.
34. Hu SS, Balluz L, Battaglia MP, Frankel MR. Improving public health surveillance using a dual-frame survey of landline and cell phone numbers. *Am J Epidemiol* 2011;173:703-11.
35. Shay J. Ethical standing for commander self-care: the need for sleep. *Parameters* 1998;28:93-105.

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Address correspondence to: Paul Faestel, M.D., M.P.H., Mt. Belvedere Drive, Bldg 10720, Dept of Preventive Medicine, MEDDAC, Ft. Drum, NY 13602-5004; Tel: (303) 907-0352; Fax: (315) 772-6351; E-mail: paul.faestel@us.army.mil

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