Arthritis Prevalence and Symptoms Among US Non-Veterans, Veterans, and Veterans Receiving Department of Veterans Affairs Healthcare

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ABSTRACT. *Objective*. Studies suggest arthritis and rheumatic diseases are common among military veterans, but prior research has not directly compared arthritis between veterans and the general population. This study compared arthritis prevalence and symptoms between veterans of the US Armed Forces and non-veterans, and between veterans who are US Department of Veterans Affairs (VA) healthcare users and veteran nonusers.

Methods. Study participants were 123,395 respondents from 36 states that completed the 2000 Behavioral Risk Factor Surveillance System arthritis module. Analyses compared self-reports of doctor-diagnosed arthritis, chronic joint symptoms, and activity limitation according to veteran status. Analyses also compared relationships of demographic characteristics to arthritis according to veteran status.

Results. US veterans were more likely to report doctor-diagnosed arthritis than non-veterans (32% vs 22%; p < 0.001), and VA healthcare users were more likely to report doctor-diagnosed arthritis than veteran nonusers (43% vs 30%; p < 0.001). Differences remained in analyses controlling for demographic characteristics. Among respondents with arthritis, veterans were more likely to report chronic joint symptoms and activity limitation than non-veterans, and VA healthcare users were more likely to report chronic symptoms and activity limitation than veteran nonusers. Demographic factors predicting doctor-diagnosed arthritis were similar among the 3 groups.

Conclusion. This study shows a significant burden of arthritis among US veterans, particularly VA healthcare users. Increased prevention of orthopedic injuries in the military may reduce the risk of arthritis in veterans. Within the VA healthcare system, self-management interventions may help to improve outcomes among the many patients with arthritis. (J Rheumatol 2006;33:348–54)

Key Indexing Terms:
ARTHRITIS   VETERANS   UNITED STATES DEPARTMENT OF VETERANS AFFAIRS
                BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM

Arthritis and other rheumatic conditions are the most common cause of disability among older adults in the United States and other developed countries[1-4]. Because of the rapidly growing number of older adults, the prevalence of arthritis is expected to increase substantially over the next 2 decades[5,6]. Arthritis has a considerable impact on health, quality of life, and healthcare costs. In 2 recent studies, participants with arthritis reported poorer health-related quality of life (HRQOL) (i.e., general health, physical health, mental health, quality of life) than those without arthritis[7,8]. MacLean, *et al* reported that medical care charges for patients with symptomatic osteoarthritis (OA) are nearly double the charges for patients without OA[9], and direct costs of rheumatoid arthritis (RA) may be even greater[10]. According to the US Centers for Disease Control and Prevention (CDC), the total direct and indirect costs of arthritis and other rheumatic conditions in the US during 1997 was $86.2 billion, or 1% of the US gross domestic product[11].

Military service may play a role in various aspects of health. War and conflict-specific health syndromes have been reported at least since the US Civil War[12]. For example, studies have reported that Persian Gulf War deployment (1990–91) is associated with poorer HRQOL[13-15], higher self-reported incidence of medical and psychiatric conditions[16], greater risk of amyotrophic lateral sclerosis[17], and increased frequency of musculoskeletal complaints[15]. In a study by Boehmer, *et al*, active-duty US military personnel reported more days of activity limitation, pain, and not enough rest than individuals with no military service[18]. Another recent study reported that veterans had poorer HRQOL than the general US population[19]. However, studies have not compared the prevalence of many common health conditions among the general population of veterans and non-veterans.

According to the 2001 National Survey of US Veterans, 27% of all veterans reported receiving treatment for arthritis or rheumatism during the past year[20]. About 50% of all veterans with military service-connected disabilities reported receiving care for these conditions during the prior year. While this information identifies arthritis as a significant burden among veterans, no previous study to our knowledge has compared the prevalence and impact of arthritis among veterans and non-veterans. Our objectives were to: (1) compare the prevalence of self-reported doctor-diagnosed arthritis according to US veteran status (veterans vs non-veterans) and healthcare status [veterans who receive care within the Department of Veterans Affairs (VA) healthcare system vs veterans who receive medical care elsewhere]; (2) compare arthritis symptoms and activity limitation according to US veteran status and healthcare status; and (3) compare factors that predict doctor-diagnosed arthritis according to veteran status and healthcare status.

MATERIALS AND METHODS

Subjects. All subjects were participants in the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a state-based, random-digit-dialed survey of the noninstitutionalized US population aged > 18 years, supported by the CDC[21-23]. In 2000, all 50 states and the District of Columbia and Puerto Rico participated in the BRFSS, with a median response rate of 49%[24].

The BRFSS includes core questions, optional modules, and state-added questions[23]. Core questions are asked by all states and include items on health status, demographics, and some health behaviors. In addition to the core questions, states can elect to administer any of a standardized set of optional modules on special topics, such as arthritis. In 2000, the arthritis module was used by 36 states. The state of Illinois administered this module to only half of eligible respondents. A total of 123,395 BRFSS participants received the arthritis module.

Variables. In 2000, the following 2 veteran status questions were included in the BRFSS core module: (1) Have you ever served on active duty in the US Armed Forces, either in the regular military or in a National Guard or military reserve unit? (2) Which of the following best describes your current military status: currently on active duty, currently in reserves, or no longer in military service? For this study, we were interested in comparing veterans with non-veterans. Therefore we compared those who indicated they served in the US Armed Forces and were no longer in military service with those who never served in the US Armed Forces.

We examined VA healthcare use from the following question, which was also included on the core module in 2000: In the past 12 months have you received some or all of your healthcare from VA facilities? The VA healthcare system encompasses preventive care services, outpatient ambulatory diagnostic and treatment services, inpatient services, and medicines and supplies. All honorably discharged veterans of the US Army, Navy, Air Force, Marines, Coast Guard, or Merchant Marine are eligible to receive VA healthcare benefits. Veterans with military service-connected disabilities are given priority for receiving healthcare within the VA system.

We used the following question from the arthritis module to identify individuals with "doctor-diagnosed arthritis": Have you ever been told by a doctor that you have arthritis? A similar question is currently used by the CDC to estimate arthritis prevalence[25]. We also examined 3 other variables from the arthritis module: (1) During the past 12 months, have you had pain, aching, stiffness, or swelling in or around a joint? (2) Were these symptoms present on most days for at least one month ("chronic joint symptoms")? (3) Are you now limited in any way in any activities because of joint symptoms ("activity limitation")? The second and third questions are only administered to respondents who answer "yes" to the first question regarding symptoms during the past 12 months. Participants who reported having joint symptoms but who had not been told by a doctor that they had arthritis were categorized as not having doctor-diagnosed arthritis.

We included the following demographic variables from the core module as covariates in our analyses, since they may be related to veterans' status, VA healthcare use, and/or risk for arthritis: age (18–44, 45–64, 65+), sex, race (Caucasian vs other), marital status (married vs not married), education (high school only vs any post-high school), and body mass index (BMI; < 18.5 = underweight; 18.5–24.9 = normal weight; 25–29.9 = overweight; 30+ = obese). We also examined associations of these variables with doctor-diagnosed arthritis among non-veterans, veteran non-VA healthcare users, and VA healthcare users.

Analyses. To account for the complex sample survey design of the BRFSS, all data were weighted by respondent age, sex, and race to reflect the adult population from the 36 states that completed the arthritis module[23,26]. New weights were calculated for the state of Illinois because they administered the arthritis module to only half of their sample. Demographic characteristics were compared between veterans and non-veterans, as well as between VA healthcare users, using chi-square analyses. Chi-square analyses were also used to examine bivariate relationships of doctor-diagnosed arthritis to veteran status, VA healthcare use status, and all demographic variables. Multivariable logistic regression models were then conducted to examine the relationship of veteran status to doctor-diagnosed arthritis when controlling for other demographic characteristics. First, we considered veteran status as a 3-level variable: non-veteran, veterans not receiving VA healthcare, and veterans receiving VA healthcare. Next, we conducted an analysis among only veterans and considered healthcare status as a bivariate variable: VA healthcare user versus nonuser. We also examined relationships of veteran status and VA healthcare status to 2 arthritis symptom-related variables: chronic joint symptoms and activity limitation. We used the same modeling strategy as described above for doctor-diagnosed arthritis. Finally, we conducted 3 separate multivariable logistic regression models to examine the relationships of demographic characteristics with doctor-diagnosed arthritis among non-veterans, veteran non-VA healthcare users, and VA healthcare users.

Because BRFSS subjects come from state (cluster) level samples, we performed all logistic regression models with the Huber-White estimate of variance, which provides an unbiased variance estimate for linear statistics arising from cluster-correlated data[27]. These calculations were made using Intercooled Stata® version 8.2 (Stata Corp., LP, College Station, TX, USA).

RESULTS

Among 123,395 BRFSS participants who completed the

arthritis module, 7307 individuals had missing data for the question regarding a doctor's diagnosis of arthritis, had missing data for the veteran status question, and/or reported they were currently active-duty military. These individuals were eliminated from the current study sample, resulting in a final sample size of 116,088. Demographic characteristics of the sample are presented in Table 1. Sample demographic characteristics were similar to both the full BRFSS survey sample[28] and the US adult population in 2000[29], except that the study sample had a higher proportion of Caucasians than the US population (82% vs 72%). Data for this study are all weighted to reflect the US adult population in 2000.

Among the study sample, 13% were US veterans and 87% were non-veterans. Compared to non-veterans, veterans were older and more likely to be male, Caucasian, married, overweight or obese, and to have education beyond high school (Table 1). Among veterans in the sample, 14% reported they received healthcare within the VA system, and 86% received no VA healthcare. Veterans receiving care in the VA system were older and less likely to be Caucasian, married, and to have education beyond high school compared to those with no VA healthcare (Table 1). VA healthcare system users had slightly higher proportions of males and individuals who were obese.

In bivariate analyses, US veterans were significantly more likely than non-veterans to report doctor-diagnosed arthritis (31.5% vs 22.1%; p < 0.001). Among veterans, the prevalence of doctor-diagnosed arthritis was higher among VA healthcare users than nonusers (42.7% and 29.8%, respectively; Table 2). Other variables associated with a greater likelihood of doctor-diagnosed arthritis were older age, female sex, Caucasian race, being married, having high school education only, and higher BMI.

In a multivariable logistic regression model, both veterans not receiving VA care (OR 1.09, 95% CI 1.02–1.15) and veterans receiving VA care (OR 2.12, 95% CI 1.82–2.47)

Table 2. Bivariate relationships of doctor-diagnosed arthritis with veteran status and other characteristics. Percentage values are weighted by age, race, and sex to population of 36 states that completed the BRFSS arthritis module.

	With Arthritis, %	p
Veteran/healthcare status		
Non-veteran	22.1	
Veterans: non-VA users	29.8	
Veterans: VA users	42.7	< 0.001
Age, yrs		
18–44	9.1	
45–64	31.4	
65+	51.6	< 0.001
Sex		
Male	18.3	
Female	27.7	< 0.001
Race		
Caucasian (non-Hispanic)	24.3	
Other	18.4	< 0.001
Marital status		
Not married	22.7	
Married	23.6	< 0.001
Education		
High school	27.0	
Post-high school	20.3	< 0.001
BMI		
< 18.5 (underweight)	20.7	
18.5–24.9 (normal)	18.1	
25–29.9 (overweight)	23.4	
30+ (obese)	32.8	< 0.001

had greater odds of doctor-diagnosed arthritis compared to non-veterans (Table 3). All other demographic variables were also significantly related to odds of reporting doctor-diagnosed arthritis. In a separate multivariable logistic regression model including only veterans, VA healthcare users were more likely to report doctor-diagnosed arthritis than nonusers (OR 2.03, 95% CI 1.77–2.33, p < 0.001). All

Table 1. Characteristics of subjects according to veteran status and VA healthcare status (unweighted).

				Veterans		
	Veterans	Non-Veterans	p	VA Healthcare Users	Non-VA Healthcare Users	p
No. (%)	15,490 (13.3)	100,598 (86.7)		2,092 (13.6)	13,346 (86.5)	
Age, yrs						
18–44	3,283 (21.3)	53,218 (53.3)		376 (18.0)	2,900 (21.8)	
45–64	6,754 (43.8)	30,633 (30.7)		829 (39.8)	5,909 (44.4)	
65+	5,394 (35.0)	16,089 (16.1)	< 0.001	879 (42.2)	4,488 (33.8)	< 0.001
Male	14,324 (92.5)	32,418 (32.2)	< 0.001	1,926 (92.1)	12,356 (92.6)	< 0.001
Caucasian (non-Hispanic)	13,461 (87.6)	83,339 (83.4)	< 0.001	1,725 (83.1)	11,690 (88.3)	< 0.001
Married	9,967 (64.5)	53,312 (53.2)	< 0.001	1, 111 (53.2)	8,832 (66.4)	< 0.001
Post-high school education	9,385 (60.7)	56,794 (56.6)	< 0.001	1,102 (52.9)	8,259 (62.0)	< 0.001
BMI						
< 18.5 (underweight)	135 (0.9)	2,294 (2.4)		26 (1.3)	109 (0.8)	
18.5–24.9 (normal)	4,694 (30.6)	42,159 (44.0)		619 (29.9)	4,054 (30.7)	
25–29.9 (overweight)	7,188 (46.8)	32,161 (33.6)		871 (42.0)	6,297 (47.6)	
30+ (obese)	3,332 (21.7)	19,173 (20.0)	< 0.001	558 (26.9)	2,765 (20.9)	< 0.001

Table 3. Odds of doctor-diagnosed arthritis according to veteran status and other characteristics: results of multiple logistic regression model. Data weighted by age, race, and sex to population of 36 states that completed the BRFSS arthritis module.

	OR	95% CI	p
Veteran/healthcare status			
Non-veteran	1.00		
Veterans: non-VA users	1.09	1.02–1.15	0.005
Veterans: VA users	2.12	1.82–2.47	< 0.001
Age, yrs			
18–44	1.00		
45–64	3.97	3.82–4.13	< 0.001
65+	8.80	8.13–9.51	< 0.001
Sex			
Male	1.00		
Female	1.75	1.65–1.85	< 0.001
Race			
Caucasian (non-Hispanic)	1.00		
Non-Caucasian	0.72	0.59–0.89	0.002
Marital status			
Not married	1.00		
Married	0.89	0.87–0.92	< 0.001
Education			
High school	1.00		
Post-high school	0.76	0.72–0.81	< 0.001
BMI			
18.5–24.9 (normal)	1.00		
< 18.5 (underweight)	1.13	1.02–1.25	0.022
25–29.9 (overweight)	1.40	1.36–1.45	< 0.001
30+ (obese)	2.35	2.26–2.44	< 0.001

demographic variables in this multivariable regression model were also significantly related to odds of reporting doctor-diagnosed arthritis, except for the difference between individuals who were underweight and compared to normal weight (results not shown).

Among respondents who reported doctor-diagnosed arthritis and joint symptoms during the past 12 months, veterans who received care from the VA were more likely to report both chronic joint symptoms (OR 1.85, 95% CI 1.48–2.31) and activity limitation (OR 2.05, 95% CI 1.75–2.41) than non-veterans (Table 4). There were no significant associations for veterans who do not use the VA compared to non-veterans. Among veterans, large differences according to healthcare status were observed. VA healthcare users were about twice as likely as nonusers to

report having chronic joint symptoms (OR 1.85, 95% CI 1.51–2.26, p < 0.001) and activity limitation (OR 2.17, 95% CI 1.82–2.59, p < 0.001).

Results of 3 separate multivariable logistic regression models examining predictors of doctor-diagnosed arthritis according to veteran status are presented in Table 5. In general, the relationships of demographic characteristics with arthritis were similar among the 3 groups. There were a few exceptions. Age was a significant predictor of self-reported arthritis for all 3 groups, but the relationship was stronger for non-veterans than for either of the 2 veteran groups. Non-white race and post-high school education were associated with lower odds of arthritis among non-veterans and veteran non-VA healthcare users, but not among VA healthcare users. Being married was associated with lower odds of arthritis only among non-veterans.

DISCUSSION

Previous studies have compared overall health among US veterans and non-veterans, as well as VA healthcare users and nonusers[19,30–33]. However, to our knowledge this is the first study to compare the prevalence and symptoms of arthritis among these groups. Results of this study showed that veterans had significantly greater odds of reporting doctor-diagnosed arthritis compared to non-veterans, even when controlling for key demographic characteristics. The reason for this higher rate of arthritis among veterans is unknown. However, military service-related overuse and injuries may be one contributing factor, particularly related to veterans' risk for OA[34]. Previous studies have reported that among active-duty military personnel, orthopedic and rheumatic complaints are among the most common reasons for visits to healthcare facilities[35–39]. Military training and service often involve intense physical activity and other situations that may place personnel at greater risk for overuse injuries. For example, West reported an overuse syndrome among soldiers deployed to the Persian Gulf during Operation Desert Storm[35]. Specifically, soldiers who wore Kevlar helmets and heavy battle gear while riding in trucks over dessert terrain commonly reported extreme posterior neck pain. Many orthopedic and overuse injuries may be preventable[40–42]. Further research is needed to examine whether overuse injuries are a direct contributor to veterans' risk for OA. In addition, research is needed to examine

Table 4. Arthritis symptoms and limitations according to veteran status and VA healthcare status. Data weighted by age, race, and sex to population of 36 states that completed the BRFSS arthritis module. Analyses are adjusted for age, sex, race, marital status, education, and BMI.

	OR for Veterans Not Receiving VA Care*	95% CI	p	OR for VA Healthcare Users*	95% CI	p
Chronic joint symptoms†	1.02	0.88–1.19	0.792	1.85	1.48–2.31	< 0.001
Activity limitation††	0.95	0.82–1.10	0.479	2.05	1.75–2.41	< 0.001

* Reference group: non-veterans. † Defined as having joint symptoms on most days for at least one month during the past year. †† Defined as having chronic joint symptoms and being limited in any way due to joint symptoms.

Table 5. Relationships of demographic characteristics with self-reported arthritis according to veteran status.

	Non-Veterans			Veterans:Non-VA Users			Veterans:VA Users		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Age, yrs									
18–44	1.00			1.00			1.00		
45–64	4.05	3.90–4.21	< 0.001	2.82	2.55–3.13	< 0.001	2.57	1.94–3.40	< 0.001
65+	9.59	8.83–10.42	< 0.001	5.39	4.70–6.17	< 0.001	2.83	2.22–3.61	< 0.001
Sex									
Male	1.00			1.00			1.00		
Female	1.71	1.61–1.81	< 0.001	1.84	1.56–2.24	< 0.001	1.40	1.02–1.92	0.038
Race									
Caucasian	1.00			1.00			1.00		
Other	0.71	0.59–0.86	0.001	0.68	0.50–0.94	0.017	1.08	0.79–1.47	0.615
Marital status									
Not married	1.00			1.00			1.00		
Married	0.87	0.85–0.90	< 0.001	1.08	0.97–1.21	0.149	1.12	0.91–1.37	0.293
Education									
High school	1.00			1.00			1.00		
Post-high school	0.74	0.69–0.80	< 0.001	0.85	0.78–0.93	< 0.001	0.94	0.80–1.09	0.404
BMI									
18.5–24.9 (normal)	1.00			1.00			1.00		
< 18.5 (underweight)	1.11	1.01–1.24	0.040	1.34	0.90–2.00	0.149	1.37	0.68–2.90	0.410
25–29.9 (overweight)	1.41	1.36–1.47	< 0.001	1.29	1.17–1.43	< 0.001	1.21	0.99–1.47	0.060
30+ (obese)	2.43	2.33–2.55	< 0.001	1.88	1.67–2.12	< 0.001	1.79	1.43–2.25	< 0.001

potential risk factors for other forms of arthritis (such as RA) among veterans.

Among US veterans in this study, VA healthcare users were twice as likely to report doctor-diagnosed arthritis than nonusers, even when controlling for demographic variables. One likely reason for this difference is that, in general, VA healthcare users tend to have overall poorer health status than those who receive medical care elsewhere[30,31,43]. In addition, VA healthcare users are more likely to have a military service-connected disability, which may include orthopedic problems. It is also possible that veterans within the VA healthcare system receive more regular or frequent medical care than those outside the VA system. Therefore they may be more likely to receive an evaluation and diagnosis from a physician when they are experiencing joint pain.

In addition to differences in the prevalence of doctor-diagnosed arthritis, this study showed variations in arthritis symptoms and activity limitation according to veteran status and healthcare use status. Specifically, VA healthcare users were about twice as likely to report chronic joint symptoms and activity limitation compared to both non-veterans and veterans who did not use VA healthcare. In contrast, veterans who did not use VA healthcare services did not differ significantly from non-veterans. These results show that among individuals with arthritis, VA healthcare users appear to have more severe disease, involving pain and functional limitation. Again, this may be due to this group's overall poorer health status and military service-connected disabilities.

This study identified few differences in predictors of doctor-diagnosed arthritis according to veteran status. Interestingly, although increasing age was associated with greater odds of arthritis in all 3 groups, this was a weaker predictor among veterans (and especially VA healthcare users) compared to non-veterans. This may be because veterans are at increased risk for arthritis at younger ages, partly due to military service and combat-related orthopedic injuries. Race and education were significant predictors of arthritis among non-veterans and veteran non-VA healthcare users, but not among VA healthcare users. This may be partly due to greater socioeconomic homogeneity among VA healthcare users, who tend to have lower income levels than the general population[44]. Thus, factors typically associated with socioeconomic status (i.e., education level) may not be strong risk factors for some medical conditions in this population.

There are several limitations to this study. These data rely on self-reports, and arthritis diagnoses were not confirmed by a physician. In addition, the BRFSS arthritis questions are global and do not distinguish between specific diagnoses (i.e., OA, RA, and other types of arthritis). However, studies have shown that self-reports of specific types of arthritis are not accurate[45,46]. There are also limitations to the chronic joint symptoms and activity limitation questions. The chronic joint symptoms item is general and does not refer specifically to arthritis. The activity limitation item refers to joint symptoms, but it is not limited to arthritis-related symptoms. Therefore it is possible that some chronic joint symptoms and activity limitation were caused by conditions other than arthritis. However, we only examined these questions among individuals who reported having a doctor's diagnosis of arthritis. Therefore we believe that the majority of chronic joint symptoms and joint-related activity limitation are

related to arthritis among this group. The BRFSS does not include individuals without telephone service or in institutions. This may result in underrepresentation of individuals with low socioeconomic status and health or activity limitations[23,47]. The response rate for the BRFSS in 2000 was 49%. However, data were weighted to the US population to account for noncoverage and nonresponse bias. Because this is a cross-sectional design, causal relationships between military status and arthritis cannot be inferred.

In summary, this study showed that US veterans — particularly VA healthcare users — have a higher arthritis burden than non-veterans. Results of this study have important implications for both the military and the VA healthcare system. Individuals entering military service, both in the US and in other countries[37], may benefit from comprehensive physical screening to identify predisposing factors for orthopedic injury, such as skeletal malalignment, ligamentous laxity, or muscular imbalances[48]. Preventive measures, such as foot orthotics, supportive shoes, bracing, and individualized stretching and strengthening programs, may reduce the risk of injury in this population. The US VA healthcare system is faced with treating a large number of veterans with arthritis, whose joint symptoms and limitations are more severe than the general population of individuals with arthritis. Further, the burden of treating these veterans with arthritis will increase as the number of older veterans grows during the next several decades[5,6]. While medications are the cornerstone of medical treatment for arthritis, they are limited in their ability to control pain and other symptoms. Self-care behaviors such as exercise, weight control, and cognitive strategies have been shown to improve arthritis symptoms, but they are vastly underutilized[49]. The VA healthcare system, as well as other healthcare organizations, must consider ways to effectively disseminate low-cost interventions that enhance self-management among patients with arthritis.

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