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Cardiovascular Disease Risk Factors Among Male Veterans, U.S., 2009–2012

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Abstract

Introduction: Cardiovascular disease remains an important cause of death in the U.S. where veterans of the U.S. Armed Forces represent a significant segment of the population. Limited national estimates of cardiovascular disease risk factors using physical measurements and reported veteran status in the U.S. civilian population have been reported. The purpose of this study was to compare the prevalence of cardiovascular disease risk factors among veteran and non-veteran men in the U.S. civilian population.

Methods: Using data from the 2009–2012 National Health and Nutrition Examination Surveys, 1,107 veteran and 3,972 non-veteran men were identified for this study (analyzed in 2014–2015). Differences in hypertension, dsylipidemia, diabetes, obesity, and smoking between veterans and non-veterans were compared using chi-square and *t*-tests. Predicted prevalence from multivariable logistic regression models adjusted for age, race/Hispanic origin, and poverty level were used to assess whether previous military service was associated with having a cardiovascular disease risk factor.

Results: Veteran men were older than non-veteran men (59.9 years vs 43.4 years) and were more likely to be non-Hispanic white (79.9% vs 65.7%). Adjusted predicted prevalence estimates show that veterans were more likely than non-veterans to be obese (42.6% vs 33.7%, $p<0.01$). After adjustment for obesity, there was no difference in hypertension, dyslipidemia, diagnosed diabetes, or smoking between veteran and non-veteran men.

Conclusions: This study identified a segment of the U.S. civilian population—veteran men—who have a higher prevalence for obesity, a risk factor associated with increased risk for other cardiovascular disease risk factors.

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Introduction

Military service has been shown to have a profound impact on later health behaviors and outcomes.[1–5] Ischemic heart disease is the leading cause of morbidity and mortality among U.S. veterans who use the Veterans Affairs healthcare system.[6] In 2012, male veterans were 18% of all U.S. men aged 20 years and older,[7,8] representing a significant group with unique characteristics and needs in the U.S. population.

Many studies of veteran's health have focused on information from military and veteran databases.[9–14] Several nationally representative studies have used self-reported outcomes to describe the health and health behaviors of veterans.[4,15–21] Sources of information with both measurements of health status and reported veterans status in the general population are limited. The objective of this study was to compare recent national estimates of cardiovascular disease (CVD) risk factors (hypertension, diabetes, dyslipidemia, obesity, and smoking) in veteran and non-veteran men using objective measurements.

Methods

Data from the National Health and Nutrition Examination Survey (NHANES), a complex, multistage, probabilistic survey conducted by the National Center for Health Statistics (NCHS), CDC were analyzed. NHANES consists of nationally representative samples of the U.S. civilian, non-institutionalized population. Participants complete interviews in the home, and physical assessments, including collection of blood samples and measurement of blood pressure, weight, and height, in a mobile examination center. NHANES was approved by the NCHS Research Ethics Review Board and written informed consent was obtained from study participants.[22]

Primary analyses used data from 2009–2012. Potential trends were investigated using data from 2001–2004 and 2005–2008. This study was limited to men with known veteran status who had non-missing data for all CVD risk factors. Sample sizes are shown in Table 1.

Measures

Veterans were identified as people with a positive response to having served in the Armed Forces of the U.S. Hypertension was defined as having a systolic blood pressure ≥140 mmHg, a diastolic blood pressure ≥90 mmHg, or self-reported current use of a hypertension medication. Diagnosed diabetes was defined as a self-reported physician diagnosis of diabetes. Dyslipidemia was defined as non–high density lipoprotein ≥160 mg/dL or self-report of currently taking cholesterol-lowering medication. Obesity was defined as BMI (weight in kilograms divided by height in meters squared) ≥30. Current smoking was defined as smoking at least 100 cigarettes during one's lifetime and now smoking cigarettes every day or some days or having a measured serum cotinine level >10 ng/mL.

Statistical Analysis

Crude and age-standardized (defined in footnote, Table 2) prevalence estimates of each CVD risk factor were calculated and compared by veteran status using *t*-tests. Multivariable logistic regression models, adjusted for age, race/Hispanic origin, poverty level, and obesity

for hypertension, dyslipidemia, diagnosed diabetes, and smoking, were used to calculate predicted prevalence of CVD risk factors. No significant interactions between age and veteran status or race and veterans status were found. Linear trends between the 2001–2004 and 2009–2012 age-standardized prevalence of each CVD risk factor by veteran status were tested using orthogonal polynomials. Statistical testing was performed using an α-level of 0.05.

Analyses were conducted during 2014 and 2015 using SAS, version 9.3 and SUDAAN, version 11.0 to account for the complex survey design. All analyses incorporated examination sampling weights.

Results

Of the 5,549 men aged ≥20 years examined in 2009–2012, a total of 470 were missing at least one measurement. This resulted in a study sample of 1,107 veteran and 3,972 non-veteran men. Table 1 shows the distribution of demographic characteristics among men according to veteran status. There were differences in the distribution of age, race/Hispanic origin, and poverty level by veteran status. During 2009–2012, veterans on average were older, more likely to be non-Hispanic white, and less likely to be in the lowest income group than non-veterans.

Table 2 shows the crude, age-standardized, and adjusted predicted prevalence of CVD risk factors among men by veteran status. During 2009–2012, close to 57% of veterans had dyslipidemia, 51% had hypertension, 41% were classified as obese, 29% were current smokers, and 16% had diagnosed diabetes. In contrast to crude estimates, age-standardized (41.8% vs 33.5%, $p<0.05$) and predicted (42.6% vs 33.7%, $p<0.01$) prevalence estimates show that veterans significantly differed from non-veterans only in obesity. Because obesity is associated with other CVD risk factors, the predicted prevalence estimates were adjusted for obesity, in addition to age, race, and income. In 2009–2012, none of the other CVD risk factors' (hypertension, dyslipidemia, diagnosed diabetes, or smoking) predicted that prevalence differed by veteran status.

Hypertension, dyslipidemia, and diagnosed diabetes remained stable across survey years for both veterans and non-veterans. Obesity and smoking prevalence, however, had less favorable trends among veterans than non-veterans. Among veterans, the age-standardized prevalence of obesity increased significantly between 2001–2004 and 2009–2012 (31.3% to 41.8%, $p<0.01$) whereas there was no statistically significant change in obesity among non-veterans. Although the magnitude of decline in smoking prevalence was similar in veterans (40.7% to35.7%, $p>0.05$) and non-veterans (35.8% to 30.3%, $p<0.01$), the change was only statistically significant among non-veterans.

Discussion

To the authors' knowledge, this study provides the most-recent national estimates of CVD risk factors for veteran and non-veteran men based on measured values. After adjusting for age, race/Hispanic origin, and income, in 2009–2012, veteran men were more likely to be

obese than non-veteran men. After adjustment for obesity, no difference by veteran status was found for hypertension, dyslipidemia, diagnosed diabetes, or smoking.

The findings for obesity are consistent with other studies that have reported high rates of overweight and obesity among veterans.[15,20] A previous study,[23] using NHANES data for 1999–2008 combined, investigated overweight and obesity among veterans but combined men with women, making it difficult to interpret for men only. Other studies of veterans have found associations with heart disease or heart failure. For example, a 20-year community-based cohort study[2] found that veteran status was associated with heart disease after controlling for socioeconomic data, health behaviors, BMI, and depressive symptoms. Another recent study[1] that investigated the impact of post-traumatic stress disorder (PTSD) on heart failure found that PTSD along with age, diabetes, hypertension, overweight, obesity, and combat service were all predictors.

A strength of this study is the use of laboratory and examination measures to define CVD risk factors. However, because NHANES is a survey of the non-institutionalized population, veterans with chronic conditions may not be well represented. Moreover, the sample size for male veterans is relatively small, leading to some wide CIs and noticeable observed differences that are not significant. Length of military service was not available and may influence prevalence of CVD risk. Finally, source of health care, which may be useful for policy, was not ascertained in this study.

Conclusions

Veteran men are more likely than non-veteran men to be obese. Over the last 12 years, the prevalence of obesity increased among male veterans but not among non-veteran U.S. men. There are race/ethnic disparities in obesity. Given that the number of African American and Hispanic veterans is projected to almost double in size by 2040,[24] disparities by veteran's status may also increase. This suggests the need to monitor the impact of changing demographics on CVD risk factors, including obesity, among veterans.

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Table 1.

Characteristics of Study Sample by Veteran Status, U.S. Men, 2001–2012

	2001–2004				2005–2008				2009–2012			
	Veteran				Veteran				Veteran			
	Yes		No		Yes		No		Yes		No	
Age (y), n mean *	1,273	57.2	2,873	40.5	1,241	59.8	3,351	42.1	1,107	59.9	3,972	43.4
Age group (y), n % **												
20–39	111	13.8	1,263	49.8	103	11.7	1,391	45.9	113	12.8	1,588	42.8
40–59	357	41.9	978	40.4	276	33.2	1,203	42.5	247	30.5	1,445	41.7
≥60	805	44.3	632	9.8	862	55.1	757	11.7	747	56.7	939	15.5
Race and Hispanic origin, [a] n % **												
Mexican American	118	2.4	745	10.0	73	2.5	764	11.0	79	3.1	675	10.3
Non-Hispanic white	900	84.1	1,331	69.7	848	83.4	1,481	68.3	673	79.9	1,561	65.7
Non-Hispanic black	208	8.2	555	9.9	261	9.5	675	9.9	260	10.3	801	9.8
Poverty level, [b] n % **												
<130%	198	12.0	771	18.8	210	11.3	912	18.2	194	12.1	1,276	23.0
130% – <350%	506	37.4	1,034	35.5	515	41.1	1,182	34.7	415	37.9	1,268	33.7
≥ 350%	496	50.6	910	45.7	441	47.6	1,033	47.1	419	50.0	1,069	43.4

Source: National Health and Nutrition Examination Survey.

* $p<0.001$ based on *t*-test of difference within each survey period.

** $p<0.001$ based on chi-square analyses within each survey period. Percentages and means are weighted values.

[a] Estimates will not sum to 100% because other race and Hispanic origin groups (including multiple races) are not shown in table but included in calculation of percentages.

[b] Poverty level based on family income-to-poverty ratio; 968 (7%) missing poverty level data from 2001–2012.

N, unweighted sample size; y, years

Table 2.

Prevalence (%, [CI]) of Cardiovascular Disease Risk Factors by Veteran Status, U.S. Men, 2001–2012

	2001–2004		2005–2008		2009–2012	
	Veteran		Veteran		Veteran	
	Yes	No	Yes	No	Yes	No
Obesity						
Crude	30.3 (27.8–32.9)	29.4 (27.5–31.4)	**36.5 (32.7–40.5)** *	32.0 (29.3–34.9)	**41.2 (36.6–46.0)** **	33.8 (31.4–36.3)
Age standardized[a]	31.3 (27.5–35.3)	30.5 (28.5–32.6)	36.6 (31.2–42.4)	32.6 (30.1–35.2)	**41.8 (35.6–48.1)** *	33.5 (31.1–36.0)
Adjusted[b]	28.0 (25.3–30.9)	30.4 (28.2–32.7)	35.2 (31.2–39.5)	32.7 (30.0–35.4)	**42.6 (37.5–47.8)** **	33.7 (31.3–36.2)
Hypertension						
Crude	**43.2 (39.7–46.8)** ***	22.9 (20.5–25.5)	**50.7 (47.6–53.8)** ***	25.2 (23.5–27.1)	**50.8 (45.7–55.8)** ***	26.8 (24.4–29.4)
Age standardized[a]	30.4 (27.2–33.8)	28.6 (25.9–31.5)	**33.7 (30.3–37.2)** *	29.6 (27.9–31.5)	34.6 (29.7–39.9)	29.8 (28.0–31.7)
Adjusted[c]	30.4 (27.6–33.3)	27.5 (24.7–30.4)	**34.6 (31.5–37.9)** **	30.0 (28.0–32.1)	34.4 (29.9–39.2)	31.2 (28.7–33.9)
Dyslipidemia						
Crude	**56.7 (52.9–60.4)** ***	45.2 (42.8–47.6)	**56.2 (52.3–60.0)** ***	45.2 (42.9–47.6)	**56.6 (53.1–60.0)** ***	46.4 (44.8–48.1)
Age standardized[a]	52.2 (47.3–57.0)	47.7 (45.2–50.2)	49.7 (43.4–56.1)	46.7 (44.6–48.8)	47.6 (43.9–51.5)	47.2 (45.7–48.7)
Adjusted[c]	50.4 (46.5–54.4)	48.0 (45.5–50.4)	50.0 (44.8–55.1)	47.1 (44.6–49.5)	49.2 (45.3–53.1)	48.3 (46.6–50.0)
Diagnosed diabetes						
Crude	**11.7 (9.8–13.8)** ***	5.5 (4.8–6.4)	**11.9 (9.8–14.4)** ***	6.6 (5.7–7.6)	**16.4 (14.4–18.7)** ***	7.4 (6.5–8.5)
Age standardized[a]	8.8 (6.9–11.3)	8.0 (7.0–9.2)	7.3 (5.6–9.4)	8.3 (7.2–9.6)	10.1 (8.4–12.2)	8.5 (7.5–9.6)
Adjusted[c]	7.6 (6.2–9.3)	6.7 (5.6–7.9)	7.4 (6.0–9.2)	8.0 (6.8–9.4)	10.4 (8.8–12.3)	8.8 (7.7–10.2)
Smoking						
Crude	**33.2 (30.0–36.6)** **	38.1 (34.7–41.7)	**28.7 (24.5–33.2)** ***	36.8 (34.2–39.4)	28.6 (24.5–33.1)	31.3 (28.8–33.9)
Age standardized[a]	**40.7 (36.2–45.4)** *	35.8 (32.5–39.3)	37.7 (32.1–43.7)	34.6 (32.2–37.1)	35.7 (30.4–41.4)	30.3 (27.8–32.9)
Adjusted[c]	**40.6 (37.2–44.0)** *	35.6 (32.2–39.1)	36.3 (31.6–41.2)	34.1 (31.6–36.7)	32.8 (27.5–38.6)	29.8 (27.5–32.2)

Source: National Health and Nutrition Examination Survey.

Note: Boldface indicates statistical significance.

[*] $p<0.05$;

[**] $p<0.01$;

[***] $p<0.001$, based on *t*-test of difference between veterans and non-veterans within each survey period.

[a] Age-standardized by the direct method to the 2000 U.S. Census Bureau population using age groups 20–39, 40–59, and ≥60 years.

[b] Predicted prevalence from logistic regression models adjusted for age group, race and Hispanic origin, and poverty level.

[c] Predicted prevalence from logistic regression models adjusted for age group, race and Hispanic origin, poverty level, and obesity.