The Burden of Obesity Among a National Probability Sample of Veterans

Karin M. Nelson, MD, MSHS^{1,2,3}

¹Primary and Specialty Medical Care Service, VA Puget Sound Health Care System, Seattle, WA, USA; ²Department of Medicine, University of Washington, Seattle, WA, USA; ³Health Services Research and Development, VA Puget Sound Health Care System, Seattle, WA, USA.

BACKGROUND: Few national data exist about the prevalence of obesity and the resulting health burden among veterans.

METHODS: We analyzed data from the 2003 Behavioral Risk Factor Surveillance System ($n=242,362$) to compare rates of obesity among veterans who do and do not utilize the VA, compared with nonveterans. We used bivariate analyses to describe the association of obesity with lifestyle factors, disability, and comorbid disease, and multivariate analysis to assess the independent association of obesity with VA care.

RESULTS: Veterans who use the VA for health care have the highest rates of obesity compared with veterans who do not use the VA and nonveterans (27.7% vs 23.9% vs 22.8%, $P<.001$). Only 27.8% of veterans who receive health care at the VA are of normal weight (vs 42.6% of the general population, $P<.001$), 44.5% are overweight, 19.9% have class I obesity, 6% have class II obesity, and 1.8% are morbidly obese (an estimated 82,950 individuals). Obese veterans who utilize the VA for services have higher rates of hypertension (65.8%) and diabetes (31.3%), are less likely to follow diet and exercise guidelines, and more likely to report poor health and disability than their normal-weight counterparts.

CONCLUSIONS: Veterans who receive care at the VA have higher rates of overweight and obesity than the general population. At present, less than half of VA medical centers have weight management programs. As the largest integrated U.S. health system, the VA has a unique opportunity to respond to the epidemic of obesity.

KEY WORDS: veterans; obesity.

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Overweight and obesity have reached epidemic proportions in the United States.¹ The most recent data from the National Health and Nutrition Examination Surveys (NHANES) for 1999 to 2000 reported age-adjusted rates for obesity of 30% for U.S. adults, an increase of almost 8% since NHANES III in 1994 to 1998.¹ Lifestyle factors including excess calorie and fat intake and low levels of physical activity are central causes of obesity. The disease burden of overweight and obesity is well documented.² Obesity is associated with higher rates of hypertension, dyslipidemia, diabetes, osteoarthritis, and coronary artery disease.² Obesity and overweight are also associated with poorer quality of life, earlier mortality, and increased health care costs.³⁻⁶

There are limited U.S. national epidemiological data on the prevalence of overweight and obesity, levels of physical activity and nutritional intake, and the health burden associated with obesity among veterans.⁷⁻⁹ Previous studies are limited by the use of convenience sampling, incomplete

data, and data from a single VA site.^{7,8} Although well studied within the general population,² the health effects of obesity among veterans are not well described. The objectives of this study are to determine the prevalence of overweight and obesity among veterans using a national probability sample of the U.S. adult population and to describe the association of obesity with lifestyle factors (diet and physical activity), health status, and disability, and with comorbid diseases (coronary heart disease, diabetes, arthritis, high blood pressure, and dyslipidemia) among veterans who do and do not utilize the VA for health care services as well as nonveterans.

METHODS

Study Population

We analyzed data from the 2003 Behavioral Risk Factor Surveillance System (BRFSS), a cross-sectional telephone survey of the civilian, noninstitutionalized adult population over the age of 18 years. This federally funded survey is conducted annually by the Centers for Disease Control and Prevention (CDC). The survey selects state-specific probability samples of households using a multistage cluster design to produce a nationally representative sample. Each respondent is assigned a final sampling weight based on their probability of selection and a poststratification factor to assure that the age and race distribution of the weighted sample agrees with population estimates from the U.S. Census Bureau. The BRFSS uses random-digit dialing within blocks of telephone numbers to identify a probability sample of households with telephones in each state. In each household, 1 adult is randomly identified and interviewed. Adults living in institutions such as nursing homes, prisons, or college dormitories are not eligible to be interviewed.

In 2003, 264,684 adults participated in the BRFSS study, with a response rate of 53%.¹⁰ Respondents were included in this study if the individual was 18 years of age or older and reported height, weight, and veteran status ($n=242,362$). Behavioral Risk Factor Surveillance System data are in the public domain, and this study was granted an exemption from review by the Institutional Review Board at the University of Washington.

Study Variables

Veteran Status and Use of VA Services. Veteran status and use of VA facilities for health care were assessed with a series of questions. All respondents were asked: "Have you ever served on active duty in the United States Armed Forces?" If they an-

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Address correspondence and requests for reprints to Dr. Nelson: 1660 South Columbian Way, S-111-GIMC, Seattle, WA 98108-1597 (e-mail: Karin.Nelson@va.gov).

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swered affirmatively and were not in active military service, they were considered to be a veteran and were then asked: "In the past 12 months, have you received some or all of your health care from VA facilities?"

Obesity and Overweight. Individuals reported height in inches and weight in pounds. Body mass index (BMI) was calculated as the weight in kilograms divided by the squared height in meters. The National Heart, Lung, and Blood Institute's definition for the cutoff points between normal weight, overweight, and obesity were used.¹¹ Individuals were classified as: underweight (BMI < 18.5 kg/m²), normal (BMI 18.5 to 24.9 kg/m²), overweight (BMI 25 to 29.9 kg/m²), class I obesity (BMI 30 to 34.9 kg/m²), class II obesity (BMI 35 to 39.9 kg/m²), and class III or morbid obesity (BMI > 40 kg/m²). Behavioral Risk Factor Surveillance System data have a high reliability for categorizing individuals as obese or normal weight, but compared with the measured values, underestimate the prevalence of obesity.¹²

Sociodemographics, Comorbid Disease, Health Status, and Disability. The population was categorized by demographic characteristics including: (1) age in years (age 18 to 39, 40 to 59, 60+); (2) gender; (3) race/ethnicity (white, African American, Hispanic, other); and (4) annual income (less than \$15,000, \$15,000 to 24,999, \$25,000 to 34,999, \$35,000 to 49,999, and ≥\$50,000). Obesity and overweight have been linked to a number of disease and metabolic abnormalities, such as coronary artery disease, arthritis, diabetes, hypertension, and dyslipidemia.² Individuals were asked whether they had a personal history of these conditions. Smoking status (current, previous, never) was also ascertained. Because obesity has been associated with lower quality of life among veterans,⁵ health status (responses: excellent, very good, good, fair, or poor health), and level of disability were analyzed. Respondents were asked about limitations in any activities due to physical, mental, or emotional problems, and the use of equipment (for example, a cane, wheelchair, or special bed) due to health problems. Respondents were also asked the number of days in the past month where (1) their physical health (including physical illness or injury) was not good; (2) their mental health (including stress, depression, and problems with emotions) was not good; and (3) how many days their physical or mental health problems kept them from doing usual activities. Restricted days due to mental or physical health problems were categorized into 2 groups (0 to 13 days, 14 or more days during the past month).¹³ A 14-day period was selected because a similar period is used as a marker for clinical depression and anxiety, and persons who report 14 or more days of recent mental health problems have a high level of disability.¹³

Data collected from the BRFSS questions related to socio-demographic information, hypertension, diabetes, and dyslipidemia have good reproducibility and validity.¹⁴ The reliability and validity of BRFSS data on smoking status are high, although the prevalence of current smoking is slightly less than estimates obtained from biochemical measures.¹²

Nutritional Intake and Physical Activity. Respondents reported the number of fruits and vegetables consumed per day. Individuals were asked whether they performed any leisure time physical activity during the past 30 days other than the

respondent's regular job. Respondents were asked to report the type of physical activity and the time spent. Physical activity was classified as moderate or vigorous intensity using previously validated measures based on metabolic-equivalent (MET) intensity levels.¹⁵ Individuals were considered to fulfill national recommendations for physical activity if they reported doing 20 or more minutes per day of vigorous physical activity 3 or more days per week, or if they reported doing 30 minutes or more per day of moderate physical activity 5 or more days per week.¹⁶ Persons reporting some physical activity during the preceding month but not at or above the recommended frequencies were classified as performing insufficient physical activity.

Data Analysis

All analyses took into account the complex survey design and weighted sampling probabilities, and were performed using SUDAAN software (Research Triangle Institute, Research Triangle Park, NC, 1989). Bivariate analyses were used to describe differences in rates of obesity, lifestyle habits (nutritional intake and physical activity), and the health burden of obesity in the veteran population as compared with nonveterans. Using bivariate analysis to calculate proportions and 95% confidence intervals, differences in rates of obesity and overweight were calculated between veterans who utilize the VA for health care compared with veterans who do not use the VA and the nonveteran populations. Bivariate analysis was used to assess the association of obesity with level of physical activity (inactive, insufficient, or recommended levels), nutritional intake (number of daily fruits/vegetables), health status and disability, and comorbid diseases (including hypertension, dyslipidemia, diabetes, arthritis, and coronary heart disease) in veterans as compared with nonveterans. Multivariate logistic regression was used to assess the independent association of obesity with VA care, controlling for the effects of age, gender, and race/ethnicity.

RESULTS

Among the 2003 BRFSS sample, 86.3% reported being nonveterans, 11.3% were veterans who did not use the VA for services, and the remaining 2.4% were veterans who utilized the VA for care (population estimate 4,688,500; Table 1). Veterans who used the VA for services had the highest rates of obesity (27.7%) compared with nonveterans (22.8%) or veterans who did not use the VA for services (23.9%). Among veterans who used the VA for services, 72.2% were either overweight or obese, significantly more than 57.4% of individuals in the general population. An estimated 82,950 veterans (1.8%) who use the VA for care were morbidly obese (data not shown). Significant demographic differences were noted between veterans and nonveterans (Table 1). Veterans who used the VA for services were more likely to be 60 years of age or older, male, African American, and to report lower incomes than the general population. Veterans who utilized the VA for services had much higher reported rates of hypertension, dyslipidemia, diabetes, arthritis, and coronary artery disease. Veterans were more likely to be current or previous smokers. Veterans who utilized the VA were much more likely to report poor health, more disability days due to poor mental or physical health, with limitations in their activities due to these

Table 1. Rates of Obesity and Demographics of Nonveterans and Veterans, BRFSS 2003, n=242,362

	Nonveteran N=208,913	Veteran Who Uses VA N=6,338	Veteran With No Use of VA N=27,111
Population Estimate (%)	171,610,584 (86.3)	4,688,500 (2.4)	22,557,044 (11.3)
	(%)	(%)	(%)
Weight category [‡]			
Underweight	2.1	1.1	0.5*
Normal	40.5	26.7	27.4
Overweight	34.6	44.5	48.2
Obese	22.8	27.7	23.9
Age (y)			
18 to 39	44.4	9.1	14.4*
40 to 59	36.5	33.8	38.6
> 60	19.1	57.1	47.0
Male	40.7	94.4	94.4*
Race/ethnicity			
White	69.6	75.9	83.3*
African American	9.8	13.6	7.2
Hispanic	14.6	5.5	5.8
Other	6.0	5.0	3.7
Annual income [‡]			
<\$15 000	12.3	15.0	5.7*
\$15 to 24,999	18.2	25.6	14.4
\$25 to 34,999	13.5	18.9	14.8
\$35 to 49,999	16.6	18.0	19.9
>\$50,000	39.4	22.5	45.2
Hypertension	23.7	55.6	37.2*
Dyslipidemia	31.9	51.9	42.1*
Diabetes	6.7	20.1	11.6
Arthritis	25.6	51.5	35.4*
Coronary artery disease	5.2	25.3	13.6*
Smoker			
Current	22.1	24.7	22.5*
Previous	21.6	46.8	44.7
Never	56.3	28.5	32.8
Health status			
Excellent	21.6	11.3	19.2*
Very good	33.2	22.2	32.7
Good	29.4	33.1	31.4
Fair	11.6	21.5	11.6
Poor	4.2	11.9	5.0
Activities limited by health problems	17.9	41.3	22.2*
Require special medical equipment	5.8	19.8	7.4*
14+ d/past month of poor physical health	10.5	22.4	11.6*
14+ d/past month of poor mental health	10.6	13.1	7.0*
14+ d/past month health-restricted activities	9.6	20.1	9.3*
Met recommendations for physical activity [§]	45.7	42.6	46.8*
Insufficient physical activity	38.8	34.8	38.3
No physical activity	15.5	22.6	14.9
5 or more fruits and vegetables/day	23.9	20.8	20.1*

* χ^2 , $P < .001$.

Column totals may vary due to rounding error.

[‡]Data available for n = 221,050.[§]Underweight BMI < 18.5 kg/m²; Normal BMI 18.5–25 kg/m²; Overweight BMI 25 to 29.9 kg/m²; Obese BMI ≥ 30 kg/m².[§]20+ minutes/day of vigorous physical activity, 3+ days/week, or 30+ minutes/day of moderate physical activity, 5+ days/week.

BMI, body mass index; BRFSS, Behavioral Risk Factor Surveillance System.

Table 2. Adjusted Odds of Obesity by Veteran and Demographic Groups

	Odds Ratio [‡]	95% CI
All or some care at the VA	1.17	1.04, 1.31 [†]
No care at the VA	0.99	0.94, 1.06
Nonveteran	Reference group	
Age (y)		
60 or greater	1.25	1.19, 1.31*
40 to 59	1.55	1.48, 1.62*
18 to 39	Reference group	
Female gender	0.94	0.90, 0.98 [†]
Race/ethnicity		
Hispanic	1.29	1.19, 1.39*
African American	1.89	1.78, 2.00*
Other	0.62	0.56, 0.69*
White	Reference group	

* $P < .001$.[†] $P < .05$.[‡]OR > 1 associated with BMI ≥ 30 kg/m².

OR, odds ratio; CI, confidence interval.

health problems. Veterans who utilized the VA were less likely to meet national guidelines for physical activity or eat the recommended daily number of fruits and vegetables than non-veterans. In multivariate analysis, veterans who utilized the VA for health care were more likely to be obese (BMI > 30 kg/m²), controlling for age, race/ethnicity, and gender (Table 2).

Table 3 presents rates of comorbid disease, disability, and lifestyle factors among veterans who utilized the VA for services by weight category (n = 6,338). Obese veterans who utilized the VA reported very high rates of hypertension (65.8%), diabetes (31.3%), and arthritis (57.0%) compared with overweight or normal-weight veterans who used the VA. Obese veterans were more likely to report fair or poor health, 14 or more days of poor physical or mental health in the past month, and limitations in their daily activities due to health problems. Obese veterans who use the VA were less likely to report eating the recommended daily number of fruits and vegetables, or meeting national guidelines for physical activity. The majority of obese veterans who used the VA reported either insufficient (35.3%) or no physical activity (27.4%), and only 19.2% reported eating 5 or more fruits and vegetables per day. There were no significant differences in income or race/ethnicity by weight category among veterans who utilized the VA (data not shown).

DISCUSSION

Veterans who received health care from the VA had higher rates of obesity than the general population, with significant levels of associated comorbid disease and disability, and low rates of preventive health behaviors. These results provide national estimates and extend previous studies on rates of obesity among veterans, which have been limited by convenience sampling of VA medical centers,⁷ incomplete data,⁷ and a single site location.⁸ A previous study using older data from the 2000 BRFSS did not compare rates of obesity among veterans with the general population or describe the associated health burden of obesity among veterans.⁹ The results of the current study show a substantial health burden from obesity among veterans cared for by the VA. Almost two thirds of this obese

Table 3. Risk Factors, Disability, and Unhealthy Lifestyles Among Veterans Who Utilize the VA, *n*=6,338

	Normal <i>n</i> =1,823 (%)	Overweight <i>n</i> =2,818 (%)	Obese <i>n</i> =1,697 (%)
Comorbid conditions			
Hypertension	47.1	54.5	65.8*
Dyslipidemia	49.3	50.8	56.7
Diabetes	14.1	18.1	31.3*
Arthritis	48.4	50.0	57.0†
Coronary heart disease	23.7	25.6	26.6
Current smoker	31.4	20.8	29.9†
Health status			
Excellent	12.3	13.7	6.5*
Very good	23.5	23.5	19.1
Good	30.9	33.3	35.2
Fair	20.3	20.2	24.1
Poor	13.0	9.3	15.1
Activities limited by health problems	40.8	37.5	47.3†
Require special medical equipment	18.6	16.1	26.7*
14+ d/past month of poor physical health	21.3	19.5	27.2†
14+ d/past month of poor mental health	11.8	11.7	16.2†
14+ d/past month health-restricted activities	19.3	15.3	27.8*
Met recommendations for physical activity†	43.2	45.9	37.3†
Insufficient physical activity	35.9	33.9	35.3
No physical activity	20.9	20.2	27.4
> 5 or more fruits and vegetables/d	24.3	19.5	19.2†

* χ^2 , $P < .001$. † $P < .05$. ‡20+ minutes/day of vigorous physical activity, 3+ days/week, or 30+ minutes/day of moderate physical activity, 5+ days/week.

population reported comorbid hypertension, one half had dyslipidemia or arthritis, and one third had diabetes. In addition, obese veterans reported poorer health status and more disability days, consistent with previous studies showing an association between obesity and quality of life among veterans.⁵

The high rates of obesity and overweight among veterans have important health policy and economic implications for the VA, as almost three quarters of veterans were overweight or obese. Previous studies show that obese patients have more hospitalizations, prescription drugs, professional claims, outpatient visits, and higher costs.^{4,6} A study by Raebel et al.⁴ estimated that, after controlling for age, sex, and chronic disease, a person with a BMI of 40 kg/m² is likely to consume \$115 more in health care costs per year compared with a person with a BMI of 25 kg/m². Five obesity-related diseases (hypertension, dyslipidemia, diabetes, coronary artery disease, and stroke) accounted for approximately 85% of the economic burden of obesity.¹⁷ Given the long-term cost implications of obesity among younger individuals¹⁸ and the increasing prevalence of overweight and obesity among active service personnel,¹⁹ VA may need to consider strategies to work in conjunction with the armed forces to decrease rates of obesity and overweight in this population.

There is a wide continuum of weight loss strategies showing varied short-term and long-term effectiveness.²⁰ A recent systematic review of interventions to treat obesity found counseling to modify diet and exercise, and pharmacotherapy promoted modest sustained weight loss and improved clinical outcomes.²⁰ Among selected patient populations, bariatric surgery has been shown to promote significant weight loss.^{20,21} At the current time, less than half of VA medical centers have

weight management and/or physical activity programs, and these programs are highly variable.²² The VA recently developed a weight management and physical activity initiative titled Managing Overweight and/or Obesity for Veterans Everywhere (MOVE!). This program is designed to provide assessment and treatment procedures, clinical algorithms, patient and provider information, and instructional material.²² The MOVE! program is a multidisciplinary, evidenced-based stepped care program with treatment intensities ranging from tailored self-help materials to promote lifestyle changes in diet and exercise, individual consultation, and nutrition information.²³ Weight control medications and residential weight control programs are recommended as more intensive treatment strategies. If more conservative approaches are not successful, bariatric surgery can be considered for eligible patients.

Previous studies that have examined trends and correlations of morbid obesity in the United States did not examine veteran status.²⁴ We found that an estimated 82,950 veterans who receive VA care are morbidly obese with a BMI of 40 kg/m² or greater. According to national guidelines, these individuals are potentially eligible for gastric bypass surgery.²⁵ Others who may be eligible include veterans with a BMI over 35 kg/m² and complications of obesity including obstructive sleep apnea, diabetes, heart disease, and functional impairment. Previous studies of gastric bypass among veterans at single VA sites report low surgical morbidity and mortality,²⁶ in addition to cost offsets of bariatric surgery within the first postoperative year.²⁷ Among Medicare beneficiaries, higher postoperative mortality was noted with increasing age, especially among men, and in hospitals with lower surgical volume.²⁸ Studies among nonveterans have shown gastric bypass to be cost-effective (especially among women and younger men)²⁹ and a viable treatment option for severe obesity and resulting complications of hypertension and diabetes.³⁰ Currently, 13 VA facilities provide bariatric surgery services directly to qualified patients. However, a Bariatric Surgery Workgroup has been formed to develop a national gastric bypass surgery program within the VA.³¹

This study has several limitations. The cohort does not include adults living in households without telephones, homeless individuals, or those residing in institutions such as nursing homes or prisons. Suboptimal response rates may also impact the generalizability of this sample, especially given higher rates of homelessness among veterans.^{32,33} The BRFSS does not contain diagnostic information about psychiatric illness, which may bias results given that mental illness is more common among veterans³⁴ and is associated with obesity.^{35,36} In addition, all data were obtained by self-report and are subject to recall and other biases. Rates of self-reported hypertension, diabetes, and coronary disease are similar to rates reported in other studies based on chart review or administrative data.^{37–39} Rates of self-reported dyslipidemia among veterans (52%) are higher than reported in a single previous study (36%) based on administrative data.³⁷ Body mass index based on self-report and measured data are highly correlated ($r > .95$), and self-reported data have been used in cohort studies and in studies of secular trends.^{40,41} However, the bias is to underreport weight and overreport height, thus decreasing reported BMI.^{42,43} Given the bias to underestimate BMI, we may have actually under reported rates of obesity.

In conclusion, we found that veterans who use the VA have higher rates of obesity than the general population, with

significant comorbid disease and disability, and low levels of preventive behaviors. As the largest provider of comprehensive integrated health care in the United States, the VA is uniquely positioned to sponsor a nationwide weight management and physical activity program. The Managing Overweight and/or Obesity for Veterans Everywhere program is scheduled for national dissemination in 2006.²² This program is focused on disease prevention, improving health status and quality of life, and decreasing rates of chronic disease among overweight and obese veterans.²² If successful, this VA initiative could potentially serve as a model for other initiatives to respond to the national epidemic of obesity in the United States.

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