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# Variation in Quality of Care Indicators for Diabetes in a National Sample of Veterans and Non-Veterans

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## Abstract

***Background:*** Veterans have a disproportionately higher burden of type 2 diabetes. It is unclear whether veterans with diabetes have better self-care behaviors or receive better quality of care than non-veterans. The objective was to examine differences in diabetes care between veterans and non-veterans.

***Methods:*** Data analysis was performed with respondents from the 2003 Behavioral Risk Factor Surveillance Survey ($n = 21{,}111$ with diabetes). Veterans were those who reported U.S. military service and no longer on active duty. Self-care behaviors included daily fruit and vegetable intake, physical activity level, self-foot checks, and home glucose testing. Quality of care indicators included provider actions over the past 12 months (2+ office visits, 2+ glycosylated hemoglobin checks, 1+ foot exams, 1+ dilated eye exams, daily aspirin use, receiving flu or pneumonia vaccine). Multiple logistic regression using STATA version 10 (Stata Corp., College Station, TX) analyzed differences by veteran status on each quality indicator, controlling for sociodemographics and diabetes education.

***Results:*** Veterans comprised 14.2% of the sample, and 12.4% had diabetes compared to 6.7% of non-veterans. In final adjusted models, veterans were significantly more likely to check their feet (odds ratio [OR] 1.33, 95% confidence interval [CI] 1.09, 1.64), get a dilated eye exam (OR 1.36, 95% CI 1.11, 1.66), receive aspirin (OR 1.31, 95% CI 1.04, 1.65), get a flu shot (OR 1.32, 95% CI 1.09, 1.61), and ever get a pneumonia shot (OR 1.38, 95% CI 1.12, 1.70).

***Conclusions:*** Veterans appear to have better self-care behaviors and receive better preventive care than non-veterans. However, future efforts need to focus on boosting self-care to improve diabetes outcomes.

## Introduction

Diabetes is the seventh leading cause of death in the United States and is strongly linked to potentially fatal cardiovascular disease outcomes, such as myocardial infarction, heart failure, and stroke.[1,2] Individuals with diabetes have twice the risk of death as those who do not have diabetes, with heart disease accounting for 68% of diabetes-related deaths in 2007.[2] The national annual prevalence of diabetes has continued climbing to affect 23 million adults (or 10.7%) in 2007[2] with a disproportionate burden on the elderly, racial/ethnic minorities, and low-income populations.[3] The American Diabetes Association[4] has updated prior reports on the economic burden of diabetes and indicates that direct medical costs have increased substantially from nearly $92 million[5] to now $116 billion in the last 5 years.

A higher burden of diabetes and disability has also been identified in the population of veterans receiving care at Veteran Health Administration facilities[6,7] compared to the general U.S. population. The prevalence of diabetes among veterans increased from 16.7% in 1998 to 19.6% in 2000, and the annual incidence of diabetes in veterans is approximately 2% per year.[8] Current clinical guidelines have outlined processes of care that are associated with improved diabetes outcomes.[4] These processes of care include appropriate patient self-care behaviors and provider-driven quality of care indicators.[4]

However, few studies have examined self-care behaviors and quality of diabetes care in veterans compared to non-veterans. Therefore, we sought to examine differences in patient self-care behaviors and provider-based diabetes quality of care indicators among veterans and non-veterans in a

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national sample of the U.S. population. Based on the findings of prior studies[9,10] we hypothesized that veterans would have better self-care behaviors and have better overall quality of diabetes care compared to non-veterans.

## Subjects and Methods

We examined self-reported data from respondents of the 2003 Behavioral Risk Factor Surveillance System (BRFSS), a state-based, random-digit dialing telephone survey designed to measure behavioral risk factors of the non-institutionalized, civilian population of the United States aged 18 years and older. Details about the BRFSS have been published previously.[12] The BRFSS, initiated in 1984, is an ongoing data collection program with the objective of collecting uniform, state-specific data on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and preventable infectious diseases in the adult population. The BRFSS uses a complex sampling design involving stratification, clustering, and multistage sampling to yield nationally representative estimates. Weights were applied so that estimates reflect the non-institutionalized population of the United States.

### *Veteran status*

In 2000, questions were introduced into the BRFSS and used in all states to capture veteran status. Subjects were asked, "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?" Subjects were also asked, "Which of the following best describes your service in the United States military?" Veterans were defined as those who served in a regular military or in a National Guard or military reserve unit but were not currently on active duty. Subjects who refused to answer the question or responded "don't know" or "not sure" were excluded.

### Sample characteristics

Demographic variables used for this study included age, race/ethnicity, education, income, marital status, employment, health status, body mass index, and insulin use. Age was divided into four categories: 18–34, 35–49, 50–64, and 65+ years. Race/ethnicity was defined as non-Hispanic white, non-Hispanic black, Hispanic, and other. Four levels of education were created—less than high school graduate, high school graduate or general equivalency diploma, some college, and college graduate—along with four income categories: <$25,000, <$50,000, <$75,000, and $75,000+. Marital status was dichotomized as married or not married, and employment status was either employed or unemployed. Health status was dichotomized as excellent/very good/good versus fair/poor. Body mass index was calculated by BRFSS and categorized as <25, 25–29.9, and 30+ $kg/m^2$. The use of insulin was assessed by asking respondents, "Are you now taking insulin"?

### *Diagnosis of diabetes and diabetes education*

The diagnosis of diabetes was based on self-report of whether a doctor had ever told them they had diabetes. Diabetes education was based on "yes" responses to the question, "Have you ever taken a course or class in how to manage your diabetes yourself?"

### *Diabetes self-care behaviors*

Four diabetes self-care behaviors were assessed based on self-report: physical activity (PA), testing blood glucose at home, checking feet at home, and fruit and vegetable intake.

PA was computed based on questions about type, duration, and intensity of PA. Two categories of PA were created: meeting PA recommendations (defined as 30 or more min/day for 5 or more days per week of moderate activity or 20 or more min/day on 3 or more days per week of vigorous activity) and not meeting PA recommendations.

Home blood glucose testing was assessed as respondents were asked, "About how often do you check your blood for glucose or sugar? Include times when checked by a family member or friend, but do not include times when checked by a health professional." A dichotomous variable for frequency of testing was created: 1+ times versus <1 time per day.

Home foot examination was assessed by asking respondents, "About how often do you check your feet for any sores or irritations? Include times when checked by a family member or friend, but do not include times when checked by a health professional." A dichotomous variable for frequency of foot examination was created: 1+ times versus <1 time per day.

Fruit and vegetable intake was determined using a summary index item within the BRFSS database that calculated whether or not respondents consumed five or more servings of fruits or vegetable per day. The original question items asked respondents, "How often do you drink fruit juices such as orange, grapefruit, or tomato?," "Not counting juice, how often do you eat fruit?," and "Not counting carrots, potatoes, or salad, how many servings of vegetables do you usually eat?"

### *Quality of diabetes care*

Seven quality of diabetes care indicators were defined based on current American Diabetes Association guidelines,[4] including biannual provider office visits, hemoglobin A1c testing, foot exam, dilated eye exam, aspirin use, and influenza and pneumonia vaccination.

Office visit to a health provider was determined by asking respondents, "About how many times in the past 12 months have you seen a doctor, nurse or other health professional for your diabetes?" A dichotomous variable was created to distinguish those who had 2+ times versus <2 visits in the last 1 year.

Hemoglobin A1c testing by a health provider was assessed by asking respondents, "A test for hemoglobin A one C measures average level of blood sugar over the past three months. About how many times in the past 12 months has a doctor, nurse, or other health professional checked you for A one C?" Frequency of hemoglobin A1c testing by health providers was categorized as 2+ times versus <2 times per year.

Foot exam by a health provider was assessed by asking respondents, "About how many times in the past 12 months has a health professional checked your feet for any sores or irritations?" Frequency of foot exam by health providers was categorized as 1+ times versus <1 time per year.

Dilated eye exam by a health provider was assessed by asking respondents, "When was the last time you had an eye exam in which the pupils were dilated? This would have made you temporarily sensitive to bright light." Frequency of dilated eye exam by health providers was categorized as 1+ times versus <1 visit per year.

Aspirin use was assessed by asking respondents, "Do you take aspirin daily or every other day?" An individual was deemed to have used aspirin if they responded "yes."

Table 1. Demographic Characteristics Among Those with Diabetes (n = 21,111) by Veteran Status

| | *Veteran* | *Non-veteran* | P *value* |
|---|---|---|---|
| Age group | | | < 0.001* |
| 18–34 years | 0.93 | 7.66 | |
| 35–49 years | 7.89 | 23.5 | |
| 50–64 years | 36.07 | 36.71 | |
| 65+ years | 55.11 | 32.09 | |
| Gender (sex) | | | < 0.001* |
| Female | 2.73 | 66.08 | |
| Male | 97.27 | 33.92 | |
| Race/ethnicity | | | < 0.001* |
| Non-Hispanic white | 78.07 | 61.35 | |
| Non-Hispanic black | 9.74 | 15.98 | |
| Hispanic | 5.24 | 7.14 | |
| Other | 6.96 | 15.54 | |
| Marital status | | | < 0.001* |
| Married | 74.74 | 55.72 | |
| Not married | 25.26 | 44.28 | |
| Educational level | | | < 0.001* |
| Less than HS graduate | 11.87 | 23.22 | |
| HS graduate | 31.69 | 34.16 | |
| Some college | 28.76 | 23.06 | |
| College graduate | 27.68 | 19.56 | |
| Annual income level | | | < 0.001* |
| <$25,000 | 37.04 | 49.01 | |
| $25,000–$49,999 | 34.00 | 28.27 | |
| $50,000–$74,999 | 12.97 | 10.86 | |
| $75,000+ | 15.98 | 11.87 | |
| Employment status | | | < 0.001* |
| Employed | 29.62 | 38.77 | |
| Unemployed | 70.38 | 61.23 | |
| Self-rated health status | | | < 0.001* |
| Excellent/very good/good | 56.25 | 48.45 | |
| Fair/poor | 43.75 | 51.55 | |
| Has health insurance | | | < 0.001* |
| Yes | 93.85 | 88.16 | |
| No | 6.15 | 11.84 | |
| Has healthcare provider | | | 0.273 |
| Yes | 93.60 | 92.50 | |
| No | 6.40 | 7.50 | |
| Received diabetes education | | | 0.007* |
| Yes | 44.55 | 50.20 | |
| No | 55.45 | 49.80 | |
| Insulin therapy | | | 0.076 |
| Insulin user | 23.45 | 25.94 | |
| Non-insulin user | 76.55 | 74.06 | |
| Body mass index (kg/m$^2$) | | | < 0.001* |
| <25 | 17.86 | 18.05 | |
| 25–29.9 | 40.88 | 32.03 | |
| ≥30 | 41.27 | 49.92 | |

All numbers represent percentages except the *P* value column.
*Statistically significant at $P < 0.05$.
HS, high school.

Influenza vaccination was assessed by asking respondents whether they got the flu shot in the past 12 months. An individual was deemed to have received the flu shot if they responded "yes."

Pneumonia vaccination was assessed by asking respondents whether they had ever received the pneumonia shot. An individual was deemed to have received the pneumonia shot if they responded "yes."

### *Statistical analyses*

Three sets of statistical analyses were performed. The first set of analyses compared the sociodemographic and clinical characteristics of participants by VA user status using $\chi^2$ test. The second set compared diabetes self-care and quality of care indicators by VA user status using $\chi^2$ test. The third set analyzed 11 separate multiple logistic regression models for the four self-care behaviors and seven quality of care indicators to assess the independent association between use of VA facilities and these outcome variables. In each model, the dichotomous variable for each self-care behavior and quality of care indicator was entered as the dependent variable, VA user status as the primary independent variable, and age, sex, education, income, marital status, employment, insurance status, access to care, health status, attendance at diabetes education classes, body mass index, and insulin use as covariates. All variables were included in the models because they were conceptually related to the outcomes of interest and differed significantly by veteran status. All analyses took into account the complex survey design and weighted sampling probabilities of the data source and were performed using STATA version 10 (Stata, College Station, TX).[13] All statistical tests were two-tailed, and significance was set at alpha of 0.05.

## Results

Veterans comprised 14.2% of the entire sample ($n = 37,849$), and the overall prevalence of diabetes was 7.5%. This analysis focused on the proportion of individuals who reported having diabetes ($n = 21,111$), of which 23.4% were also veterans. The demographic characteristics of the study sample are

Table 2. Self-Care Behaviors Among Those with Diabetes by Veteran Status

| | *Veteran* | *Non-veteran* | P *value* |
|---|---|---|---|
| Physical activity level | | | 0.007* |
| Meets recommendations | 36.62 | 31.45 | |
| Insufficient or no physical activity | 63.38 | 68.55 | |
| Fruit and vegetable intake | | | < 0.001* |
| Less than 5 servings per day | 77.97 | 72.30 | |
| 5+ servings per day | 22.03 | 27.70 | |
| Blood sugar testing | | | 0.108 |
| Less than 1 time daily | 44.00 | 41.29 | |
| 1+ times daily | 56.00 | 58.71 | |
| How often you check your feet | | | 0.184 |
| Less than 1 time daily | 29.65 | 31.80 | |
| 1+ times daily | 70.35 | 68.20 | |

All numbers represent percentages except the *P* value column.
*Statistically significant at $P < 0.05$.

Table 3. Provider-Based Quality of Care Indicators Among Those with Diabetes by Veteran Status

| | *Veteran* | *Non-veteran* | P *value* |
|---|---|---|---|
| Office visits in last 12 months | | | 0.665 |
| 2+ visits | 79.17 | 79.17 | |
| <2 visits | 20.21 | 20.83 | |
| Dilated eye exam in last 12 months | | | < 0.001* |
| 1 or more exams | 74.18 | 64.76 | |
| <1 exam | 25.82 | 35.24 | |
| Hemoglobin A1c testing in last 12 months | | | 0.145 |
| 2+ tests | 69.82 | 67.28 | |
| <2 tests | 30.18 | 32.72 | |
| Foot exam in last 12 months | | | < 0.001* |
| 1 or more exams | 75.33 | 67.29 | |
| <1 exam | 24.67 | 32.71 | |
| Daily aspirin use | | | < 0.001* |
| Yes | 65.56 | 50.18 | |
| No | 35.44 | 49.82 | |
| Received flu shot in last 12 months | | | < 0.001* |
| Yes | 68.22 | 52.47 | |
| No | 31.78 | 47.53 | |
| Ever received pneumonia vaccine | | | < 0.001* |
| Yes | 60.10 | 44.31 | |
| No | 39.90 | 55.69 | |

All numbers represent percentages except the *P* value column.
*Statistically significant at $P < 0.05$.

shown in Table 1 according to their veteran status. The majority of the veteran sample is composed of elderly individuals (55%) compared to the non-veterans (32%). In addition, veterans had a significantly higher proportion of non-Hispanic whites and comprised nearly three times as many males as non-veterans. Veterans tended to be married, have higher educational attainment, report having at least good health, and have insurance. However, no significant difference in the proportions having a healthcare provider or using insulin therapy was demonstrated by veteran status. Diabetes education occurred significantly less often among veterans than non-veterans (44% vs. 50%). Body mass index differed significantly by veteran status, whereas insulin use did not.

Results from bivariate analyses demonstrated particular differences by veteran status, shown in Tables 2 and 3. Of the four self-care behaviors, veterans had a significantly higher proportion that met PA recommendations (37% vs. 31%) but a lower percentage that reported having an adequate daily intake of fruits and vegetables than non-veterans (22% vs. 28%). There were no statistically significant differences between veterans and non-veterans in testing their blood sugar or checking their feet.

Examining diabetes quality of care indicators with providers (Table 3) reveals that compared to non-veterans, a significantly higher proportion of veterans had a dilated eye exam (65% vs. 74%) or a foot exam (67% vs. 75%, respectively) in the last 12 months, had a flu shot in the last 12 months (52% vs. 68%, respectively), daily aspirin use (50% vs. 66%, respectively) and ever received a pneumonia vaccine (44% vs. 60%, respectively). Similar proportions of veterans and non-veterans had two or more office visits or hemoglobin A1c tests in the last 12 months (approximately 70% and 80%, respectively).

Table 4. Logistic Regression for Self-Care Behaviors and Quality of Care Indicators Among Veterans with Diabetes

| | *OR* | *95% CI* |
|---|---|---|
| Self-care behaviors | | |
| Meets physical activity recommendations | 1.07 | (0.89, 1.31) |
| 5+ daily servings of fruits, vegetables | 0.88 | (0.70, 1.09) |
| At least once daily blood sugar testing | 0.91 | (0.75, 1.10) |
| At least once daily checking of feet | 1.33* | (1.09, 1.64) |
| Quality of care indicators | | |
| At least two office visits, last 12 months | 1.04 | (0.83, 1.32) |
| At least one exam of feet, last 12 months | 1.22 | (0.99, 1.51) |
| 2+ hemoglobin A1c testing, last 12 months | 1.04 | (0.83, 1.29) |
| Dilated eye exam, last 12 months | 1.36* | (1.11, 1.66) |
| Daily aspirin use | 1.31* | (1.04, 1.65) |
| Flu shot received, last 12 months | 1.32* | (1.09, 1.61) |
| Ever received pneumonia vaccine | 1.38* | (1.12, 1.70) |

The logistic regression analysis was adjusted for age, gender, race, education, income, insurance status, diabetes education, body mass index, and insulin use. The reference group is non-veterans with diabetes.
*Statistically significant at $P < 0.05$.
CI, confidence interval; OR, odds ratio.

Logistic regression analyses were conducted for both self-care and provider-based quality of care measures (Table 4). For self-care behaviors, only self-checking their feet remained significant as veterans were 33% more likely to report this behavior compared to non-veterans (odds ratio [OR] 1.33, 95% condifence interval [CI] 1.09–1.64). For quality of care indicators, veterans were more likely than non-veterans to use aspirin daily (OR 1.31, 95% CI 1.04, 1.65) or to have received a flu shot in the last 12 months (OR 1.32, 95% CI 1.09, 1.61). In addition, veterans were significantly more likely to have a dilated eye exam in the last 12 months (OR 1.36, 95% CI 1.11, 1.66) and ever received a pneumonia vaccine (OR 1.38, 95% CI 1.12, 1.705) compared to non-veterans. Other self-care and quality of care measures did not show a statistically significant difference between the two groups.

## Discussion

In this nationally representative sample of adults with diabetes, after adjusting for relevant confounding factors, veterans were more likely to check their feet daily and receive four of the seven provider-based quality of care indicators (eye exam, aspirin, and flu or pneumonia vaccine) compared to non-veterans. Previous studies have shown that provider-based quality of care indicators are better in the Veterans Administration compared to a national sample of Medicare patients,[9] commercial managed care organizations,[10] and a random, nonspecific sample of the U.S. population.[7,11] Provider-based quality of care measures showed the most

favorable results in our adjusted models with veterans being 31–38% more likely to receive daily aspirin, flu shots, dilated eye exams, and pneumonia vaccines.

Veterans in this sample were 33% more likely to perform self-foot checks than non-veterans; otherwise, most self-care behaviors were not different between the two groups. A recent examination of characteristics of VA processes (or "must-do's") related to reducing diabetes-related foot ulcers, amputations, and hospitalizations identified a number of system modifications likely to improve foot care.[14] These "must-do's" were aimed at provider efforts and accounted for 59% of the variance in improved foot care outcomes.[14] However, this process of care intervention in the Veterans Administration may have heightened patient awareness. Therefore, the difference in self-foot checks could be as a result of intensive efforts aimed at improving diabetes-related processes specific to foot care in the Veterans Administration.[14,15] We can also speculate that amputations present a more tangible and visible disability for patients; therefore veterans may be more likely to aggressively perform self-monitoring, especially if it is being emphasized by their providers.

National rates for PA (approximately 50%) and fruit and vegetable intake (approximately 20%) remain dismally low, even in the Veterans Administration where processes of diabetes care have been successful.[6,7,9,10,16] Strategies for improving diabetes self-management education have been clearly documented within the VA healthcare system[7] and are also emphasized as a priority through initiatives from the VA Quality Enhancement Research Initiative-Diabetes Mellitus.[15] Self-management of chronic disease has been shown to have a greatly disproportionate impact between patient- and physician-level factors.[17] Prior studies indicate that patient-level factors account for at least 95% of the variance in glycemic control, whereas provider-level factors account for only 2%,[18] with minimal differences being due to age or race/ethnicity.[18] Interventions and education should be geared towards stressing the importance of self-examination in diabetes patients. Patient empowerment is a strong predictor of improved outcomes[19–21] and would be an effective strategy to improve diabetes self-care in the Veterans Administration. To increase the likelihood of success, primary care physicians need to have a more proactive role in the management of patients with diabetes by educating them on the importance of lifestyle modifications.[22,23] Furthermore, research interventions that focus on behavior change as a primary method for improving self-management of diabetes will lend credence to modifying cardiovascular disease risk.[23]

There are strengths and limitations that deserve mention and helps put the study in perspective. The strengths of this study are that it used a large nationally representative sample of both veterans and non-veterans and provides comparable data on self-care and quality of care for diabetes and more reliably mirrors diabetes care indicators for these two groups. However, the study has some limitations. First, the study did not distinguish between those veterans who used VA facilities for health care versus those who did not use the Veterans Administration for health care. This is a complex issue because some veterans use only the Veterans Administration, others use both the Veterans Administration and the general health system, whereas another group do not use the Veterans Administration at all. It will be important to understand how these three groups of veterans differ; however, it will require having access to both VA and non-VA data (e.g., Medicare, managed care) for the same individuals. Future studies are needed to better clarify these differences. Second, women veterans comprised <3% of the sample compared to 66% of non-veterans, so the veteran sample may not be representative of female veterans. However, these gender differences are consistent with other studies of veterans. Third, more objective, clinical measures for risk factor control, i.e., blood pressure, lipid, and hemoglobin A1c values, were not included as outcomes. Nevertheless, it has already been shown that processes of care are strongly associated with clinical outcomes, so we expect our findings to translate to differences in clinical end points.

In summary, the findings from this study show that veterans tend to receive better quality of care for diabetes, although patient self-care behaviors are mostly not different from what is obtained in non-veterans. These results help define areas of strength and areas for improvement as efforts are targeted at improving diabetes care. With the growth in the veteran population that has resulted from the recent wars, efforts are needed to improve the self-care behavior of veterans so that they reach levels that are known to translate to optimal outcomes. Our findings also indicate the need for better self-care and quality of diabetes care in the general healthcare system.

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