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Effect of Veterans Administration Use on Indicators of Diabetes Care in a National Sample of Veterans

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Abstract

Background: Diabetes poses a serious health burden, of which veterans have a disproportionate share. Few data exist regarding differences in self-care behaviors and provider-based quality of care indicators among a large sample of veterans. The objective of this study was to determine the effect of Veterans Affairs (VA) use on diabetes quality of care indicators among veterans.

Methods: A cross-sectional analysis was done on data from 36,525 veterans in the 2003 Behavioral Risk Factor Surveillance Survey. VA use was defined as receiving some or all health care from a VA facility in the previous 12 months. Diabetes quality indicators such as two or more provider visits, two or more hemoglobin A1c tests, and flu and pneumonia shots were compared between VA users and non-VA users. The independent effect of VA use on each quality indicator was analyzed with multiple regression using STATA version 10 (Stata Press, College Station, TX) to account for the complex survey design and yield population estimates.

Results: Among veterans with diabetes, 26.8% were VA users. The only significant difference between VA users and non-VA users was that VA users were significantly more likely to check their feet one or more times daily (75.7% vs. 68.5%, $P = 0.015$). In final adjusted models, VA users were at least twice as likely as non-VA users to have foot exams by a provider (odds ratio 2.59) and receive flu and pneumonia shots (odds ratio 2.30 and 2.05, respectively). VA users were also more likely to have two or more provider visits, dilated eye exams, and two or more hemoglobin A1c tests than non-VA users.

Conclusions: Key quality indicators for diabetes care were better among veterans getting some or all of their care from VA facilities, suggesting more effective care strategies. However, interventions should identify and perpetuate excellent self-care behaviors to more substantially impact adverse diabetes-related outcomes.

Introduction

Diabetes hastens death and disability through serious cardiovascular disease outcomes, such as myocardial infarction, stroke, peripheral arterial disease, blindness, and kidney damage.[1] Approximately 23.6 million people in the United States or 7.8% of the population have diabetes,[1] and a disproportionate burden is seen among the elderly, racial/ethnic minorities, and low-income populations.[1,2] Estimates from 2007 indicate the total cost of diabetes is approximately $174 billion, including $116 billion in direct costs and $58 billion in indirect costs.[1] After adjusting for age and sex, having diabetes is associated with a 2.3-fold increase in health expenditures compared to not having diabetes.[1]

Diabetes is equally highly prevalent among veterans. The annual incidence of diabetes in veterans is ~2% per year,[3] with prevalence rates increasing from 16.7% in 1998 to 19.6% in 2000. In the Veterans Affairs (VA) system, diabetes is the third most common diagnosis, affecting 16% of patients.[4] The average age of VA patients with diabetes is 65.3 years.[5] Published literature has demonstrated that nearly 4% of total VA expenditures are attributable to veterans with diabetes.[6]

Previous studies have shown that quality of care for many chronic conditions is higher in the VA system than in non-VA systems.[7–9] However, few studies have used nationally representative samples to examine whether diabetes self-care and provider-based quality of care differ between those who use VA facilities for medical care and those who use non-VA facilities. We used the Behavioral Risk Factor Surveillance Survey (BRFSS) to examine whether self-care behaviors and provider-based quality of care differed significantly between veterans who received care from VA

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facilities compared to those that did not. We hypothesized that veterans with diabetes receiving care from VA facilities would have collectively better diabetes self-care and provider-based quality of care compared to those who received care from non-VA facilities.

Subjects and Methods

We examined self-reported data from respondents of the 2003 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.[10] 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 U.S. population.

Veterans' status and use of VA facilities

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, in National Guard or reserve units. Subjects who refused to answer the question or responded "don't know" or "not sure" were excluded. Users of VA facilities were defined as veterans who reported that in the last 12 months they had received some or all of their health care from VA facilities.

Sample characteristics

Demographic variables included age, race/ethnicity, education, income, marital status, employment, and health status. Age was divided into four categories: 18–34, 35–49, 50–64, and 65+ years. Race/ethnicity was defined as non-Hispanic whites, non-Hispanic blacks, Hispanics, and others based on self-report. Four education levels were created: less than high school graduate, high school graduate or general equivalency diploma, less than college graduate, and college graduate. Four income categories were used: <$25,000, <$50,000, <$75,000, and $75,000+. Marital status was dichotomized as married or not married, and employment status as employed or unemployed. Health status was dichotomized as excellent/very good/good versus fair/poor.

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 other than during pregnancy. Diabetes education was based on "yes" response 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 physical activity were created: meeting PA recommendations (defined as $\geq$30 min/day for $\geq$5 days per week of moderate activity or $\geq$20 min/day on $\geq$3 days of vigorous activity) and not meeting PA recommendations.

Home blood glucose testing was assessed by the question, "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: one or more times versus less than once 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: one or more times versus less than once 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/vegetables per day based on established algorithms. The variable was categorized as consumption of five or more servings of fruits and vegetables per day versus less than five servings per day.

Quality of diabetes care

Seven quality of diabetes care indicators were defined based on current American Diabetes Association guidelines,[11] 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 two or more visits versus less than two visits in the last year (12 months).

Hemoglobin A1c testing by a health provider was assessed by asking respondents, "A test for hemoglobin A1C measures average level of blood sugar over the past 3 months. About how many times in the past 12 months has a doctor, nurse, or other health professional checked your A1C?" Frequency of hemoglobin A1c testing by health providers was categorized as less than two versus two or more 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 less than one versus one or more times 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 never, less than 1 year ago, 1–2 years ago, and 2+ years ago. A dichotomous variable categorized as less than one versus one or more times per year.

Aspirin use was assessed by asking respondents, "Do you take aspirin daily or every other day?"

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 he or she 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 he or she responded "yes."

Statistical analyses

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 Press, College Station, TX).[12] All statistical tests were two-tailed, and significance was set at an α of 0.05. Three sets of statistical analyses were performed. In the first set of analyses, demographic and clinical characteristics of participants were compared by VA user status using χ^2 test. In the second set of analyses, diabetes self-care and quality of care indicators were compared by VA user status using the χ^2 test. In the third set of analyses, 11 separate multiple logistic regression models were run for the four self-care behaviors (PA, fruit/vegetable intake, home glucose testing, and home foot care) and seven

Table 1. Demographic Characteristics of Veterans with Diabetes by VA User Status

	All (n = *4,501*)	*Non-VA users* (n = *3,159*)	*VA users* (n = *1,342*)	P *value*
Age (years)				0.618
18–34	0.87	1.04	0.40	
35–49	7.67	7.59	7.89	
50–64	36.0	36.3	35.0	
≥65	55.6	55.1	56.7	
Gender/sex				0.558
Female	2.77	2.83	2.46	
Male	97.2	97.1	97.5	
Race/ethnicity				0.028*
Non-Hispanic white	78.8	80.8	73.1	
Non-Hispanic black	9.69	8.20	13.8	
Hispanic	6.28	6.42	5.91	
Other	5.27	4.54	7.26	
Marital status				<0.001*
Married	74.8	76.6	69.8	
Not married	25.2	23.4	30.2	
Educational level				0.002*
Less than HS graduate	11.4	10.3	14.5	
HS graduate	31.7	31.7	32.0	
Some college	29.0	27.1	34.2	
College graduate	27.9	31.0	19.4	
Employment status				<0.001*
Employed	29.3	32.5	20.6	
Unemployed	70.7	67.5	79.4	
Annual income level				<0.001*
<$25,000	36.7	30.7	52.5	
$25,000–$49,999	34.2	34.4	33.4	
$50,000–$74,999	13.0	15.0	7.74	
$75,000+	16.1	19.8	6.34	
Self-rated health status				0.001*
Excellent/very good/good	56.7	60.1	47.1	
Fair/poor	43.4	39.9	52.9	
Has health insurance				0.001*
Yes	94.2	95.4	90.9	
No	5.81	4.61	9.10	
Saw healthcare provider in the last 12 months				0.150
Yes	93.5	94.2	91.8	
No	6.48	5.83	8.25	
Received diabetes education				0.034*
Yes	55.3	53.4	60.2	
No	44.8	47.0	39.9	

All numbers represent percentages. HS, high school.
*Statistically significant, $P < 0.05$.

Table 2. Self-Care Behaviors by VA Use Among Veterans with Diabetes

	All	*Non-VA users*	*VA users*	P *value*
PA level				0.853
Meets PA recommendations	36.8	37.0	36.4	
Insufficient or no PA	63.2	63.0	63.6	
Fruit and vegetable intake				0.136
5+ servings per day	22.3	23.3	19.7	
<5 servings per day	77.7	76.7	80.3	
Blood sugar testing				0.924
1+ times daily	56.0	55.9	56.2	
<1 time daily	44.0	44.1	43.8	
How often you check your feet				0.015*
1+ times daily	70.5	68.5	75.7	
<1 time daily	29.5	31.5	24.3	

All numbers represent percentages.
*Statistically significant, $P < 0.05$.

quality of care indicators (number of office visits, hemoglobin A1c testing by provider, foot exam by provider, dilated eye exam by provider, aspirin use, receipt of flu shot, and receipt of pneumonia shot) to assess the independent association between use of VA facilities and these outcome variables. In each model, self-care behaviors and quality of care indicators were entered as dependent variables, VA user status as the primary independent variable, and demographics, access to care, health status, and attendance at diabetes education classes as covariates. All variables included in the models were conceptually related to the outcomes of interest and differed significantly by VA user status.

Results

Veterans comprised 14.2% ($n = 36{,}525$) of the BRFSS sample in 2003. Approximately 12.4% reported being diagnosed with diabetes ($n = 4{,}501$). Among veterans with diabetes, 26.8% ($n = 1{,}342$) received some or all of their care from a VA facility. Table 1 shows the characteristics of the sample by VA user status. Overall, the majority of the sample was 50 years of age or older, male, mostly non-Hispanic white, and married. Similarly, the vast majority was insured and saw a healthcare provider in the last 12 months. Notable differences between VA users and non-users was that VA users were more likely to be non-Hispanic black, less educated, and unemployed, to have lower income, and to report poorer health and were less likely to have health insurance.

Self-care behaviors among this sample of veterans with diabetes are shown in Table 2. The only significant difference between VA users and non-VA users was that VA users were significantly more likely to check their feet one or more times daily (75.7% vs. 68.5%, respectively; $P = 0.015$). There were no significant differences between VA users versus non-VA users

Table 3. Quality of Care by VA Use Among Veterans with Diabetes

	All	*Non-VA users*	*VA users*	P *value*
Office visits in the last 12 months				0.011*
2+ visits	79.9	78.1	84.5	
<2 visits	20.1	21.9	15.5	
Dilated eye exam in the last 12 months				0.005*
≥1 exams	74.5	72.2	80.5	
<1 exam	25.5	27.8	19.5	
Hemoglobin A1c testing in the last 12 months				0.023*
≥2 tests	69.9	68.0	75.0	
<2 tests	30.1	32.0	25.0	
Foot exam in the last 12 months				<0.001*
≥1 exams	75.7	72.1	85.2	
<1 exam	24.3	28.0	14.8	
Daily aspirin use				0.945
Yes	64.6	64.7	64.5	
No	35.4	35.3	35.5	
Received flu shot in the last 12 months				<0.001*
Yes	68.6	65.5	77.2	
No	31.4	34.5	22.8	
Ever received pneumonia vaccine				<0.001*
Yes	60.4	56.1	72.0	
No	39.6	43.9	28.0	

All numbers represent percentages.
*Statistically significant, $P < 0.05$.

with regards to PA, eating fruits and vegetables, and doing self-foot exams.

Table 3 shows provider-based quality of care (i.e., proportions of veterans reporting receipt of diabetes quality of care measures generally performed by healthcare providers) by VA user status. Veterans using VA facilities were significantly more likely than non-VA users to have at least two office visits within 12 months (84% vs. 78%, respectively; $P = 0.011$). Veterans receiving care at a VA facility were significantly more likely to have had their hemoglobin A1c levels checked two or more times in the last 12 months (75% for VA users vs. 68% for non-VA users, $P < 0.001$). VA users were more likely to have a clinical foot exam in the last 12 months (85%) compared to 72% of non-VA users ($P = 0.005$). More VA users (80%) received a dilated eye exam in the last 12 months than non-VA users (72%) ($P = 0.005$). Similarly, VA users were more likely to have received an influenza vaccination in the last 12 months (77% vs. 65%, respectively; $P < 0.001$) and ever received pneumonia vaccination (72% vs. 56%, respectively; $P < 0.001$). There was no statistically significant difference in aspirin use between the two groups ($P = 0.945$).

In final adjusted models (Table 4), with non-VA users as the reference group and controlling for age, sex, race/ethnicity, education, income, insurance, and diabetes education, the same provider-based quality of care measures remained significant. VA users were more than twice as likely to have received foot exams by a provider (odds ratio [OR] 2.59, 95% confidence interval [CI] 1.76–3.83), ever had a pneumonia shot (OR 2.30, 95% CI 1.68–3.14), and had a flu shot (OR 2.05, 95% CI 1.44–2.92). In addition, VA users had a 60–70% greater likelihood of having a dilated eye exam (OR 1.68, 95% CI 1.14–2.49), two or more hemoglobin A1c tests (OR 1.65, 95% CI 1.19–2.28), and two or more provider visits (OR 1.61, 95% CI 1.08–2.39) in the previous 12 months.

Discussion

Among this national sample of veterans, important differences in diabetes quality of care were demonstrated between those who use VA facilities for their medical care and those who do not. Veterans with diabetes who were VA users had significantly better quality of care, particularly for those measures targeted by provider performance initiatives within the VA healthcare system. In adjusted models, VA users were significantly more likely to have clinical foot exams and to receive preventive care (flu shot, pneumonia vaccination, office visit, and eye exam) than non-VA users. Additionally, VA users had a significantly higher proportion receiving diabetes education than non-VA users (60% vs. 53%, respectively; $P = 0.03$). However, diabetes self-care behaviors were not significantly different between the two groups. These findings suggest that the VA healthcare system provides better diabetes quality of care; however, there remains a need to improve diabetes self-management strategies.

Studies that have examined diabetes processes of care demonstrate a higher quality of care with respect to provider-specific measures.[4,9] Two studies have reported a higher level of diabetes processes of care ranging from 72% to 95% of patients within the VA healthcare system compared to those using non-federal care systems.[9,13] Our findings are consistent with these studies such that most diabetes processes of care remained statistically significantly greater among VA users compared to non-VA users: provider foot checks (OR 2.59), pneumonia vaccination (OR 2.30), flu shot (OR 2.05), dilated eye exam (OR 1.69), hemoglobin A1c testing (OR 1.65), and office visits (OR 1.61). Therefore, research findings continue to consistently support substantial improvement in processes of care within the VA health system.[7–9,13]

For diabetes self-care behaviors, VA users were significantly more likely to perform self-foot checks than non-VA users (76% vs. 68%, respectively; $P = 0.01$) and were not inferior in other self-care measures. However, in adjusted models for quality of care, none of the diabetes self-care behaviors was different by VA user status. A recent analysis of diabetes self-management revealed that only 6% of adults with diabetes performed all four self-care behaviors (PA, fruit and vegetable intake, home glucose testing, and home foot exams) at recommended levels.[14] Similar to our results, these authors also found adults with diabetes were much more likely to perform one self-care behavior ($\sim$90%) with more

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

	OR	*95% CI*
Self-care behaviors		
Meets physical activity recommendations	1.15	0.87, 1.52
$\geq$5 daily servings of fruits, vegetables	0.92	0.66, 1.29
At least once daily blood sugar testing	1.06	0.79, 1.40
At least once daily checking of feet	1.35	0.98, 1.85
Quality of care indicators		
At least office visits in the last 12 months	1.61*	1.09, 2.39
At least one exam of feet in the last 12 months	2.59*	1.76, 3.82
$\geq$2 hemoglobin A1c testing in the last 12 months	1.65*	1.19, 2.28
Dilated eye exam in the last 12 months	1.69*	1.14, 2.49
Daily aspirin use	0.99	0.69, 1.42
Flu shot received in the last 12 months	2.05*	1.44, 2.92
Ever received pneumonia vaccine	2.30*	1.68, 3.14

Adjusted for age, gender, race, education, income, insurance status, and diabetes education. The reference group comprises veterans with diabetes who are non-VA users.

*Statistically significant when range of the CI excludes 1.00.

attention paid to home foot exams (69%) and home glucose testing (55%), whereas very low rates of recommended diet and activity patterns were achieved (26% and 31%, respectively).

While most elements of provider care are highly related to diabetes monitoring and the logistics of treatment adjustment, clinical care factors have a small impact on diabetes outcomes.[15] Daily behaviors and activities (diet, PA, and medication adherence) are key in maintaining good glycemic control and therefore are critical for diabetes management. Patient-level factors have been shown to account for at least 95% of patient care and health management.[15,16] The findings of this and other investigations support a dire need for successful lifestyle interventions and patient education. From a research standpoint, patient-level interventions should be the primary method by which behavior change is directed and better diabetes self-management is achieved. From the clinical standpoint, providers should place greater emphasis on the importance of self-examination and self-care among patients with diabetes, thus reducing complications. In addition, another strategy could focus on educating providers about how to empower patients to better manage their diabetes.[17–19] As reported by Reiber et al.,[13] diabetes self-management education is a necessary component of care within the VA health system, and, as such, the VA has a number of diabetes education strategies in place. However, the low proportions of veterans in this study receiving these educational strategies (ranging from 7% to 48%) suggest the need for VA administration to rethink the quality and effectiveness of these services.

This study demonstrated substantial differences in diabetes quality of care in a comparable sample of VA users and non-VA users. In each of the aforementioned studies the demographics of veteran populations were similar: older, mostly male, lower socioeconomic status, and higher diabetes burden. This study comprised typical veterans who use the VA healthcare system for their medical care[7,20] but differs in that we analyzed data from one large single source, allowing for greater comparability within the veteran population. Therefore, these results have a higher likelihood of more accurately representing diabetes processes of care and self-care behaviors among veterans. However, secondary analyses have inherent limitations that deserve mention. First, BRFSS data are self-reported, thus lending the results to recall bias. A growing number of studies show a high correlation between self-reported data and objective measures. Second, very few female veterans use VA facilities for medical care,[20] so results cannot be generalized to them. Third, the majority of veterans in this sample were elderly, so the study has limited generalizability to younger veterans. Finally, we analyzed secondary data so the inherent limitations of existing data apply. We cannot account for potential confounding factors such as diabetes severity, glycemic control, and veterans who utilize medical services at both VA and non-VA facilities.

In summary, veterans with diabetes who receive at least some care within the VA health system have a high quality of diabetes care. The lack of differences in self-care behaviors between VA users and non-VA users suggests that greater efforts need to target patients' self-management behaviors. Diabetes educators should implement more creative strategies to actively engage patients with diabetes in self-care potentially through a nutrition education intervention that demonstrates practical changes (cooking skills) or use of technological resources (electronic food diary). Health professionals should also integrate different self-care components to provide more comprehensive education (PA along with nutrition education). Patients are likely the principal drivers of diabetes outcomes through their daily lifestyle habits. Therefore, interventions should identify and perpetuate excellent self-care behaviors to more substantially impact adverse diabetes-related outcomes.

Author Disclosure Statement

No competing financial interests exist.

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