



Veteran and Health System Factors Contributing to Diabetic Foot Complications

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INTRODUCTION

Diabetes Mellitus (DM) and diabetes complications were the seventh leading cause of death in the US in 2013.¹ In the US, more than 29 million people (approximately 9.3% of US population) are estimated to have diagnosed or undiagnosed DM. Common DM complications including coronary arterial disease (CAD), peripheral arterial disease (PAD), renal failure, visual loss, stroke, heart attack, and premature death. These complications reduce the length and quality of life of DM patients. In 2012, the costs of caring for US DM patients were \$245 billion.¹ About 1.6 million Veterans have DM.^{6,9} Veterans' risk factors for developing DM includes being overweight/obese and smoking.

Proactive management of risk factors, including patient education, can markedly decrease microvascular complications of diabetes.⁴⁻⁷ Accordingly, the US government has set goals for increasing preventive care to persons with DM, as well as decreased rates of hospitalization and complications. These rates are monitored on a population basis, and emphasize reducing disparities.^{3,8} Private sector organizations and health care quality coalitions have also developed, adopted, or endorsed process and intermediate outcomes for DM patients persons for physicians and health care plans.²⁻¹³

Diabetic foot ulcers (DFUs) are among the most common complications of diabetes and account for more hospitalizations than any other diabetes complication. DFUs occur due to damage DM inflicts on blood vessels in different parts of the body, especially the extremities. Neuropathy causes loss of protective sensation and coordination of muscles in the foot and leg, which increases mechanical stresses during ambulation.

Early effective management of DFU can reduce the severity of complications such as preventable amputations and possible mortality, and also can improve overall quality of life. DFU management should be optimized by providing comprehensive approach to care via a multidisciplinary team including blood sugar control, wound debridement, advanced dressings and offloading modalities.

Nearly one in four Veterans receiving care from VA has diabetes, in part, due to the older average age of Veterans. Due to lack of sensation, patients with diabetic neuropathy may be unaware of skin breakdown and may not understand their implications and may delay seeking help. Veterans with DFUs often present to the emergency room where successful management can be challenging. Prevention involves educating patients to understand all aspects of their condition and to effectively communicate with their providers. Previous research has identified barriers to preventive care, including competing demands for provider time to properly educate patients, patient and provider lack of adherence to guidelines, lack of specialist access, and lack of patient understanding regarding the severity of DFUs.^{2,5}

The number of diabetic Veterans is growing, as is the complexity of their needs. Diabetic Veterans receiving VA care are more likely to be nonwhite, unemployed, have lower income, other comorbidities that may accompany aging and have more activity limitations than male Veterans not using the VHA. Between 15–20% of Veterans also have psychiatric disorders, which require medications that can cause weight gain or increase insulin resistance, thereby necessitating more aggressive diabetes management.

PURPOSE

The goal of this study was to describe Veterans diagnosed with diabetic foot ulcers (DFU) and/or lower extremity amputations at one VA Medical Center located in the Midwest. We examined system and patient factors that could improve patient self-management and survival skills, such as in response to acute complications from diabetes/DFU. In addition, we investigated the correlation between formalized Diabetes education and outcomes for patients with DFUs.

METHODS

We conducted a retrospective electronic medical record review for a randomly selected sample of all Veterans who received at least one prescription for a diabetes medication or 2) had two or more ICD-9-CM diagnoses of diabetes mellitus (250.xx), DFU (707.xx) or lower extremity amputation (84.13-84.17) or a CPT code for lower extremity (tibia, fibula or femur) amputation (27889, 27590) between 1/1/2015-9/30/15. We obtained VA administrative data to describe marital status, glycemic control, BMI and albumen levels. We used VA administrative data to compute Charlson Comorbidity Index (CCI) scores to measure the burden of comorbidities. The CCI predicts hospital charges, length of stay, and 1-year and in-hospital mortality. Podiatrists collected information on foot screen risk scores, deformities/ amputations, surgeries, clinical management, infection, and sensory status. Social work notes were used to examine factors related to patient abilities to manage their diabetes and/or DFU at home, including living situation, mental health issues and access to transportation. We went back to the 1st indication of diabetes to examine participation in diabetes

Eligibility criteria include diabetes diagnosis, DFU and/or amputation due to DFU (current or within past 2 years), age > 18 years, cognitively intact. No one will be excluded on the basis of gender or ethnicity. Specific exclusionary criteria include: 1) having significant active mental health co-morbidities (e.g., schizophrenia and other active psychoses, moderate to severe traumatic brain injury, dementia) or 2) terminal diagnosis. Data analyses: Descriptive analyses of patient characteristics from medical record review will be conducted using t-tests and/or Chi-square analyses (as appropriate).

FIGURES/TABLES

Demographics	
	Frequency (%)
Gender	
Male	107 (100)
Marital Status	
Married	52 (48.6)
Charlson Score	
0= No comorbid conditions	29 (27.1)
1 = heart disease, peripheral artery disease, stroke, asthma, ulcers, insulin-dependent diabetes, arthritis, dementia	30 (28.0)
2 = renal disease, cancer, hemiplegia	17 (15.9)
3 = cirrhosis	11 (10.3)
4 = advanced cancer, AIDs	20 (18.7)

Anatomic Abnormalities	
History of amputation	34 (32.4)
Charcot	5 (4.8)
Forefoot Deformities	28 (26.7)
Other	12 (11.4)
None	26 (24.8)

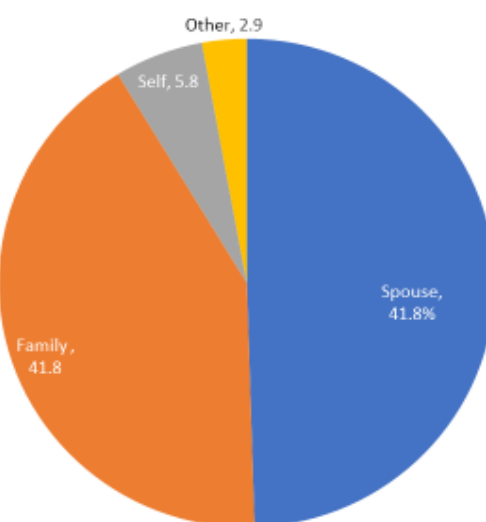
Foot Infection during 2015	Frequency (%)
Cellulitis (associated with DFU)	22 (20.6)
Osteomyelitis	31 (29.0)
Other	1 (0.9)
None	53 (50.0)

Social Work Services Rendered	Frequency (%)
No SW notes	39 (36.5)
Home situation	33 (30.8)
Transportation	30 (28.0)
Other	55 (51.4)

Adverse events patients experienced	
Amputation	32 (30.2)
Nursing home placement	22 (20.6)
Kidney dialysis	15 (14.0)
Homeless	9 (8.4)
Mental health	40 (37.4)

Onset of initial DFU	
	7.42
Years from DM diagnosis to 1 st DFU (median)	(range 0-25)

Living Situation



Glycemic control and lower extremity complications	
	Frequency (%)
HgbA1c (>7%)	65 (63.1)
BMI (Median)	30.33 (sd=6.6), range=19.5-60
Foot clinical findings	
PAVE/Foot screen score (at 1 st foot screen after DM diagnosis)	
0 – Normal	12 (11.9)
1 – Low risk	16 (15.8)
2 – Moderate risk	25 (24.8)
3 – High risk	48 (47.5)
Foot screen – Level of understanding (for 1 st foot screen)	
Good	47 (55.3)
Fair	33 (38.8)
Poor	1 (1.2)
First sensory exam (neuropathy screening)	
Sensate	52 (48.5)
Insensate	55 (52.4)
Sensory exam in 2015	
Insensate	94 (89.5)
% moved from sensate to insensate (or remained insensate) since DM diagnosis	39 (37.9)

DM education class	Frequency (%)
No diabetes class documented	51 (47.6)
One diabetes class attended	20 (18.7)
Two diabetes classes attended	23 (21.5)
All 3 diabetes classes attended	13 (12.2)
Of those attending any class – what did they attend?	
Self-management class	30 (28.0)
DM class I	42 (39.3)
DM class II	33 (39.3)
Any education class	56 (52.3)

RESULTS

- Half of study participants were categorized as “high risk” at the time of their 1st foot screening after being diagnosed with diabetes.
- Over half were insensate at the time of their initial foot screen. An additional 38% of participants went from sensate to insensate by 2015.
- The ability of almost 40% of the patients to understand the implications of diabetes for their feet was were described as “Fair/Poor” at the time of their initial foot screen.
- Half of the patients in our study participated in no formal diabetes education classes. It is possible that they received 1:1 education from their PCP at the time of their foot screen or as part of routine podiatric care, however, this is either poorly documented or challenging to find documented.
- Two-thirds of our patients received social work care addressing their home situation and/or need for transportation (typically due to their DFU).
- A significant proportion of our sample experienced a serious complication as a result of their DFUs, amputation, placement in a NH, becoming homeless.
- Almost half of our sample had mental health problems.
- The median time from diabetes diagnosis to 1st DFU in our patients is significantly shorter than in the non-Veteran population.

DISCUSSION / CONCLUSIONS

Patients with DFUs require interdisciplinary care to prevent and manage DFUs. Prevention and management of DFUs begins with a comprehensive assessment of risk factors for ulceration, including previous amputation or ulcer history, peripheral neuropathy, foot deformity, peripheral vascular disease, visual impairment, diabetic nephropathy (especially patients on dialysis), poor glycemic control and smoking status. Patients with DFUs require offloading and management of any foot-related complications, wounds, and shoe gear. Patients with DFUs may need assistance to improve effective glycemic control and adherence to dietary recommendations. In addition to these medical services, ancillary services (e.g., nutrition, patient education, wound care and social work) are equally important in assisting DFU patients with overall comprehensive quality of care. Patients should also receive education about their role in self-management of diabetes, including how to check their feet for indications of wound formation.

We conducted chart reviews for patients with a DFU in 2015. We went back through their electronic medical records (EMR) to understand their trajectories and to highlight potential areas for improvement. Despite having an EMR since 1997, we found it very challenging to locate relevant information to assist podiatrists in managing Veterans with DFUs. Much of the literature focuses on problem-based treatment after development of a DFU, not on preventing the DFU in the first place. We focused on availability of social support, patient understanding of their diabetes, foot screen scores, MH diagnosis, lack of sensation, glycemic control, and the Charlson index.

VA requires annual foot screening to identify those patients at high-risk of developing DFU or amputation. About half of our participants were described as “high risk” for DFU or amputation at the time of their initial foot screen after diabetes diagnosis. At a minimum, these patients should be referred to podiatry clinic and followed on a regularly scheduled basis. All high-risk patients also should receive ongoing formal diabetes education that conforms to NIH guidelines for low literacy populations (e.g. requiring patients to demonstrate their understanding of recommended foot care by explaining it in their own words). In addition, DFU patients would benefit from ongoing education on diabetes and glycemic control and cardiovascular health as well as recommended foot care practices.

In our study, only half of the participants had any documented formal diabetes education since their DM diagnosis. We observed inconsistency regarding when their diabetes was first diagnosed and what education was actually provided. Examination of materials used in currently available diabetes education classes also identified a lack of emphasis on practical tips for foot care.

The relatively short time from the study participant DM diagnosis to first DFU (7.42 years) highlights the need for more aggressive management of high risk patients. Primary care and podiatrists must agree on criteria for identifying high risk patients and what services these patients should receive. Identifying other risk factors that affect patient ability to participate in self-management (social circumstances, mental health, transportation concerns) is necessary for providing better preventative care, and improving overall outcomes in the DFU patient population. Tracking education and patient understanding of prevention and management of DM and DFU is a necessary first step in improving care for diabetic Veterans.

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