Assessment of Documented Foot Examinations for Patients With Diabetes in Inner-city Primary Care Clinics

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**Background:** The established guidelines for a diabetes foot examination include assessing circulatory, skin, and neurological status to detect problems early and reduce the likelihood of amputation.

**Objective:** To determine documented adherence with guidelines for foot examinations.

**Setting:** Four clinics in underserved areas.

**Methods:** Charts of 350 diabetic patients, identified by billing code, were reviewed for foot examination documentation. A documented foot examination was defined as assessing at least two of the three components of a foot examination. The review determined the periodicity and prevalence of foot examinations, referrals to a podiatrist or vascular surgeon during a 2-year period, and risk factors for foot complications. Stepwise logistic regression was used to determine whether risk factors for foot complications predicted foot examination status.

**Results:** The patients had a mean age and duration of diabetes of 57.7 and 8.8 years, respectively; 86% were black or Hispanic. There was no indication of foot examination or referral for 55.7% of the patients during the 2-year period. Patients with foot care referrals were more likely to have foot examinations by their primary care providers (P=.0001). There was almost a fourfold increase in the odds that patients with diagnosed peripheral vascular disease had foot examinations, with twofold greater odds for each 25-year increase in age.

**Conclusions:** Populations at risk of diabetic complications are unlikely to have foot examinations in their primary medical care, but having peripheral vascular disease increases the likelihood. Efforts are needed to improve adherence to foot examination guidelines for patients with diabetes from underserved populations.

(Arch Fam Med. 1995;4:46-50)

Of the 14 million Americans with diabetes, 55,000 have lower-limb amputations each year,^1^ with the elderly and minorities being disproportionately affected. It has been estimated that 50% of these amputations are preventable^2,3^ through early detection and treatment.^4^ Factors related to the risk for peripheral vascular disease (PVD) and amputation are well established.^1-12^ The risk factors for amputation listed by the American Diabetes Association include cigarette smoking, hyperlipidemia, hypertension, hyperglycemia, lack of self-management skills, inaccessibility to care and education, being male, having non-insulin-dependent diabetes, and being from a racial minority group.^3^ Increasing age and duration of diabetes are also associated with an increased likelihood of having an amputation.^2^

The American Diabetes Association^12,13^ and the Centers for Disease Prevention recommend that primary care providers examine the feet of diabetic patients at every medical visit. A complete foot examination includes assessment of circulation, skin condition, and neurological status.^2,13,14^ Clinical practice patterns for foot examinations have been assessed on the basis of providers' self-reports,^15^ chart reviews,^16,17^ and a combination of providers' self-reports with patient corroboration and chart reviews.^18^

A 1989 National Institutes of Health mailed survey found that over 80% of the 1502 primary care physicians reported performing a "foot exam for infection and ulceration" and "peripheral circulatory and neurological exam" in patients with non-
METHODS

A sample of four New York neighborhood family care clinics providing regular care to at least 50 patients with diabetes and receiving Federal Title 42 Section 330 funding to provide services to a medically underserved community participated in a diabetes quality assurance chart review. Two clinics were located in the Bronx, one in Brooklyn, and one in Manhattan. Patients with diabetes were identified using billing codes. Inclusion criteria for patients consisted of the diagnosis of diabetes, a minimum age of 18 years, and at least one clinic visit in the preceding 2 years. Patients with gestational diabetes were excluded.

The health characteristics of the diabetic patient population in these clinics have been reported previously. The chart reviews were conducted by health care professionals experienced in diabetes care who followed a standardized chart review protocol. The intrarater and intrarater reliability of the chart review method were acceptable (r > .9 for intrarater and r > .75 for intrarater). Chart notations were examined to determine the rate of complete foot examinations and referrals to a podiatrist or vascular surgeon during each of the 2 years immediately preceding the review. Documentation of a complete foot examination consisted of notation indicating assessment of at least two of the following for the lower extremities: circulation, skin condition, and neurological status.

Other information obtained from the charts included age at diabetes diagnosis, current diagnosis of PVD or hypertension, blood glucose and cholesterol levels, systolic and diastolic blood pressure, and smoking history. For the present study, a diagnosis of hypertension was defined by the presence of an explicit chart note or prescription of antihypertensives. Fasting blood glucose levels were calculated as the means of up to 12 fasting laboratory values noted during the review period. All charts were reviewed to determine whether smoking status was assessed, and patients were classified as smokers if the assessment included a note of tobacco smoked in cigarettes, cigars, or pipes.

Qualitative data about diabetes-related procedures and protocols in each clinic were obtained by observing a clinic session and interviewing medical staff. Research staff observed clinic flow and at least one patient encounter in each clinic. The semi-structured group interviews of the primary care providers were conducted by the researchers in each clinic to determine how decisions were made regarding elements of care.

Descriptive statistics for each clinic on demographic and screening variables are presented. Stepwise logistic regression was used to predict screening status in all four clinics combined.

In insulin-dependent diabetes one or more times a year. Payne et al. reported that, based on a 1-year review of charts, approximately half of diabetic patients in Denver inner-city clinics had a foot examination by their primary care provider. Based on a chart review of primary care clinics in Florida, Deeb et al. found that annual rates of foot examinations for patients with diabetes varied widely, but the factors accounting for the large difference among clinics were not identified. These three studies, however, did not examine the relationship between risk factors for PVD and likelihood of foot examinations.

Based on patient and physician interviews in a diabetes specialty clinic, Bailey et al. reported that 65% of patients undergoing evaluation had received annual foot examinations, either by a direct examination or a foot care referral. In their study, patients with foot problems (such as corns, calluses, or foot deformities) were more likely to have foot care referrals, but risk factors for lower-limb amputations did not predict the frequency of foot examinations by the diabetes clinic physician. Whether having risk factors for lower-limb vascular insufficiency and amputation affects the rate of foot examinations in primary care clinics is unknown.

We conducted cross-sectional chart audits of patients with diabetes in four primary care clinics in New York, NY, to assess rates of adherence with the recommended annual comprehensive foot examinations. We also looked at the relationships between PVD risk factors and the occurrence of foot examinations or referrals.

Table 1 lists the demographic characteristics of the 350 patients whose charts were audited. Overall, 86.0% of the patients were either Hispanic or black, with the rate varying from 77.6% to 96.3% among the four clinics. Men constituted 32.0% of the sample overall, with the proportion varying by clinic from 19.7% to 39.2%. The mean age of the total patient sample was 57.7 years, varying from 54.5 to 62.1 years among the clinics. The mean duration of diabetes for the total sample was 8.8 years, varying from 7.8 to 9.4 years among the clinics. The proportions of patients with risk factors for amputation were 68.3% with a blood cholesterol level of 5.17 mmol/L (200 mg/dL) or greater, 58.3% with diagnosed hypertension, 43.7% with a blood glucose level of 11.1 mmol/L (200 mg/dL) or greater, 27.3% of patients undergoing assessment of smoking status (n=165) with positive results, and 7.1% with diagnosed PVD. The mean number of visits during the 2-year assessment period was 16.2.

Table 2 lists the proportion of charts with documented comprehensive foot examinations performed by a primary care provider or provided by virtue of a foot care referral. During year 1 (the more recent of the 2 years studied), 29.4% of all charts documented foot examinations, and 12.3%, foot care referral. A total of 34.9% of the charts had evidence of a referral and/or examination by a primary care provider. The majority of foot care referrals was to podiatrists. Foot examination documentation was found for both of the 2 years examined in 9.7% of the charts, and referrals, in 2.3%. Evidence of examinations by primary care providers and/or referrals were found in a total of 12.0% of the charts. There was a positive association between having a foot examination by a primary care
Data were missing in nine charts.

Data were missing in 25 charts.

Data were missing in two charts.

Numbers were limited to charts with smoking assessment. For clinic 1, 43 charts were included; for clinic 2, 34; for clinic 3, 38; and for clinic 4, 51.

Data were missing in six charts.

Wata were missing in 26 charts.

*Based on chart audit indicating that examination was performed by primary care provider or through foot care referral.

The characteristics of patients with and without foot examinations or referrals are listed in Table 3. Data from all four clinics were combined, and stepwise logistic regression was used to identify correlates of foot screening status: at least one foot examination by a primary care provider or referral to a podiatrist or vascular surgeon in the past 2 years vs neither examination nor referral. For these analyses, 155 of 350 patients were identified as receiving a foot examination or referral. Possible correlates were age at last visit, sex, duration of diabetes, smoking (analysis of smoking status was limited to the 166 patients who had smoking status assessed), mean blood glucose level of 11.1 mmol/L (200 mg/dL) or greater, diagnosis of hypertension, diagnosis of PVD, cholesterol level of 5.17 mmol/L (200 mg/dL) or greater, and mean number of visits.

When considered one at a time, only four of these variables were related to foot examination status: age, diagnosis of hypertension, diagnosis of PVD, and mean number of visits (Table 3). Once age was controlled for statistically, only the diagnosis of PVD remained significant. The regression coefficients indicated an almost fourfold increase in the odds of having either a foot examination or referral associated with a diagnosis of PVD (ß=1.3; exponent ß=3.8). For each 25 years of age, the odds of having a foot examination

### Table 1. Demographic and Clinical Characteristics of Patients With Diabetes Whose Charts Were Reviewed

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Clinic No.</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 (n=82)</td>
<td>2 (n=71)</td>
<td>3 (n=90)</td>
<td>4 (n=107)</td>
<td>Total (n=350)</td>
</tr>
<tr>
<td>Black or Hispanic, %</td>
<td>96.3</td>
<td>91.5</td>
<td>82.2</td>
<td>77.6</td>
<td>86.0</td>
</tr>
<tr>
<td>Male, %*</td>
<td>39.2</td>
<td>19.7</td>
<td>33.7</td>
<td>33.3</td>
<td>32.0</td>
</tr>
<tr>
<td>Cholesterol level ≥5.17 mmol/L (200 mg/dL), †</td>
<td>79.7</td>
<td>62.5</td>
<td>60.5</td>
<td>70.3</td>
<td>68.3</td>
</tr>
<tr>
<td>Hypertension present, %</td>
<td>73.2</td>
<td>60.6</td>
<td>48.9</td>
<td>53.3</td>
<td>58.3</td>
</tr>
<tr>
<td>Glucose level ≥11.1 mmol/L (200 mg/dL), ‡</td>
<td>33.3</td>
<td>67.6</td>
<td>32.2</td>
<td>45.3</td>
<td>43.7</td>
</tr>
<tr>
<td>Smoker, %§</td>
<td>14.3</td>
<td>32.4</td>
<td>31.6</td>
<td>31.4</td>
<td>27.3</td>
</tr>
<tr>
<td>Peripheral vascular disease present, %</td>
<td>0</td>
<td>7.0</td>
<td>14.4</td>
<td>6.5</td>
<td>7.1</td>
</tr>
<tr>
<td>Mean (±SD) age, y</td>
<td>59.7 (12.1)</td>
<td>54.7 (14.3)</td>
<td>62.1 (12.8)</td>
<td>54.5 (14.5)</td>
<td>57.7 (13.8)</td>
</tr>
<tr>
<td>Mean (±SD) duration of diabetes, y</td>
<td>7.8 (6.6)</td>
<td>8.5 (7.1)</td>
<td>9.4 (6.1)</td>
<td>9.3 (7.5)</td>
<td>8.8 (6.9)</td>
</tr>
<tr>
<td>Mean (±SD) No. of visits in 2 y</td>
<td>14.4 (7.0)</td>
<td>20.4 (12.5)</td>
<td>17.3 (9.8)</td>
<td>13.8 (8.1)</td>
<td>16.2 (9.7)</td>
</tr>
</tbody>
</table>

*Data were missing in nine charts.
†Data were missing in 25 charts.
‡Data were missing in two charts.
§Numbers were limited to charts with smoking assessment. For clinic 1, 43 charts were included; for clinic 2, 34; for clinic 3, 38; and for clinic 4, 51.
§Data were missing in six charts.

### Table 2. Proportion of Patients From All Clinics With Annual Complete Foot Examinations*

<table>
<thead>
<tr>
<th>Foot examination by primary care provider</th>
<th>% (No.) of Patients</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>29.4 (103)</td>
<td>(25.4-36.4)</td>
</tr>
<tr>
<td>Both year 1 and 2</td>
<td>9.7 (34)</td>
<td>(5.6-17.1)</td>
</tr>
<tr>
<td>Either year 1 or 2</td>
<td>38.3 (134)</td>
<td>(32.4-42.7)</td>
</tr>
<tr>
<td>Referral for foot care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 1</td>
<td>12.3 (43)</td>
<td>(1.2-24.4)</td>
</tr>
<tr>
<td>Both year 1 and 2</td>
<td>2.3 (8)</td>
<td>(0.3-3.3)</td>
</tr>
<tr>
<td>Either year 1 or 2</td>
<td>16.6 (58)</td>
<td>(1.2-35.6)</td>
</tr>
<tr>
<td>Foot examination or referral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 1</td>
<td>34.9 (122)</td>
<td>(28.0-43.0)</td>
</tr>
<tr>
<td>Both year 1 and 2</td>
<td>12.0 (42)</td>
<td>(7.8-17.1)</td>
</tr>
<tr>
<td>Either year 1 or 2</td>
<td>44.3 (155)</td>
<td>(35.2-45.8)</td>
</tr>
</tbody>
</table>

*Based on chart audit indicating that examination was performed by primary care provider or through foot care referral.

### Table 3. Selected Characteristics of Patients in All Clinics With and Without Complete Foot Examinations*

<table>
<thead>
<tr>
<th>Patients With Examination</th>
<th>Patients Without Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black or Hispanic</td>
<td>84.5 (71.1-96.0)</td>
</tr>
<tr>
<td>Cholesterol level ≥5.17 mmol/L (200 mg/dL)</td>
<td>67.6 (56.7-81.8)</td>
</tr>
<tr>
<td>Mean age, y (range)</td>
<td>60.5 (55.4-65.5)</td>
</tr>
<tr>
<td>Diagnosis of peripheral vascular disease</td>
<td>12.3 (0-21.7)</td>
</tr>
<tr>
<td>Diagnosis of hypertension</td>
<td>65.8 (55.1-80.0)</td>
</tr>
<tr>
<td>Glucose level ≥11.1 mmol/L (200 mg/dL)</td>
<td>38.7 (25.7-68.0)</td>
</tr>
<tr>
<td>Smokers</td>
<td>22.7 (18.2-33.3)</td>
</tr>
<tr>
<td>Mean No. of visits during 2 y</td>
<td>18.0 (16.4-20.4)</td>
</tr>
</tbody>
</table>

*Numbers for each variable analyzed in which n is less than 350 are given in Table 1. Unless otherwise indicated, data are presented as percent of patients (range among clinics).
†P=0.003.
‡P=.007.
§P<.0001.
doubled (β=0.03; exponent β=1.03). Only about two thirds of those predicted to be in the screened group based on age and existence of PVD were actually screened.

Observation during a clinical session indicated that (1) most diabetic patients were examined with shoes and socks on; (2) none of the clinics used diabetes-related forms on a regular basis or had a systematic method of flagging patients for screening of foot problems; and (3) patient visits for follow-up care were limited to about 10 minutes. Group interviews with medical staff indicated the following: most diabetic patient visits addressed acute medical problems rather than the risk of diabetic complications; time constraints prevented addressing the risk of diabetic complications; and the frequency of foot examinations was at the discretion of each primary care provider.

COMMENT

Our results indicate that recommendations for complete foot examinations are not being implemented in this high-risk population. Among the patients with diabetes in the clinics studied, less than 10% of the charts indicated that complete foot examinations were performed on an annual basis by a primary care provider. Only about a third of the charts indicated that a foot examination was performed either by a primary care provider or through a referral to a foot care specialist when we assessed a 1-year window of care. Furthermore, over 55% of the charts had no indication that a complete foot examination was ever performed during a 2-year period reviewed. The low proportion of charts with documented foot examinations was similar across all of the clinics we studied. These results are striking when compared with those of the National Institutes of Health survey,

in which over 80% of primary care providers indicated by self-report that they performed annual foot examinations. Our rate of foot examinations is also less than the overall rates obtained by earlier chart review studies, which indicated that about half of the patients received foot examinations from their primary care providers during a 1-year review of care in primary care clinics

or a diabetes specialty clinic.

Even though there was some variability in the reported rates of foot examinations, especially in the study by Deeb et al,

our rate was considerably lower than the overall rate of the earlier chart studies, which indicated that about half of diabetic patients had at least one foot examination annually. Our findings that less than half of the patients had examinations over a 2-year period and less than 10% had annual examinations in relation to regular medical care were somewhat surprising. However, we defined a foot examination as an assessment of at least two of the three elements of an examination, including circulation, neurological status, and skin condition. The criteria used to indicate that a foot examination was performed were not provided in the studies by the National Institute of Diabetes and Digestive and Kidney Diseases,

Payne et al,

or Deeb et al.

Bailey et al

used removing socks and shoes as an indication that a foot examination was performed.

Patients, providers, and the health care system can each be influential factors in the implementation of preventive care recommendations. We considered each of these factors as we further examined the difference between our results and those obtained in earlier chart-based studies. Our rate of foot examinations might be expected to be considerably lower than that found in a diabetes specialty clinic. In fact, the study by Payne et al

found that the rate of foot examinations was considerably higher among patients who had been seen in the diabetes clinics than among those seen only in primary care clinics.

Although our study, like the study by Payne et al

focused on urban primary care clinics serving predominantly minority patients, patients in the earlier study appeared to be part of an organized health care system in which patient utilization of a neighborhood clinic, emergency department, and other hospital services could be tracked. Whether the potential to track services influences primary care provider behavior remains to be determined.

Based on our direct observation of clinic procedures, we did not find a systematic approach to lower-extremity examination in any of the clinics we studied. The lack of a systematic approach to examining feet was apparent even when we found evidence of a method for tracking the care provided. The charts in one clinic contained diabetes flow sheets, but these were rarely completed. In the two clinics with chart forms that could have flagged specific patient needs, the staff indicated that completing forms was too time-consuming. Furthermore, the providers indicated that most patients wore shoes throughout their clinic visits and waiting for patients to remove footwear was likely to disrupt the clinic schedule. Based on results of a study by Cohen,

patients with diabetes who present with bare feet are three times as likely to have their feet examined as those wearing shoes and socks. None of the clinics we studied had organized diabetes care in such a manner as to facilitate screening for regular complications or to perform a general checkup related to diabetes. One clinic had a general problem list in each chart, but these were not kept up-to-date.

The providers in our study indicated that most clinic visits focused on the patient's chief complaint, a situation reflected in chart notations that addressed acute rather than chronic problems. Chart notes also indicated that some visits primarily addressed diabetes or hypertension medication renewals and changes. We found, as did Payne et al

that patients with foot examinations or referrals made a greater number of total clinic visits, which may reflect visits related to the clinical management of foot problems. Nevertheless, in our study, even patients without foot examinations averaged over 14 visits each during a 2-year period.

Our finding that foot examinations by primary care providers and foot care referrals were related is not surprising. Providers who document foot examinations in the chart may be more likely to document referrals. In addition, we found that patients with identified PVD were also more likely to have examinations by their primary care provider.
care providers. These results are consistent with the early findings. Whether having more examinations reflects follow-up care or increased detection of problems when foot examinations are performed cannot be determined from our cross-sectional data. The majority of the referrals in our study were to podiatrists.

Having a foot examination in the earlier year of our study was associated with double the chance of having a foot examination during the next year. Since patients with foot examinations were more likely to have foot problems, the apparent continuity of their foot examinations may be owing to follow-up of existing foot problems. Thus, it appears that when a foot problem was identified, health care priorities change so that time is allocated to ensure that feet are examined more routinely. Intervention studies by Deeb et al. and Litzelman et al. indicated that a systematic approach to patient care improves rates of foot examinations. The randomized, controlled trial by Litzelman et al. found that patient education reduced the rate of serious foot lesions and increased the rate of foot examinations by providers as well as appropriate patient self-care behaviors. In a case-control study by Reiber et al., patients with diabetes who had not received diabetes outpatient education were more than three times more likely to have had a lower-limb amputation.

Increasing medical provider awareness of the foot care needs of diabetic patients is needed. Preventive education could potentially cut the rate of amputations in half and could potentially reduce medical care costs as well. However, this preventive education program will need to include the patients and providers and be integrated into the health care system to maximize its impact on amputation rates. Reiber estimated that the medical and rehabilitation cost of a lower-limb amputation was $40,000 in 1986. Since early intervention could potentially prevent up to 275 amputations each year, a comprehensive education program could substantially reduce diabetes-related costs as well as prevent amputations.

Accepted for publication September 7, 1994.

Supported in part by grant P60DK20541 from the National Institutes of Health, Bethesda, Md.

We appreciate Virginia Lioi's technical assistance in preparing the manuscript. The advice and effort of Marjorie Cypress, MS, RN, CDE, in conducting the investigation was invaluable. We appreciate the insights and advice of Elliot Rayfield, MD, whose review and suggestions were very helpful.

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REFERENCES


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