What Podiatrists Would Like Team Members to Know About Foot Health and Diabetes

In this section, you will find an overview of key medical issues related to foot health and diabetes to inform all members of the health care team about diabetes and how it can affect the health of the patient's feet. The information presented in this section validates key Healthy People 2020 objectives for diabetes and reinforces your value as pharmacy, podiatry, optometry, and dentistry (PPOD) professionals in the team care approach to comprehensive diabetes care.

Healthy People 2020 Objectives (Released by the U.S. Department of Health and Human Services each decade, Healthy People is a set of goals and objectives with 10-year targets designed to guide national health promotion and disease prevention efforts to improve the health of all people in the United States.)

> **Diabetes Objective #9 (D–9):** Increase the proportion of adults with diabetes who have at least an annual foot examination.
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> **Target:** 74.8%.
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> **Baseline:** 68.0% of adults ages 18 years and older with diagnosed diabetes had at least one foot examination by a health professional in the past 12 months, as reported in 2008 (age adjusted to the year 2000 standard population).
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> **Target Setting Method:** 10% improvement.
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> **Data Source:** Behavioral Risk Factor Surveillance System (BRFSS), Centers for Disease Control and Prevention (CDC), National Center for Chronic Disease Prevention and Health Promotion.

Current Data and Trends

Diabetes-related complications may present initially in the foot. Foot symptoms increase the risk for comorbid complications, of which nontraumatic lower-extremity amputations (LEAs) are the greatest concern:

- In the United States, more than 60% of nontraumatic LEAs occur in people with diabetes. About 65,700 nontraumatic LEAs were performed in 1 year on people with diabetes.[1]
- In the general population aged ≥45 years, the incidence of vascular lower-limb amputation (LLA) at or proximal to the transmetatarsal level is eight times higher in people with diabetes than those without diabetes.[2] The incidence of initial unilateral amputation per 100,000 person-years was 192 for women with diabetes versus 22 for women without diabetes, and 197 for men with diabetes versus 24 for men without diabetes.[2]
- The overall 25-year incidence of LEA in people with diabetes was 10.1%. Male gender, smoking, hypertension, diabetic retinopathy, and higher A1C values were associated with a greater risk of LEA.[3]

Patient Case Example

A podiatrist notices his 35-year-old patient with diabetes has terrible breath and asks about it. The patient is embarrassed, but admits that he has noticed a bad taste as well. A quick look in the patient's mouth reveals inflamed, swollen gums with pus at the gum line.

The podiatrist describes the link between periodontal disease and poor blood glucose control and stresses the need for urgent dental attention for a possible abscess. The podiatrist's office helps the patient obtain a prompt dental appointment for care.

From reported statistics, about 75,000 diabetes-related hospital discharges involve LEA. The LEA rate per 1,000 persons with diabetes is 3.9 among persons ages 65 years and younger, 6.6 among persons ages 65 to 74 years, and 7.9 among persons ages 75 years or older. After their initial amputation, 9% to 17% of patients will experience a second amputation within the same year[4], and 25% to 68% of people with diabetes will have an amputation of the contralateral extremity within 5 years.[5]

One study found that 80% of nontraumatic LEAs are preceded by a foot ulceration, which provides a portal for infection.[6] According to BRFSS data, approximately 12% of U.S. adults with diabetes have a history of foot ulcer, a risk factor for LEA.[7]

Another report identified minor trauma, ulceration, and faulty wound healing as precursors to 73% of LEAs, often in combination with gangrene and infection.[6] Other risk factors include the presence of sensory peripheral neuropathy, altered biomechanics, elevated pressure on the sole of the foot, and limited joint mobility.[8]

Diabetes-related Foot Conditions

Podiatrists consider the following conditions as they assess the risk for complications when evaluating the feet of people with diabetes.

Neuropathy

A patient who experiences subjective tingling, burning, numbness, or the sensation of bugs crawling on the skin, especially at night, may be experiencing peripheral sensory neuropathy. On clinical examination, podiatrists can detect this condition in various ways: with an instrument known as a Semmes-Weinstein 5.07 (10-gram) monofilament and also testing for vibratory sense by using a 128mhz tuning fork. You can find a description of how to perform a comprehensive foot exam in the free National Diabetes Education Program (NDEP) health care provider kit, *Feet Can Last a Lifetime*.

People with diabetes who have neuropathy are 1.7 times more likely to develop foot ulceration. In persons with both neuropathy and foot deformity, the risk is 12 times greater, and in those who also have a history of pathology (prior amputation or ulceration), the risk is 36 times greater.[6,9]

Factors that increase a patient's risk for lower-extremity ulceration and amputation include:

- Male sex
- The existence of documented diabetes for more than 10 years
- History of tobacco use
- A history of persistently elevated blood glucose levels
- The presence of cardiac, retinal, or renal complications or peripheral arterial occlusive disease[8,9,10,11]

Charcot Foot

Patients with neuropathy are at risk for painless degenerative arthropathy, which typically affects the midfoot joints, resulting in a red, swollen, and possibly deformed foot that can be mistaken as being affected by cellulitis.

One form of arthropathy, called Charcot foot, causes weakening and fracturing of the bones in the foot and occurs most often in people who have significant neuropathy. Radiographs may show collapse of joint structure and can be misinterpreted as osteomyelitis. Charcot foot is a very serious condition that can lead to severe deformity, disability, and even amputation.

Treatment for Charcot arthropathy is complicated and requires a specialist. In some instances, surgery is necessary, but most urgently a non-weight-bearing cast is generally advised. After the acute inflammation has resolved, and if the foot is braceable, the podiatrist may prescribe special shoes to correct altered biomechanics.[13] Without treatment, the Charcot foot can progress to further deformity and ulceration and lead ultimately to amputation.

Consider it a red flag when a patient complains to you that his or her shoes no longer fit, or if the patient is wearing slippers or shoes with sections cut out to accommodate changes in foot shape, walks with a new limp, or complains of unilateral swellings.

Foot Complication Prevention

- Many people with diabetes who request routine care will have a treatable foot problem.[12]
- The lifetime incidence of foot ulcers among patients with diabetes is 25%.[12] Most of these are preventable through interventions available in most primary care settings and appropriate self-care.
- Patients with diabetes who are on dialysis are at extreme risk for foot complications. Increased foot care frequency and educational outreach to this group are associated with improved foot outcomes.

A Charcot foot usually causes little to no pain and may be slowly progressive over weeks to months before coming to a health care provider's attention. You can contribute to amputation prevention by referring patients with these signs and symptoms to a foot care specialist.

Vasculopathy

When a patient experiences cramping of calf muscles when walking (often referred to as a "charley horse") that requires frequent rest periods, he or she may have intermittent claudication. This condition, often caused by insufficient blood supply to the region beneath the knee, indicates the presence of early or moderate occlusion of the arteries, which is common to the lower extremities of people with diabetes.

However, the classic symptoms of peripheral artery disease (PAD) may be absent if neuropathy is present. In these instances, patients may complain of painless fatiguing of muscles after walking short distances and indicate that the fatigue is relieved by rest. Remember, PAD is a marker for overall cardiovascular disease. If a patient is diagnosed with PAD, the patient should also be evaluated for cardiovascular risk factors. This may prevent early cardiovascular-related mortality.

Patients who experience intense cramping and aching in the toes only at night, called "rest pain," can usually relieve the discomfort by hanging their feet over the side of the bed and by walking. Rest pain signifies the end-stage blood vessel disorder and tissue ischemia that precedes diabetic gangrene. Although most clinical research continues to list the loss of sensation/neuropathy as the leading factor in ulceration and associated complications, poor blood supply can contribute to poor ulceration healing and is a significant risk factor for amputation. Both factors need to be addressed in comprehensive diabetes foot care, with diagnostic testing for treatable vascular lesions and intervention as warranted.

Dermatological Conditions

Corns and calluses (hyperkeratotic lesions) of the patient's feet result from elevated mechanical pressure and shearing of the skin. They often precede breakdown of skin and lead to blisters or ulceration, especially in neuropathic patients.

Superficial lacerations and heel fissures, or maceration (softening caused by wetness) between the toes, can all serve as portals for infection. Corns, calluses, toenail deformity, and bleeding beneath the nail may signify the presence of sensory neuropathy. Fungal infections are common and should be treated promptly.

Musculoskeletal Symptoms

Structural changes in the diabetic foot may develop in combination with muscle-tendon imbalances as a result of motor neuropathy.

These deformities include the presence of hammertoes, bunions, high-arched foot, or flatfoot—all of which increase the potential for focal irritation of the foot in the shoe. People with diabetes may have reduced elasticity of the Achilles tendon, which limits ankle dorsiflexion and increases pressure on the feet.

Patient Case Example

A 70-year-old man consults a podiatrist because of painful corns on his feet. He says, "I don't walk anymore because of these corns, but I guess that doesn't matter—I'm too old to be walking much."

The podiatrist emphasizes the many benefits, including diabetes prevention, of regular physical activity such as walking. He explains that one in five people older than age 60 have diabetes, but that the disease can be prevented or delayed.

He treats the man's corns and then shares the NDEP *It's Not Too Late to Prevent Diabetes* tip sheet with the man. He says, "After we get your feet fixed up, you will be out there walking again."

Lifestyle and Family History

People with diabetes who currently smoke are four times more likely than people without diabetes who smoke to develop lower-extremity vascular disease.

Poor food choices and low physical activity levels can lead to persistently elevated A1C levels, which can increase the risk that peripheral nervous system and/or blood vessel disorders will progress.

A family history of cerebrovascular accidents and coronary artery disease may indicate a further increased risk of developing lower-extremity arterial complications. Inherited foot types (e.g., shapes) may predispose the patient to biomechanical deformities that lead to problems with skin breakdown.

Comprehensive Foot Examination

A comprehensive foot examination for abnormalities, including evaluation of pulses, sensation, foot biomechanics (i.e., general foot structure and function), and nails, as well as a footwear assessment, helps determine the person's category of risk for developing foot complications.

Persons with diabetes who are at high risk have one or more of the following characteristics:

- Loss of protective sensation
- Absent pedal pulses
- Foot deformity
- History of foot ulcers
- Prior amputation

Low-risk individuals have none of these characteristics. Assessment of risk status identifies people who need more intensive care and evaluation. Further patient education, early intervention, and special footwear, if indicated, can prevent ulcers and ultimately LEAs.

To assess risk factors, have the patient remove socks and shoes, and then inspect both feet for acute problems at each visit.

Foot Risk Status

The American Diabetes Association and American Podiatric Medical Association consider two categories of risk for developing foot complications.

High Risk (one or more of the following):

1. Loss of protective sensation.
2. Absent pedal pulses.
3. Foot deformity.
4. History of foot ulcers.
5. Prior amputation.

Low Risk: None of the above characteristics.

See the next box, High- and Low-risk Foot Patient Education, for interventions for patients with high- and low-risk foot status.

Patient Education

The goal is to prevent low-risk patients from moving to the high-risk category by managing the ABCs (A1C, blood pressure, cholesterol, and smoking cessation).

Health care providers can inform all patients about the connection between foot health and diabetes. Encourage patients with diabetes to:

- Prevent ulcers through self-management education, podiatry care, and use of appropriate footwear. Patients should be taught how to check their own feet every day, including what to look for and when to contact their provider.
- Get a full foot exam by a podiatrist at least once each year. Patients with diabetes should also make sure their feet are checked at every health care visit. They need to take off their shoes and socks at all visits and be sure to ask for a foot exam.
- Prevent ulcers through self-management education, podiatry care, and proper use of appropriate footwear. Patients should learn how to check their own feet every day.
- Avoid minor foot trauma, such as stubbing a toe, stepping on a sharp object, or experiencing pressure from tight shoes. These can lead to ulcer in patients with diabetes.
- Be diligent in clearing walking spaces (especially around the bed and the path to the bathroom), using nightlights, and wearing properly fitted shoes.
- Know when and who to call with specific foot problems. Patients with a puncture wound, ulcer, redness, or new-onset foot pain should call and see their primary care provider or podiatrist that day. Patients with calluses and/or thick or ingrown nails should call a podiatrist and be seen within a few days.

High- and Low-risk Foot Patient Education

The goal for low-risk patients is to keep them low risk by:

- Controlling the ABCs.
- Quitting tobacco.

The goal for high-risk patients is to prevent foot ulcers by:

- Educating them on self-management.
- Stressing the role of minor trauma.
- Clearing walking spaces of potential hazards.
- Seeking prompt, same-day care for injuries.
- Receiving regular podiatry care.

For a useful exam tool for health care providers, visit NDEP's resource, *Feet Can Last a Lifetime: A Health Care Provider's Guide to Preventing Diabetes Foot Problems*.

For more information for patients, see *Diabetes and You: Healthy Feet Matter!* and

Take Care of Your Feet for a Lifetime

Please visit the Resource Center section of the PPOD Guide and Toolkit for other resources on foot health.

Key Questions That All Members of the Health Care Team Should Ask Patients About Foot Health

Patients should be referred to a podiatrist if the answers to these questions are "no" or "unsure":

- Do you get a full foot exam by a podiatrist at least once each year?
- Do you know how diabetes can affect your feet?
- Do you know how to check your feet every day?
- Do you check your feet every day?
- Do you know what to do if you develop foot pain, redness, or sores?
- Do your shoes fit you correctly?

Key Points

- Podiatrists play a key role in the early identification and treatment of foot problems in people with diabetes.
- Podiatrists are important in the collaborative interprofessional team care approach for diabetes management.

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Gangrene
Severe infections may be present but undetected by patients with neuropathy who have difficulty examining their feet.

Ulceration of the great toe
This deceptively small lesion seriously increases the risk for amputation. Risk factors for amputation include peripheral neuropathy, abnormal biomechanics, peripheral vascular disease, prior ulceration, and prior amputation.

Hammer toes
The loss of foot musculature has led to abnormal foot biomechanics with the toes drawn up into a "hammer toe" position. This increases the risk of ulceration and amputation.

Peripheral neuropathy
Shiny skin, the inability to sweat, and lack of protective sensation compound the risk for amputation in this patient with foot deformity and overriding toes. Treatment includes special footwear, patient education, and vigilant daily foot hygiene and inspection.

Ulceration
Even large wounds can be painless in the face of neuropathy, and patients may deny there is a problem. The patient with this lesion needs referral for a program of wound management and non-weight-bearing rehabilitation.