Amputation Prevention:

Your Role in Saving Limbs of Persons Living with Diabetic Foot Complications

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Introduction

Amputations are one of the most feared diabetes-related complications. The cascade of diabetes-related foot problems typically begins as calluses, then may progress to ulcers, infections, complicated wounds, amputations and even death. They may result in more days in hospital than all the other diabetes-related complications combined.[1]

Across Canada, 14 diabetes-related amputations are performed every day (over 5,000 amputations a year).[2] The five-year mortality rate following an amputation is 45–80%.[3–4] Complicating this situation, 40% of patients with diabetes are reported to not be aware of or able to recognize risk factors or practise self-care behaviours that can help prevent diabetic foot complications.[5] As well, comorbid depression affects 20–40% of those living with diabetes.[6] Williams et al. (2010) reported that within a patient population that lived with major depressive disorders, there was a two-fold increased risk for developing a foot ulcer over four years.[7]

In a recent population-based study in Ontario, Hussain and colleagues (2019) noted the decline in diabetes-related complications, including acute myocardial infarction, stroke, end-stage renal disease and hyperglycemia crisis, over the last 20 years, but highlighted an *increase* in amputations over the past 10 years.[9] Reasons for the growing number of amputations include the increasing prevalence of diabetes and peripheral artery disease, and poorly co-ordinated foot and wound care.

These statistics can be discouraging, but according to the International Working Group on the Diabetic Foot (2019), well-organized diabetic foot care teams, limb preservation teams and well-informed self-care practices by patients can reduce amputations.[10] This article reviews the roles of the patient, clinician and policy maker in preventing diabetes-related amputations.

D.C., a person living with diabetic foot disease, describes neuropathy as being "like no other health indicator. There is no pain or discomfort. It is the absence of symptoms. That means our body's early-warning signals are useless. We have to think and not feel!"[8]

Patient:
What Can I Do?

Primary Prevention

If you have diabetes, be proactive about your care. Each time you see your doctor, nurse practitioner, certified diabetes educator or health-care professional, ask them to assess and discuss with you your risk level for developing a foot ulcer or other complication. The sooner these issues are identified, the sooner they can be addressed. While some of the recommendations below may seem difficult or inconvenient to carry out, they will greatly reduce your risk of foot complications that may lead to an amputation.

A Healthy Lifestyle

Be aware that your smoking habits, alcohol use, cholesterol level and blood glucose levels are all factors that affect your risk of developing diabetic foot complications. Setting realistic and practical goals to support healthy lifestyle changes is an essential step in reducing your risk of developing diabetes-related foot complications.

Look at Your Feet—Every Day!

More than most people, you should also take an active role in daily foot, nail and skin care. Here are some key elements for looking after your feet to prevent problems:

- Perform daily foot inspections (use a mirror or have a care partner assist). See box for details.
- Wear appropriate footwear, and check and shake out your shoes before putting them on—every time.
- Learn to recognize the signs of complications and know where to go for assistance.

How to Perform a Daily Foot Exam

- Examine the area between the toes and on the sides and bottom of the foot for broken skin, cuts, bruises, cracks, blisters, redness, ulcers, and anything else that looks new or unusual. Use a mirror, if you need to, to examine the bottoms of your feet.
- Examine nails for tears, irregular edges, colour changes in the nail bed, bruising or trauma.
- Know who your foot care and footwear providers are, keep their contact information handy, and don't hesitate to contact them if you notice symptoms that concern you.
- Consider measuring the temperature of your feet (thermometry testing) using a personal infrared thermometer to detect signs of temperature change that can alert you to early signs of complication.[11] Infrared thermometers can be found in many places, including some automotive stores, as they are used to monitor the temperature of car engines.

For an informative video on what to look for, click here.

Active Pathology, or Foot Complications

When a person with diabetes develops a foot complication, the main goal of treatment is usually to achieve healing, something with which a health-care team can help. If you do develop a foot complication such as an ulcer, seek help *as soon as possible* to prevent the complication from progressing further and placing your foot or leg at greater risk of infection and amputation.

In treating a diabetic foot ulcer (DFU), you should expect your health-care team to do the following:

- Assess the ulcer.
- Rule out and/or treat infection(s).
- Assess the blood flow to your legs and feet to rule out arterial disease.
- Make sure pressure is redistributed from your foot through offloading.

Offloading is a method whereby your body's weight is transferred to another part of your foot or taken off the affected foot completely to allow healing to occur. It can involve the wearing of specialized casting or the use of a wheelchair or crutches.[12] These devices will reduce pressure and speed the healing process. If you have been prescribed offloading to help you heal, be consistent and be sure to wear your offloading device at home. This means at night if you go to the

bathroom, the device needs to be put on again. Refrain from going barefoot, as even one step can undo the healing that may have occurred. Your role is to work with your health-care team to set achievable goals and accomplish the goals.

Know, too, that your other foot is at risk of complications. Continue with your daily foot inspections to both feet. This is essential for preventing additional ulceration.

Remind your health-care clinician about regular foot screening, inquire about their findings and discuss with them your plan of care. One way to be sure this occurs is to take your shoes and socks off to have your feet inspected when visiting your physician.

Keep Informed

- Follow the Patient or Caregiver section of Wounds Canada's website.
- Attend a Diabetes Healthy Feet and You workshop.
- Participate in a Diabetes Healthy Feet and You support group.
- Sign up online for monthly foot care tips.

A Healthier Body

Managing blood glucose (sugar) levels is also important for both prevention of complications and healing of wounds such as foot ulcers. It's best if you work closely and regularly with your diabetes educator, physician (family doctor, endocrinologist), nurse practitioner or whoever is handling the diabetes portion of your health care, to manage your blood glucose and maintain your general health.

Wound healing takes time and depends on many factors, including your overall health, the wound size and location, pressure on the wound from activity and walking, circulation, blood glucose levels, wound care and pressure offloading. Do the following to care for yourself:

- Manage blood glucose levels.
- Seek medical attention when you notice any changes in your skin or nails.
- Consistently check and wear appropriate footwear.
- Perform daily foot examinations to both feet.
- Quit smoking.

Preventing Recurrence

Once a foot ulcer has healed, the new tissue is only about 85% as strong as the original. The chances are fairly high, therefore, that it will open again (called recurrence), and you will develop another wound. The best thing you can do to prevent recurrence is maintain the healthy lifestyle that helped the ulcer heal in the first place:

- Perform daily foot exams.
- Manage blood glucose, blood pressure and cholesterol levels.
- Select and wear professionally fitted shoes, and check them before putting them on.
- Eat a healthy, balanced diet.
- Perform daily foot, nail and skin care, or seek professional foot care.
- Seek help when complications arise.

Know your risk level so you can schedule a foot assessment every one to three months, or as determined by your health-care provider.

Managing diabetes can be very stressful. If you are experiencing diabetes-related burnout, talk to your health-care professionals about support services that can help you.[13]

B.J.: *"I just thought this was something that happened to someone else in my family, not me. It was my wife that encouraged me to ask for a foot assessment, she keeps me on track."* (private communication)

What is diabetes burnout?

Dealing with diabetes is a lot of work.[14] Over time, the stress of a disease that requires you to pay attention to the food you eat, and your activity level, medications, monitoring and screenings can build up. Sometimes people can feel overwhelmed or frustrated by their diabetes and, as a result, may start to ignore their condition. This is called "diabetes burnout."[15]

A Daily Commitment

Follow this link to learn how to perform foot examinations and test the temperature of your feet.

Clinician:
What Can I Do?

Frontline health-care professionals play an important role in supporting a person living with diabetes and reducing their risk of amputation by ensuring they receive timely and appropriate care. The time to start with preventative strategies with any patient is NOW!

Primary Prevention

Preventing diabetic foot complications requires a holistic approach—that is, looking at the whole patient, including the environment in which they live, work and play, what kind of support they have or could access, and how capable they are of self-management. Once a thorough health assessment is made, goals are set with the patient and a team is established, you can begin to implement regular preventative strategies (basic and advanced foot, nail and skin care), patient education/instruction that supports self-management, and a comprehensive diabetes management plan.

Primary prevention includes assisting patients to manage their glycemic levels, which, in turn, helps prevent the development of risk factors that contribute to diabetic-foot-related complications.

Every individual with diabetes requires *at a minimum* an annual foot exam, though patients at higher risk of complications should be assessed more frequently.[16] Use a standardized screening tool to help assess your patients' risk level for developing foot complications, including neuropathy or ulcers.[10] The tools for this assessment should be standardized and validated, and assessment should be completed by staff who have received education and training in this area.[17] If you are unsure of your abilities in this area, visit the Wounds Canada Institute website for courses you can take to further your education.

Inlow's 60-Second Diabetic Foot Screen is a validated tool provided by Wounds Canada for assessing amputation risk.[18] This tool involves three steps:

1. Complete an assessment of both feet (including assessing for skin and nail changes, loss of protective sensation, peripheral arterial disease, bony deformity and footwear).
2. Determine the risk for ulceration and amputation (using the International Diabetes Federation's Risk Categories [modified]).
3. Create a plan of care with the patient based on their identified risks.

Inlow's 60-Second Diabetic Foot Screen can be accessed online.

Once you have assessed the patient and determined the level of risk (five possible levels), you can begin working with your patient to set goals and assemble a team to implement a plan of care tailored to the patient's goals and their body's ability to heal itself. The plan of care should include the following:

- Engage the patient and family or care partners with individualized and interactive instruction about performing daily foot care.
- Ensure self-monitoring through regular foot inspection; basic foot, nail and skin care; and selection and use of appropriate footwear.
- Identify necessary contacts in the event of a concerning change.
- Provide your patients with information about financial supports that may be available to ensure foot care and footwear needs can be achieved and maintained.

The Importance of Screening

According to Dorresteijn and colleagues (2012), diabetic foot care education can improve short-term outcomes, but education in the absence of screening examinations and comprehensive disease management does not lead to a reduction in diabetes-related foot ulcer or amputation incidence.[26]

Active Pathology

You also have a role to play in managing active diabetic foot-related pathologies, including ulceration, vasculopathy, neuropathy, callus management, infection (bacterial, viral and/or fungal), structural deformities (e.g., Charcot foot, hammer toe) and gait anomalies. Your involvement in the initial care of any active pathology requires undertaking, or referring your patient to, a comprehensive assessment of vascular status, the presence of infection, and pressure. Careful assessment of these elements can help you, your patient and the team determine the healing potential of the wound,[19] direct the goals of the plan of care and enable appropriate referrals to specialists or other members of the interprofessional team who can deliver ongoing, co-ordinated, integrated care. Remember, pressure offloading is a crucial part of your plan of care for the healing of a diabetic foot ulcer. Without it, all other interventions are of limited value.

Timely care is critical in these cases; patients with limb-threatening complications need to be seen by a specialized team within 24 hours.[1,20] Don't hesitate to act. You could save a limb and a life.

You should also take an active role in supporting your patients as they move through different care settings by communicating effectively with the patient and other team members and providing education resources.

When treating active foot pathology, identify the underlying cause of the problem or delay in healing (pressure, repeated trauma, poor circulation, infection), as it will be crucial both for managing the active pathology and preventing recurrence. In Canada, "[t]he costs of amputations have been found to be 10 to 40 times greater than the cost of effective initiatives to prevent amputation."[21]

Preventing Recurrence

Unfortunately, recurrence of complications is common in patients with diabetic foot disease. According to Armstrong and colleagues (2017), after the resolution of a foot ulcer, there is an estimated 40% recurrence rate within one year and almost 60% within three years.[22] Furthermore, Örneholm and colleagues (2017) reported that 42% of patients they followed developed a new ulcer within two years of closure of the initial ulcer.[23] These studies remind clinicians to think of patients who have achieved wound closure as being in remission rather than being healed.[23] They are still at high risk.

As a member of a care team, ensure your patients are receiving integrated foot care and appropriate self-management resources and have appropriate shoes and orthotic devices. Education alone does not appear to significantly change foot health outcomes in persons with diabetes. It needs to be combined with motivation for self-care behaviours.[8] Since persons living with established neuropathy do not experience pain, symptom-driven motivation to be more attentive to their self-care behaviours or adhere to day-to-day preventative behaviours can be challenging.

According to Steel and colleagues (2016), there is an increase in depressive symptoms associated with risk of DFUs, and depression remains underrecognized and undertreated in the DFU patient population.[24] As a clinician, you need to be aware of the individual's capacity for self-care. Consider assessing their psychological well-being and engaging a mental health specialist in the multidisciplinary treatment of patients with a diabetic foot ulcer.[24]

Screening for depression and anxiety are part of holistic care, and such screenings may be of additional benefit if the patient is not fully engaged in care.[7] Ahmed and colleagues (2018) report rates of anxiety of 37% and depression near 40%.[25] Furthermore, the research shows that depression is positively associated with females, current smokers, patient over the age of 50, patients with foot ulceration duration greater than seven months, and those with three or more comorbid diseases. Diabetes Canada's Diabetes Distress Screening scale is a simple, two-item screening tool that can be used. Access it online here: www.diabetesed.net/page/_files/diabetes-distress.pdf.

Resources

There are excellent, credible resources available online that can support your patient in understanding the complexity of their disease, such as:

- Wounds Canada. Overview: Diabetic Foot Ulcers
- Diabetes Canada. Diabetes and Foot Care: A Patient's Checklist

Policy Maker:
What Can I Do?

Diabetic foot ulcers remain a major health-care problem despite the existence of Canadian guidelines. This area of medicine appears to be susceptible to non-standardized forms of care delivery and care approaches, which contribute to the geographic variation in outcomes.[27] It is also noteworthy that the area of diabetic foot complications has failed to attract the same level of research interest by health-care professionals as other diabetes complications, due to the complexity of the disease progression and its impact on trial design, funding opportunities and complexity of the care process.[27] Differences in amputation rates within and among countries are related more to attitudes and systems of health-care organizations, rather than type of comorbidity or insufficient resources.[28]

There are numerous obstacles to any individual achieving optimal diabetic foot care. One of the most obvious is the lack of hospital-based integrated diabetic foot care teams. Clinicians can't refer a patient to a clinical service that does not exist. As well, patients with economic challenges who have had the benefit of a foot care team may not be able to afford footwear or custom orthotics to prevent further complications.

Some of the barriers identified by primary care in a 2019 study include poor implementation of best practice and evaluation, lack of supportive education for all staff on all shifts, and the absence of supportive policies and procedures.[29] In this study, 135 nurses, two occupational therapists and two family physicians, while committed to excellence in wound care, recognized the need for effective and widespread dissemination of wound care practice through health-care systems.

"Foot care is the costliest complication, and the most amenable to rapid change."

As a policy maker, you need to consider what changes you can make to improve and standardize care to reduce variation in health outcomes and support equitable care. You have an opportunity to create and maintain a health-care system, institution or agency that provides early identification and intervention services to this unique patient population. Your primary goals should favour prevention, as this benefits patient quality of life as well as health-care budgets; amputations are expensive. **Foot care is the costliest complication, and the most amenable to rapid change.**

You are in a position to support patients with diabetes and your health-care system, institution or agency throughout primary prevention, active pathology and prevention of recurrence phases by doing the following:

- Establishing well-defined treatment pathways for persons with diabetes that support timely access to care in each community (see Figure 1, Wounds Canada's Diabetic Foot Pathway, pg 54).
- Establishing integrated multidisciplinary services to assess and treat patients living with diabetes holistically and address their systemic, psychological well-being and detect foot complications.
- Establishing a diabetic foot hotline that assists patients living with diabetes-related foot complications to navigate the health-care system.
- Establishing integrated teams with specialized education who can deliver timely and effective treatment if foot complications arise. According to the IWGDF, the health-care experts who can support patients at different levels of risk include:[10]
  - **Low Risk (Category 0):** Primary care practitioner, diabetes educator, dietitian, pharmacist
  - **Moderate Risk (Category 1):** General practitioner, podiatrist/chiropodist, diabetes educator, dietitian, pedorthist/orthotist

- **High Risk (Category 2):** Endocrinologist, surgeon (vascular and/or orthopedic), podiatrist/chiropodist, diabetes educator, dietitian, pedorthist/orthotist
- **Very High Risk (Category 3) or Urgent Risk:** Foot centre with multiple disciplines specialized in diabetic foot care and linked to a surgical facility

- Support public reimbursement for preventative foot care, shoes, socks and offloading devices for individuals with no private insurance coverage.
- Ensure patients and care partners have access to educational resources to support self-management: www.woundscanada.ca/for-patients-public.
- Recognize the mental health concerns of people living with diabetes. Ensure they are screened regularly for depression as an element in primary prevention of further foot complication—especially if they have active diabetic foot disease. Addressing mental health issues helps to support the psychological well-being that impacts prevention and healing outcomes.
- Support health-care professionals to acquire skills to address knowledge gaps specific to standard (see the Wounds Canada Institute).
- Audit all aspects of care to ensure local practice meets accepted national and international standards of care.
- Measure and track amputations (types) and wound care data across the continuum of care, along with hospital admissions realted to diabetic foot complications.
- Ensure appropriate coding in documentation so the burden of these pathologies can be reported accurately.
- Consider funding research that addresses knowledge gaps in areas that can impact the high patient morbidity and mortality and health-care costs.

"Nothing new needs to be developed. All the required pieces, all the specialties and skills, are already in the health-care system; some assembly is required."[1]
—Tom Weisz

Universal Frustration

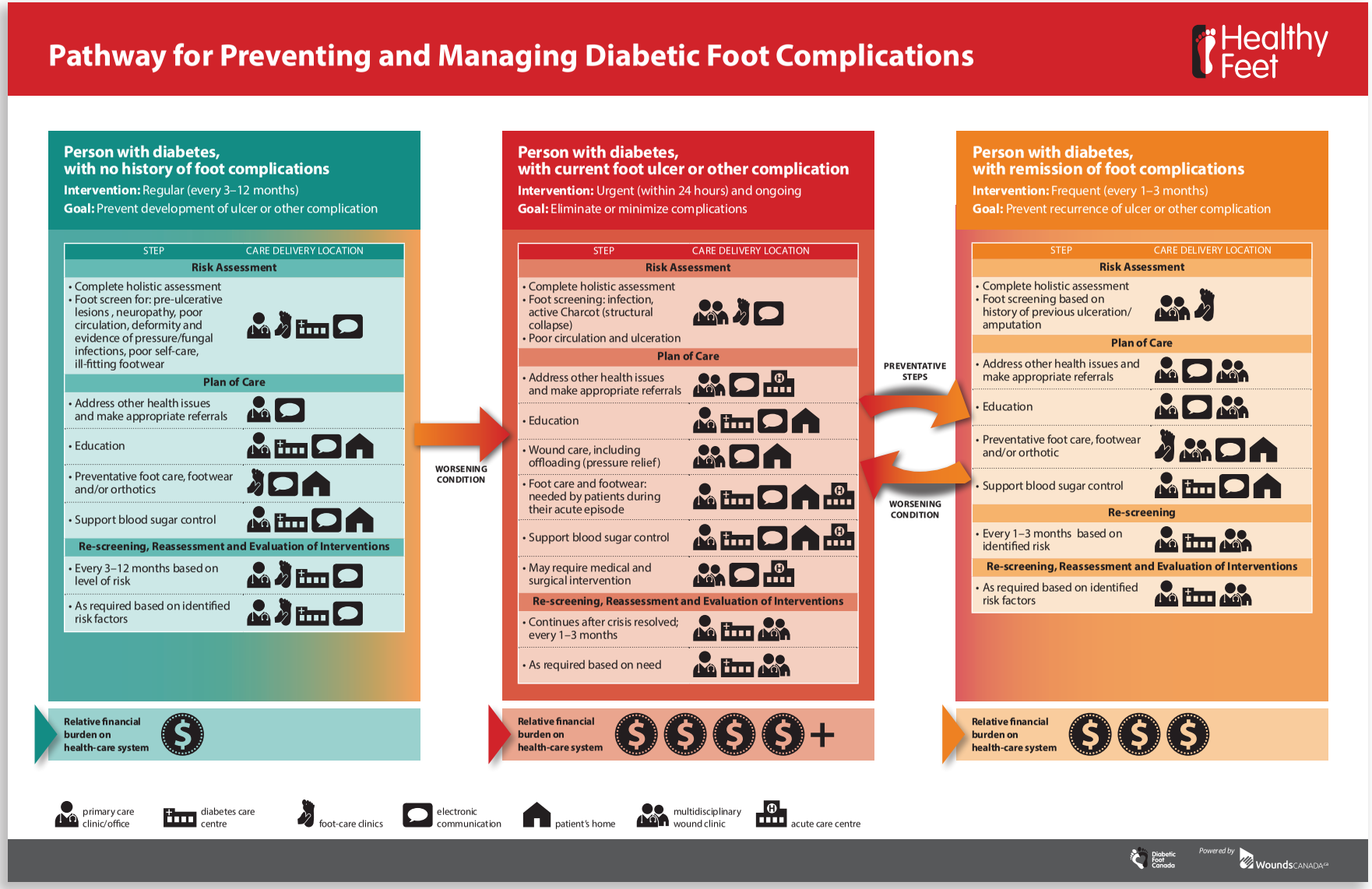
Canada provides universal funding for the prevention and management of every diabetes complication except foot care. This has implications in every sector of care. The following quotes reflect the frustration this causes individuals impacted by the lack of across-the-board support for best practice in the prevention of diabetic foot complications.

"I think the problem is that people don't recognize the lack of funded foot clinics as a problem, leaving those of us who are not foot care specialists trying to play the role of foot care specialists and doing a worse job." —Endocrinologist in the diabetic foot community

"Services such as chiropody/podiatry and orthotic and foot care, which are essential parts of the intervention shown to reduce ulcer occurrence or recurrence and ultimately amputation, are not funded by the government health-care plan." —Zoe Lysy[30]

"I am faced with patients with diabetic foot complications frequently in my clinical practice and often struggle to co-ordinate urgent care for them; but more importantly we must be identifying these individuals earlier and trying to avert the need for emergency amputation."
—Family physician

Figure 1: Wounds Canada's Diabetic Foot Pathway



Conclusion

The evidence is clear. Everyone has an important role to play in preventing diabetic foot complications, identifying and managing active pathologies and preventing recurrence. The key to prevention is a pathway that supports early identification of patients at risk of developing ulcers and amputations,[10] patient self-management and a team approach (see Figure 1, pg 54). Essential for managing active pathologies are well-trained and specialized teams that include the patient, and access to appropriate and timely care. Awareness of the high risk for recurrence is necessary so teams can implement appropriate strategies that reduce variation of health outcomes—such as amputations—and support psychological well-being.

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