Challenges to and Opportunities for Limb Preservation in Rural and Remote Communities

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In the Sioux Lookout Area catchment, in the town of Sioux Lookout, Ontario, which has a population of 5,500, Jeremy Caul serves 33 remote Indigenous communities—28 of which are fly-ins—whose combined populations equal more than 30,000 people (Figure 1). Currently these communities have documented rates of diabetes in close to 25% of the population, which many consider to be a conservative estimate.[1–3] The rates of amputation are four to seven times the provincial average,[2] and the nearest vascular program is in Thunder Bay, a five-hour drive or two-hour flight away. The geographical remoteness of this region presents a challenge.

Caul and his team have worked to identify specific barriers to limb preservation in this region. It is important for all health-care providers to appreciate the opportunities and strengths that Indigenous communities share. Through this appreciation, the health-care team can gain valuable insight as to how barriers can be addressed.

To better understand these conditions and challenges, Caul notes that it is crucial to understand the history of these communities. Indigenous peoples and their communities are wounded by severe intergenerational trauma, which impacts the ability to self-manage chronic disease and has contributed to a loss of self-determination, both individually and as a population.

History and Experience

Building rapport and trust are essential first steps toward supporting Indigenous peoples' healing.

Figure 1: Sioux Lookout Catchment Area

The current strategy to address limb preservation in Sioux Lookout is to focus on patient self-management of disease, which involves competing priorities and a pattern of negative experiences when attending health services. Programs used to be informal or nonexistent, and there is a lack of equitable access to provincial programs like negative pressure wound therapy (NPWT). While the province states that NPWT is provided, capital equipment is not permitted to leave the health-care site. Many Indigenous patients live 500-plus kilometres away, meaning they have to choose between staying in Sioux Lookout to receive treatment or going home to care for their families and to work. However, co-ordination between care partners is improving slowly.

A strategy used and recommended by Caul focuses on collaboration and comprehension. It is imperative that the health-care team understand the unique history and experiences of Indigenous communities. The team must also include members of the communities as active participants. A comprehensive approach focuses less on recommending dressings and more on overcoming each patient's own barriers to healing, such as access to supply chains, access to advanced wound therapies, treatment for grief and depression, as well as other trauma-focused, culturally safe treatment plans.

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There has been work toward building capacity in this area, as there are roughly 9,000 people in the Sioux Lookout service region who have diabetes, about 20 of whom undergo amputation each year. More capacity would help understaffed nursing stations, whose registered staff tend to be transient and who thus rely mostly on unregulated or undertrained staff and family members. One integral asset to capacity building is the Indigenous communities themselves. These communities are extremely interconnected, and the problems of any individual are felt across their entire community.

The health-care system in Sioux Lookout is fragmented due to lack of permanent funding and a federally supported population that often has solutions forced upon its communities. The intrusion of uncollaborative solutions has contributed to widening gaps between communities and the services available to them. Each forced solution builds upon a history of taking self-determination from Indigenous peoples. There is also limited data focusing on the North that could help drive outcomes, since research tends to be conducted in urban centres.

To overcome these barriers, Caul recommends engaging with community Chiefs and Elders to learn each community's needs, and to fund permanent solutions that prioritize infrastructure like housing and access to clean water and Internet. The system should be made flexible enough to provide what each community needs while acknowledging the differences among them.

Jeremy Caul is a registered nurse from Northwestern Ontario. He has dedicated his career to advocating for Indigenous populations in his region, where Ontario sees its highest rates of diabetes and amputation. He currently supervises a team of allied health professionals working in a newly developed, mobile primary care team responsible for providing services to the entire Sioux Lookout catchment, including 33 remote First Nations communities, most of which are fly-in. He has education from Lakehead University and Western University, and many CMEs from various institutions for wound healing, foot care and diabetes.

Bijan Najafi is currently serving with the Baylor College of Medicine, Department of Surgery as a tenured Professor and Director of Clinical Research in the Division of Vascular Surgery. His career has focused on developing technologies that improve stability, healing and mobility worldwide. Over the past 20 years, he and his team have created several models, methods, and "smart" wearable technologies that enable objective monitoring mobility, remote patient monitoring, and new digital platforms that have shown enormous promise in preventing limb and life-threatening complications.

Potential Solutions

One emerging opportunity to improve care in remote communities is wearable and mobile health technologies (see box). These technologies, with appropriate funding, might provide a means of improving prevention and putting power in patients' hands to optimize self-care.

Another opportunity to improve care has been gleaned during the COVID-19 pandemic, as health-care providers work to secure alternative ways to deliver timely care to patients. These new methods, which are more and more often including components of virtual care, may lead to positive changes in health care for people with chronic illness, particularly in promoting preventative and personalized care for people at risk for or with diabetic foot ulcers (DFUs).

Challenges and Opportunities in Dealing with COVID-19

While the traditional barriers—reimbursement, patient and provider buy-in, and technology—have always been there, the accelerated pace of the nation's response to the COVID-19 pandemic has allowed providers to jump in and try new solutions to facilitate care delivery to patients with acute or chronic illness, while supporting drastic containment and mitigation measures to limit

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spread of COVID-19 and preserve hospital beds for COVID-19 patients.[23] Because of the drastic containment and mitigation measures, other parts of health-care systems are leaving fragile patients, including individuals with diabetes, without necessary services. This is disrupting the best practices for preventing diabetes-related complications, including DFUs. Furthermore, because people with diabetes represent a fragile population that is at increased risk of mortality from COVID-19, it

Medical Management and Technology

Effective clinical preventative strategies to reduce the risk of ulcer recurrence are important to reduce the global burden of diabetic foot disease. About half of people who develop DFUs experience a recurrence within one year.[4] The increasing development and use of technology in every aspect of our lives represents an opportunity for creative solutions to prevent or better manage diabetic foot problems.[5]

In particular, recent advances in wearable and mobile health technologies appear to show promise in measuring and modulating dangerous foot pressure and inflammation to extend remission and improve the quality of life for the most complex patients. Najafi and his team at Baylor College of Medicine, Houston, Texas, have recently developed and/or tested different technologies that harness wearables, digital health and the internet to improve the management and optimize the prevention of DFUs.[5–21]

Sensors and wearables have been developed to monitor foot temperature, plantar pressures, glucose, blood pressure and lipids. The monitoring of these risk factors, along with telehealth consultations, has promise as a method for remotely managing people who are at risk of DFUs. This approach can potentially avoid or reduce the need for face-to-face consultations.[22] Home foot temperature monitoring, smart wearables (e.g., smart insoles, smart socks, smart offloading, smart shoes), continuous glucose monitoring and telehealth consultations are the approaches for which the most highly developed and user-friendly technology has been developed.[5,23] The potential for remote use of these technologies is promising for improving care in remote communities.[22]

Najafi and his team conducted a number of clinical studies in people at risk of DFUs and demonstrated benefits when using one of these remote monitoring methods.[5–13] Further development and evidence are needed for some of the other approaches, such as home plantar pressure and footwear adherence monitoring. As yet, no composite remote management program incorporating remote monitoring and the management of all the key risk factors for DFUs has been developed and implemented. Further research assessing the feasibility and value of combining these remote monitoring approaches as a holistic way of preventing DFUs is required. These gaps could create a great opportunity for engineers and industries to harness these innovations to address current unmet needs in the field.

is recommended to avoid unnecessary diabetes-related hospital admissions to reduce their risk of exposure to COVID-19.

However, health-care providers searching for alternatives to deliver timely care to patients with diabetic foot syndrome may imagine that a post-COVID future will include positive changes in health care for people with chronic illness, particularly in promoting preventative and personalized care for people at risk for or with DFUs. ■

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