Applying The Wounds Canada Foot Health Pathway In The Local Context Of Newfoundland And Labrador: The Development Of An Infographic And Custom Button For Health-care Providers

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Introduction

International and national health agencies endorse implementing strategies to strengthen diabetes management to reduce the burden of the disease.[1-4] Despite the call to action, diabetes remains a leading cause of major complications such as lower-limb ischemia, often leading to diabetic foot ulceration (DFU) and amputation.[3,4] The province of Newfoundland and Labrador (NL) has one of the highest incidences of diabetes in Canada, with an estimated prevalence of 34% for diabetes and prediabetes combined.[1,2,5] Currently, NL has one of the highest incidences of lower limb amputations (LLAs) in Canada, with an estimated 37.9 amputations per 100,000 individuals.[6] Given the occurrence and impact of diabetes and DFU in NL, reducing diabetic foot complications and improving patient, provider and health system outcomes must be prioritized.

In this article, a joint organizational and individual-level strategy to address diabetic foot management that was developed as part of a Master of Nursing practicum project is described. The overall goal of this project is to enhance health-care provider (HCP) application of the *Wounds Canada Foot Health Pathway for People Living with Diabetes* and improve outcomes for patients with diabetes in NL. Detailed analysis of the literature, an environmental scan and consultations revealed a need for a resource to assist local HCPs concerning diabetic foot care.

A customized 'button' for HCPs is presented as an individual-level strategy to encourage dialogue between patients and HCPs and improve foot screening (See Figure 1). An infographic to support the application of the Wounds Canada (2022) Clinical Pathway (CPW) is proposed as an organizational-level strategy to support HCPs7 (See Figure 2).

Theoretical Underpinnings

The Donabedian Model of Quality of Care (1966) and Knowles' Theory of Andragogy (1984) provided the theoretical foundation for the project.[8,9] Together, these models offered conceptual direction for the literature review, environmental scan and consultations, and informed the design, content and mode of delivery of the organizational and individual-level strategy that was developed.

According to the Donabedian model, the assessment of the quality of care encompasses three dimensions: structure, process and outcome; where structure refers to the organizational or health system resources and facilities; process refers to the care that is provided and received in the exchange between patient, provider and system, and outcome refers to the effects of the care on the patient, provider and the system. [8,10] Based on this notion, implementing changes at the structure level to address diabetic foot health is thought to produce changes at the process and outcome level to mitigate the impact of DFU (See Figure 3). [8,10]

Knowles' Theory of Andragogy (1984) provided the conceptual direction required to ensure resource development remained consistent with the needs of adult learners. The Theory of Andragogy considers six assumptions related to the adult learner: self-concept, experience, readiness to learn, orientation to learning, motivation to learn and need to know.

Given that the target audience is likely to have previous experience with managing diabetes and diabetes-related foot concerns, it is conceivable that they will be receptive to expanding their knowledge on the topic and improving the level of care their patients receive.[9]

Likewise, Knowles' theory emphasizes that adults are most interested in learning when the information is problem-centred and directly relevant to their careers and day-to-day lives. Given the substantial burden of diabetes and related complications in NL, it is highly likely that the target audience will be motivated to utilize a resource developed to improve diabetes-related outcomes.[11]

While the target audience encompasses primary HCPs such as family physicians, nurse practitioners, registered nurses, nurse educators, endocrinologists and internal medicine specialists from varied backgrounds and experiences, all providers share a common goal of promoting health among their patients. Considering these theories, an infographic and accompanying button were selected

as promising organizational and individual-level strategies to address diabetic foot management among local primary HCPs.

Method

In order to develop a comprehensive resource based on the best evidence and representative of the needs of local HCPs, data were collected using three methods: a literature review, an environmental scan and consultations with key stakeholders. While each method was conducted in sequence, the process was iterative, with multiple drafts completed for each component. Each of these components provided valuable information related to issues to address and content to include that was essential to the development of the resource.

Figure 1: Customized HCP 'Button'

Step 1:

Literature Review: A search of the databases CINAHL, PubMed, Cochrane Library and Google Scholar was conducted to gain insight into the occurrence and impact of DFUs and the contributing factors associated with their onset and management. Key questions to guide the review were:

*What is the occurrence of DFUs?
*What are the contributing factors related to DFUs? and
*What is the effectiveness of organizational-level strategies that address diabetic foot health?

Titles and abstracts of the articles retrieved were reviewed to determine relevance to the key questions and inclusion criteria. Following an in-depth screening of the full-text versions of relevant articles, five studies describing organizational-level strategies for HCPs to address DFUs were selected for inclusion in the review.[12-16] A high-quality systematic review and meta-analysis of 57 descriptive and analytic studies formed the basis of the evidence included in the integrated review.[12] The remaining studies consisted of a systematic review,[14] two cross-sectional [15,16] and one qualitative study.[13]

The Public Health Agency of Canada's (PHAC) Critical Appraisal Toolkit was used to guide the critical analysis of the quantitative articles selected, while the Critical Appraisal Skills Programme (CASP) qualitative checklist was used to guide the critique of the qualitative literature.[17,18] The reference lists of applicable articles were also reviewed as a secondary search strategy.

Step 2:

Environmental Scan: An environmental scan was performed to elicit existing knowledge from established internal and external databases and published guidelines and best practice recommendations to gain insight into managing diabetic foot complications on a provincial and national scale. The specific objectives for the environmental scan were to determine the extent of the available resources used by HCPs to direct diabetic foot management within the four NL regional health authorities, to determine the available resources for diabetic foot management used by HCPs across Canada and to identify tools recommended by leading national and international professional associations to assist providers with diabetic foot management. Sources of information for the environmental scan included provincial, national and international clinical resources for diabetic foot management. On a provincial level, clinical practice guidelines (CPGs) and policies for diabetic foot management were obtained from four NL regional health authorities by reviewing accessible websites and internal databases. On a national level, sources of infor-

Figure 2: Infographic

Applying the WOUNDS CANADA FOOT HEALTH PATHWAY FOR PEOPLE WITH DIABETES IN NEWFOUNDLAND AND LABRADOR

Foot Health Pathway for People Living with Diabetes

Healthy Feet

Person with diabetes and no history of diabetic foot disease or complications

Goal: Promote foot health and prevent diabetic foot disease

INTERVENTION	CARE DELIVERY LOCATION
Risk Assessment	
• Assess medical condition and identify related comorbidities • Assess for: foot disease and pre-ulcerative complications, mental health factors, lifestyle factors, environmental risks or social determinants that can impact health	
Plan of Care	
• Support patient self-management	
• Optimize foot health through preventative foot care and footwear interventions	
• Manage diabetes and related comorbidities	
Re-screening	
• Every 12 months based on level of risk	
Reassessment and Evaluation of Interventions	
• As required based on identified risk factors	

Relative financial burden on health-care system: $

WORSENING CONDITION

Person with diabetes and history of diabetic foot disease (neuropathy and/or PAD and/or deformity and/or consequences of plantar pressures)

Goal: Prevent development of diabetes-related foot complications like DFUs before they become serious and/or urgent

INTERVENTION	CARE DELIVERY LOCATION
Risk Assessment	
• Monitor progression of foot disease (neuropathy and/or PAD and/or deformity and/or associated pre-ulcerative complications) • Assess for: mental health, lifestyle, environmental risks or social determinants that can impact adaptation and self-management	
Plan of Care	
• Support patient self-management	
• Manage foot disease through preventative foot care and footwear interventions	
• Manage diabetes and related comorbidities	
Re-screening	
• Every 3–6 months based on level of risk	
Reassessment and Evaluation of Interventions	
• As required based on identified risk factors	

Relative financial burden on health-care system: $$

WORSENING CONDITION

Person with diabetes, with active ulcer and/or infection and/or active Charcot and/or critical ischemia

Goal: Deliver timely care to address and minimize diabetes-related foot complications

INTERVENTION	CARE DELIVERY LOCATION
Risk Assessment	
• Assess to identify wound type, extent of infection, arterial disease, active Charcot • Assess for: mental health, lifestyle, environmental risks or social determinants that can impact adaptation and self-management	
Plan of Care	
• Provide access to specialized care within 24 hours	
• Address all health issues and make appropriate referrals	
• Support patient self-management	
• Provide wound care, including offloading (pressure relief)	
• Provide foot care and footwear: needed by patients during their acute episode	
• Manage diabetes and related comorbidities	
• Investigate need for medical and/or surgical intervention	
Re-screening	
• Continues after the complication is resolved; as required	
Reassessment and Evaluation of Interventions	
• As required based on need	

Relative financial burden on health-care system: $$$$+

EFFECTIVE INTERVENTIONS

WORSENING CONDITION

Person with diabetes, with history of active foot ulcer and/or Charcot foot and/or critical ischemia

Goal: Prevent recurrence of ulcer and other complications

INTERVENTION	CARE DELIVERY LOCATION
Risk Assessment	
• Monitor progression of foot disease and recurrence of acute foot pathologies (active ulcer, infection, Charcot or critical ischemia) • Assess for: mental health, lifestyle, environmental risks or social determinants that can impact self-management	
Plan of Care	
• Support patient self-management	
• Manage foot disease through preventative foot care and footwear interventions	
• Manage diabetes and related comorbidities	
Re-screening	
• Every 1–3 months based on identified risk	
Reassessment and Evaluation of Interventions	
• As required based on identified risk factors	

Relative financial burden on health-care system: $$$

Care delivery location: primary care clinic/office; diabetes care centre; footcare clinics; virtual care; patient's home and community care/LTC; multidisciplinary wound clinic; acute care centre

RISK ASSESSMENT AND SCREENING

GREEN LOW RISK	Person with diabetes and no history of diabetic foot disease or complications
YELLOW MODERATE RISK	Person with diabetes with foot disease (neuropathy, PAD, deformity, plantar pressure)
RED URGENT RISK	Person with diabetes with active ulcer, infection, Charcot or critical ischemia in need of acute care
ORANGE VERY HIGH RISK	Person with diabetes who has a history of an active foot ulcer, Charcot foot or critical ischemia

PLAN OF CARE

At every visit

Assess foot for foot disease

- Identify co-morbid conditions

Monitor regularly for signs of foot disease or pre-ulcerative foot changes

- Identify calluses, loss of protective sensation, change in foot structure

Evaluate psychosocial risk factors

- Identify lifestyle and environmental factors that impact self-management

Educate patient and support persons on what to look for and when to seek help

- Provide Diabetes Foot Care Handout (available on Intranet)

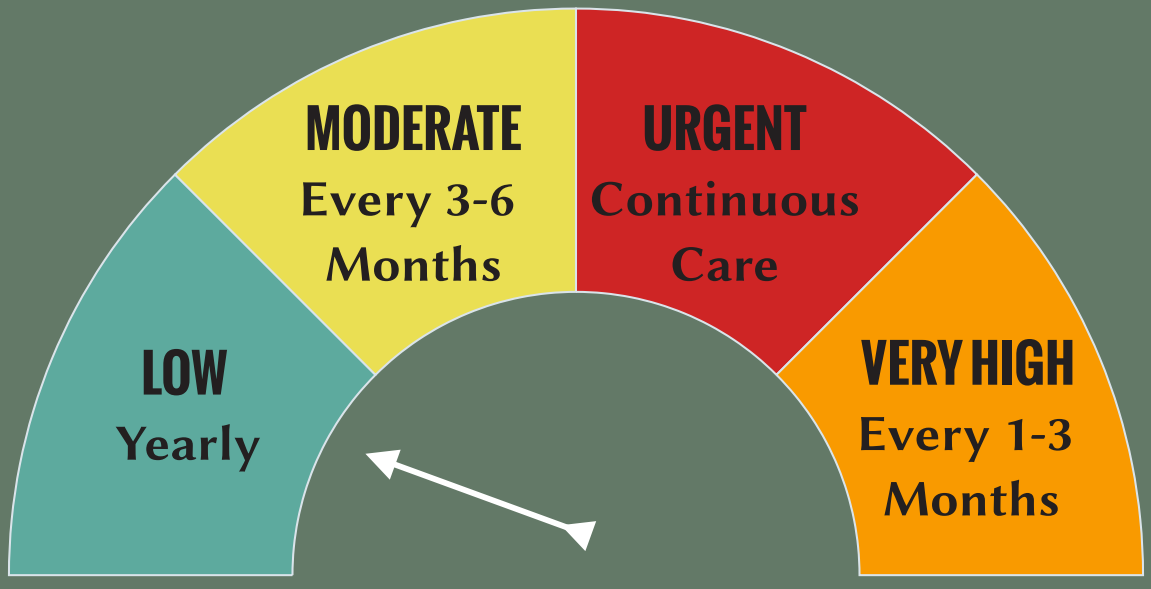
Optimize preventative foot care

- Encourage routine wear of appropriate protective footwear
- Ask about insurance coverage

Initiate referrals to appropriate health professionals

- Refer to local foot care nurses in your area for preventative care
- Refer to Diabetes Education Centre (DEC referral form on Intranet)
- Refer to the NL Federation of Podiatric Medicine for certified podiatrists
- Refer to Miller Centre Orthotics Services (Referral form on Intranet)
- Refer to Community Health or Wound Management Clinic as needed

How often do you need to follow up?



PLAN OF CARE BASED ON RISK ASSESSMENT

GREEN

LOW

- Assess yearly
- Follow steps outlined above

YELLOW

MODERATE

- Assess every 3-6 months
- Follow steps outlined above

RED

URGENT

- Provide access to specialized care within 24h
- Prioritize wound care
- Initiate offloading
- Investigate need for medical or surgical intervention
- Consult wound care nurse, vascular surgery or orthopedics as needed

ORANGE

VERY HIGH

- Re-assess every 1-3 months
- Refer to community health nurse as needed
- Refer to wound care clinic for outpatient management
- Refer to foot care nurses

Resources

Diabetes Education Centre

709-752-3687

Wound Care Clinic

709-752-6220

Check out *Foot Care for Diabetes* on the Intranet

Smoking Cessation Help Line

1-800-363-5864

Diabetes Canada NL Chapter

709-747-4590

Podiatrists and Foot Care Nurses

Local Yellow Pages

The NL Federation of Podiatric Medicine website

Scan the QR code to access the latest **Diabetes Canada Guidelines**

mation were restricted to the provinces of Alberta (AB), British Columbia (BC), New Brunswick (NB), Nova Scotia (NS) and Ontario (ON) to ensure the amount of information in the environmental scan was manageable for analysis. On an international level, CPGs and best practice recommendations (BPRs) published by leading national and international associations were reviewed for relevancy to the key questions, including Diabetes Canada,[19] Wounds Canada,[7] International Working Group on the Diabetic Foot (IWGDF)[20] and the National Institute for Health and Care Excellence (NICE).[21]

Step 3:
Consultations: Consultations were conducted with ten key informants from diverse backgrounds and experiences. In total, nine consultations that consisted of semi-structured telephone and email-based interviews were conducted to gain insight into available resources for diabetic foot management in NL and to identify the priority needs of local HCPs. Participants consisted primarily of representatives from the nursing profession, including one licensed practical nurse (LPN), six registered nurses (RNs) and one nurse practitioner (NP). The LPN specialized in advanced foot care and provided private services in a remote region of NL. The NP was a practitioner who specializes in vascular surgery. The RNs interviewed included a vascular surgery nurse, a research nurse coordinator, a diabetes nurse educator, two wound care nurse consultants and a community health nurse. Consultations were also conducted with an endocrinologist and a local podiatrist. All data were managed, analyzed and properly secured on the principal author's personal computer. No identifiable information was kept beyond sharing with the practicum supervisor to protect the anonymity of the participants. Consistent with the environmental scan, descriptive analysis was performed to analyze the data collected during the consultations and a table was created to depict the results.[22]

Results

Results of Literature Review: The integrative review of the literature revealed four prominent organizational care processes to address DFU, including dedicated care teams (DCTs), CPWs, multidisciplinary care teams (MDTs) and approaches that combine CPWs and MDTs. A critical analysis of the studies using the PHAC[17] and CASP[18] criteria demonstrated moderate evidence to support the effectiveness of CPWs and MDTs in reducing LLAs in patients with DFU, yet inconclusive and contradictory evidence to support the effectiveness of multi-component interventions and DCTs. Clinical pathways, in particular, have been gaining momentum in the literature as effective tools to promote the uptake of best practice recommendations across healthcare institutions.[12,23] Information obtained from the literature review was used to direct the project's environmental scan and consultation phase and inform the development of the resource for HCPs described in this article.

Results of the Environmental Scan: An extensive review of the diabetes services in NL revealed a lack of clinical resources to guide HCPs in providing diabetic foot care. While a variety of services were offered for patients with diabetes at the St. John's Diabetes Centre, a broad review of policies and procedures available on internal websites provided no evidence of CPWs or foot care teams dedicated to the diabetic foot. The environmental scan also highlighted the existence of a specialized wound care clinic comprised of wound care experts from nursing, dermatology, plastics and orthopedic specialties. However, a significant limitation of that service was that it was only accessible to patients via referral by a physician or an NP. A review of the available resources within the remaining three Regional Health Authorities (RHAs) proved especially limited, with services varying considerably according to site. Advanced foot care services by nurses were available upon referral but were insufficient to meet the current demand. Across all health authorities, a consistent finding among providers was the usage of the Diabetes Canada CPGs to inform diabetes management.

In contrast to other provinces in Canada, NL was lagging in the systematic management of

diabetic foot. A review of the available resources implemented in the provinces of AB, BC, NS, NB and ON highlighted the widespread use of CPGs, BPRs, CPWs and MDTs by these provinces to improve the management of diabetic foot. Although there were differences in composition, function and target areas, CPWs for providers to assist in diabetic foot management were evident in these provinces.

A review of resources developed by Diabetes Canada, Wounds Canada, IWGDF and NICE revealed several resources to guide the provision of foot care. On a national level, Diabetes Canada and Wounds Canada provide detailed guidance for HCPs in the form of CPGs,[19] BPRs and CPWs.[7] Diabetes Canada's website also provided links to access resources such as a PowerPoint presentation and a Smartphone application for ease of knowledge sharing on various topics related to DFU prevention, screening, assessment, treatment and patient education. Consistent with Diabetes Canada, Wounds Canada has developed several resources for diabetes care, including the most recent development of an integrated CPW.[7] *[Editor's note: Wounds Canada's updated Best Practice Recommendations For Skin Health and Wound Management 2024 will be published later this year.]* On an international level, IWGDF and NICE continued to lead diabetes care by developing resources to guide management, advance knowledge and improve patient care. The environmental scan findings were used to inform the nature of the questions asked during the consultations and in conjunction with the other methods to inform resource content and delivery.

Results of the Consultations: The need for a clinical resource to improve the management of diabetic foot in NL became abundantly clear during the consultations with local HCPs. On an organizational level, a need for standardized resources was a consistent finding that emerged from the consultations. Other themes identified included a lack of funding to cover services such as podiatry and advanced foot care, lack of fiscal and human resources to meet the demands of the population in terms of diabetic foot needs, long wait times to see primary care providers and specialists and ineffective lines of communication between private and public sectors to optimize the coordination of care for patients with diabetic foot needs. On a provider level, inconsistencies in HCP practices and in the advice given to patients were identified. Other important themes included a critical need for HCP education and standardized resources for prevention and screening. On a patient level, many of the factors impacting HCP management of the diabetic foot were related to: socioeconomic factors such as soaring costs of supplies; lack of resources due to low-income and limited means to afford services; lack of knowledge regarding preventative care and maintenance; non-adherence with self-care recommendations and multi-chronicity.

Discussion

An integrative literature review provided insight into the best available evidence on strategies to enhance diabetic foot management. The environmental scan identified available resources implemented in jurisdictions across Canada with varying levels of success while also revealing the lack of resources within NL to support providers in the provision of diabetic foot care. Consultations with key stakeholders in NL provided a unique understanding of the local context, which was fundamental to customizing the best available evidence to the local context. It was clear from the literature review findings, environmental scan and consultations that several organizational-level, provider-level and patient-level factors influenced diabetic foot management. To address the problem on an individual and organizational level, a decision was made to develop two complementary resources to enhance diabetic foot management: an infographic and a custom 'button'.

Clinical Resource Development: *The Wounds Canada Foot Health Pathway for People Living with Diabetes*[7] was identified during the environmental scan as a comprehensive, high-quality, and clinically useful resource representative of current best practices outlined by the IWGDF and Diabetes Canada. Despite the many strengths of the Wounds Canada pathway, it became appar-

ent during the consultations that further guidance was needed to enhance application within a local context. For this reason, a decision was made to develop an infographic to assist local providers with applying the pathway. Wounds Canada granted copyright permission to use the pathway for this specific purpose. An infographic was chosen as the most suitable mode of delivery to achieve the identified goal primarily due to its ability to reach a large audience efficiently.[24] While little is known about the infographic's effectiveness as a medium to convey health information, a growing body of literature supports its use as a visual communication tool in a wide range of education, marketing and health-care settings. Infographics are useful visual tools for communicating information to vast populations clearly, concisely and compactly.[25-27]

Education is one of many interventions needed to evoke change. Still, it is a principal step in the knowledge translation process and fundamental to enhancing the uptake of best practices among HCPs.[10] According to Harrison and Graham (2021), developing materials to support an innovation makes it easier for stakeholders to learn about and deliver it. The principles of adult learning were taken into consideration to ensure that design, content and mode of delivery aligned with the needs of the target audience as identified in the consultation phase of data collection.[10] With Knowles' Theory of Andragogy (1984) in mind, an infographic was selected as a promising organizational-level strategy to address diabetic foot management among local primary.[9]

A custom button was also developed as an individual-level strategy to encourage open dialogue between patients and HCPs about keeping feet well. The button, as depicted in Figure 1, was developed to target diabetic foot management by promoting discussion of foot health. Customized buttons have been used in health-care settings for decades as a cost-effective visual aid to promote handwashing and vaccination uptake.[28,29] Through word choice that supports open dialogue, it is hoped that the button will encourage engagement between HCPs and patients and enhance the application of the Wound Canada pathway. We hope the collective use of the button and the infographic will improve diabetic foot outcomes for patients, providers and health-care systems in NL.

During the planning stages of the practicum, the visual elements of the infographic were carefully deliberated to enhance visual simplicity, establish logical flow and promote effective communication of the health information depicted within the pathway.[20,25,26] In their book *Infographics: The Power of Storytelling*, Lankow et al. (2012) emphasized the importance of tailoring infographic design to achieve an optimal balance between appeal and clarity.[27] In keeping with the latest evidence on infographic design, the colour palette and language selected for the infographic were designed to parallel that of the Wounds Canada pathway.[24,26,27,30] A series of consultations were held with a local wound care nurse and an endocrinologist to review content and visual appeal and gauge the relevance and acceptability of the infographic among target audience members. Based on the feedback from the consultations and discussions with my supervisor, the infographic was revised to optimize clinical usefulness, readability, relevance and visual appeal among the target audience. The infographic is depicted in Figure 2.

The infographic was developed not only to convey the information depicted in the Wounds Canada Pathway but also to serve to connect providers to local resources and materials. For this reason, a quick response (QR) code was added to the infographic to connect providers directly to the latest Diabetes Canada Guidelines via their Smart Phones. According to a scoping review by Karia et al. (2019), the use of QR codes in health-care education is gaining momentum as a way to communicate information quickly and efficiently.[31]

Efforts were made to coordinate the customized button with the infographic. To enhance visual appeal, the custom button was outlined in blue with an image of feet depicted in the background of the button. The phrase "If you have diabetes, ask me about keeping your feet well" was included on the button with the words "ask

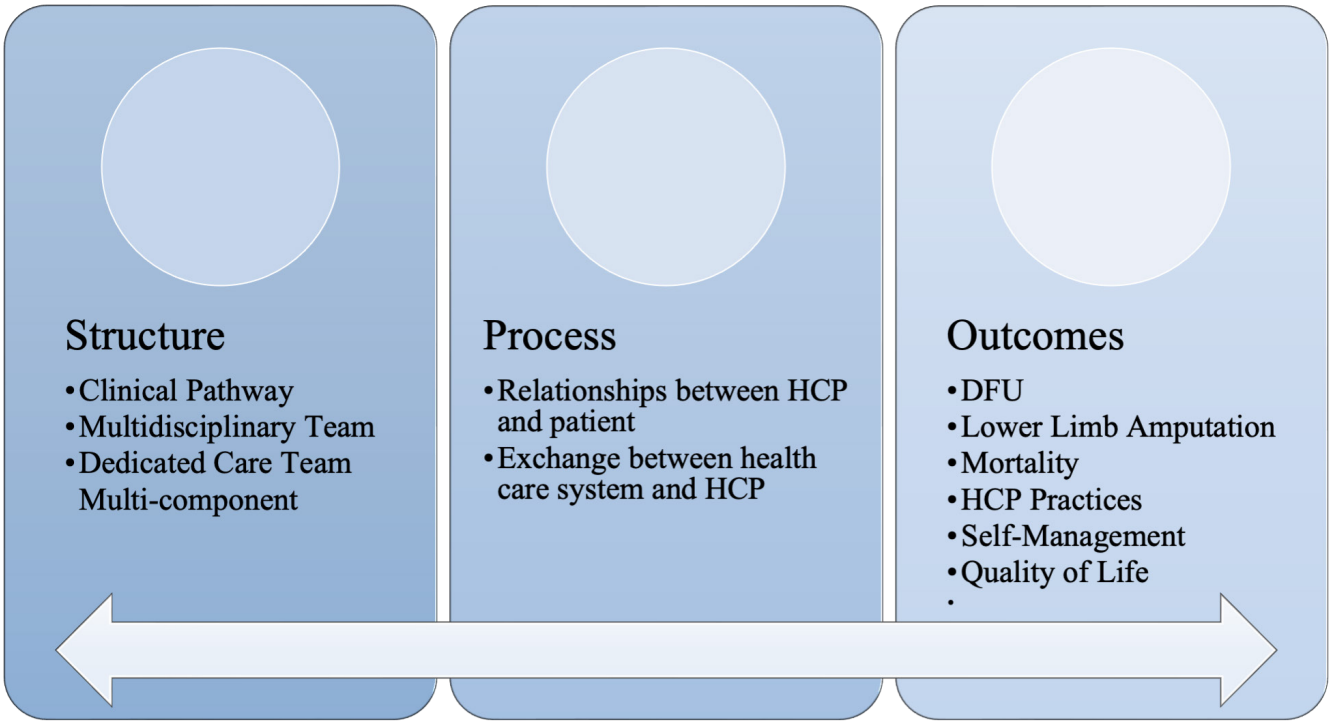


Figure 3: Donabedian Model of Care for the Diabetic Foot

me" in bold to emphasize the readiness of the provider to engage in discussion about the topic. Consistent with the infographic, a QR code was added to the button to provide quick access to Diabetes Canada patient information about foot self-care.

Overview of Next Steps: Now that evidence has been compiled and analyzed and the resource has been developed, the next step in the knowledge translation process involves establishing a working group and planning implementation and evaluation. Developing an implementation and evaluation plan that entails specific timelines and methods of assessing key indicators of success is critical to successfully integrating a knowledge translation initiative.[10,32] As a preliminary step in the implementation plan, copies of the resources were provided to former consultants for review and feedback. The feedback from the consultants, who included two wound care nurses, a nurse educator and a local endocrinologist, was incorporated into the final revisions of the resources. Now that a final version of each resource has been developed, approval will need to be obtained from appropriate decision-makers and stakeholders to promote implementation. To improve uptake of the resource, a virtual education session will need to be held for all HCPs to provide education about the resource before its distribution in clinical areas. Once implemented, ongoing evaluation will need to be initiated to determine the resource's acceptance, relevance and usefulness among the target audience. According to Harrison and Graham, ongoing support from key stakeholders, leaders and end users is instrumental to the success of a knowledge translation initiative.[10]

A tri-fold comprehensive evaluation includes assessing process, outcome and impact measures.[33] Evaluating process involves gauging the provider's perspective of the usefulness, acceptability and understanding of the content and intention of the initiative.[10] To evaluate outcome, it would be necessary to determine whether the resource has successfully achieved its intended purpose.[10] As the intended purpose is to support providers in applying the Wounds Canada pathway and improve screening and assessment of diabetic foot concerns, evaluating outcome measures would need to include assessing the HCP's perspectives regarding whether the resources

have supported their practice. In keeping with the process-outcome-impact nature of a comprehensive evaluation plan, evaluation of impact would need to measure indicators such as incidence and prevalence of LLAs, admissions to hospital for diabetic foot concerns and indicators of glycemic control such as Hemoglobin A1C. Based on the feedback from the evaluations, there may be a need to revise or expand the clinical resources to meet best the fluid needs of providers, patients and the health-care system.

To evaluate sustainability, ongoing assessment of barriers and drivers of implementation must be considered.[10] For this particular initiative, barriers that must be assessed include provider readiness, time and acceptance of the resources. Likewise, support for the initiative on an organizational level will need to be closely evaluated as it is a critical driver of success.

Conclusion

Newfoundland and Labrador is exceptionally burdened by diabetes and diabetic foot disease and needs a solution to address the problem. This article describes the development of a joint organizational and individual-level strategy to improve diabetic foot management in NL. An infographic was developed as a guide using the *Wounds Canada (2022) Foot Health Pathway for People Living with Diabetes*[7] in NL. A custom button was also developed as an individual-level strategy to encourage dialogue about foot care between patient and provider and enhance foot screening. The development of these clinical resources was informed by Knowles' Theory of Andragogy and the Donabedian Model of Quality of Care and is intended for use by providers to aid in the systematic prevention, screening, assessment and treatment of diabetic foot concerns. This resource is currently in the process of being implemented within the local regional health authority. Once implemented through an education initiative, ongoing evaluation of process, outcome and impact measures will be needed to promote sustainability and facilitate the successful integration of the resources.

Conflicts of interest

The authors declare there are no conflicts of interest.

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