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Original Research

## Optimizing Glycemic Control in Adults With Type 1 or Type 2 Diabetes Attending a Multidisciplinary Foot Clinic

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### Key Messages

- To date, the role of diabetes nurse educators in the setting of a multidisciplinary diabetes foot clinic has been poorly studied.
- This trial found that regular, face-to-face contact with a diabetes nurse educator had a positive impact on glycemic control in females.

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### ABSTRACT

**Objectives:** To determine the impact of a diabetes nurse educator (DNE) on glycemic control in a multidisciplinary diabetes foot (MDF) clinic.

**Methods:** A prospective cohort trial to measure the impact of a DNE on glycemic control was conducted in an MDF clinic. Change in glycosylated hemoglobin (A1C) levels over time was measured against the percentage of patient visits (PPVs) accompanied by a glucose meter and/or diary.

**Results:** Increasing PPVs were significantly associated with decline in A1C levels in females. Every 10% increase in PPVs resulted in a 0.18% decrease in A1C levels ( $p < 0.0001$ ). To achieve a clinically important decrease of 1% in A1C levels, a 56% increase in PPVs was required. Increased A1C levels were significantly associated with higher baseline A1C levels ( $p < 0.001$ ) and increased hospital days for foot complications ( $p < 0.0052$ ).

**Conclusions:** Regular, face-to-face contact with a DNE in an MDF clinic has a positive impact on glycemic control in females.

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### R É S U M É

**Objectifs :** Déterminer les répercussions de l'infirmier éducateur en diabète ou de l'infirmière éducatrice en diabète (IÉD) sur la régulation de la glycémie dans une clinique multidisciplinaire du pied diabétique (MPD).

**Méthodes :** Nous avons mené une étude de cohorte prospective pour mesurer les répercussions d'un ou d'une IÉD sur la régulation de la glycémie dans une clinique MPD. Nous avons mesuré les variations dans le temps des concentrations de l'hémoglobine glyquée (A1c) par rapport au pourcentage des visites du patient (PVP) sur la base d'un glucomètre ou d'un carnet, ou les deux.

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*Résultats* : L'augmentation du PVP était significativement associée au déclin des concentrations de l'A1c chez les femmes. Chaque tranche d'augmentation de 10 % du PVP entraînait une diminution des concentrations de l'A1c de 0,18 % ( $p < 0,0001$ ). Pour parvenir à une diminution importante des concentrations de l'A1c de 1 % sur le plan clinique, une augmentation du PVP de 56 % était nécessaire. L'augmentation des concentrations de l'A1c était significativement associée à des concentrations initiales plus élevées de l'A1c ( $p < 0,001$ ) et à la hausse des journées à l'hôpital en raison des complications du pied ( $p < 0,0052$ ). *Conclusions* : Les rencontres individuelles régulières avec un ou une IÉD d'une clinique MPD ont des répercussions positives sur la régulation de la glycémie chez les femmes.

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## Introduction

Complications in extremities that are caused by diabetes account for more hospital days than all other diabetes complications and are the leading causes of lower-limb amputation in Canada (1). Foot ulcers can be considered a marker for late-stage, advanced diabetes, given that they are often seen in a subset of patients who are characterized by prolonged duration of diabetes, longstanding poor glycemic control, multiple end-organ injury and high short-term mortality.

A meta-analysis of 9 randomized clinical trials has shown that intensive glycemic control is associated with a significant reduction in lower-extremity amputation and reduced progression of neuropathy (2). Achieving optimal glycemic control in the population described above is challenging, and the absence of formal diabetes education has been identified as an independent risk factor for amputation (3). This population highlights the gap between diabetes guideline recommendations and our ability to deliver optimal management in the community. Numerous strategies have emerged to address this issue, including the intervention of a certified diabetes nurse educator (DNE).

The diabetes educator's role includes assessment of patients' baseline knowledge about diabetes management, application of appropriate education, including self-management skills, and evaluation of the effectiveness of this education (4). Diabetes educators also collaborate with both the patients and the health-care teams to present treatment options and monitor the outcomes of said treatment plans. In New Brunswick, the certified DNE has recently been integrated into primary care with the goal of increasing uptake of evidence-based care guidelines, as well as promoting patient ownership of treatment practices and self-care (5). In other settings, randomized controlled trials have demonstrated that insulin adjustments delivered through regular telephone contact with a DNE for a total of 6 months leads to significant decline in glycated hemoglobin (A1C) levels when compared with standard of care (6,7). Other studies have shown similar improvements in patient care with the addition of a DNE to rural primary care practices (8,9).

Multidisciplinary diabetes foot (MDF) clinics have evolved to combat the complications in extremities that can result from poor glycemic control. Individuals with diabetes are approximately 15 to 20 times more likely to be hospitalized for nontraumatic lower-limb amputation compared to controls without diabetes (10). Furthermore, more than 70% of limb amputations in patients with diabetes are attributable to a preceding ulcer (11). MDF clinics have been shown to decrease lower-limb amputation rates by 50% or more (12).

There is a paucity of literature describing the impact of regular, face-to-face contact with a certified DNE in an MDF clinic. At The Moncton Hospital, we have observed that patients with extremity complications rarely attend visits with an endocrinologist or the diabetes education centre but display attendance upwards of 90% in the MDF clinic. This suggests that the foot clinic could be an effective location to address basic diabetes control and promote self-management. Prior to this study, staff time constraints at the clinic precluded focused discussion with patients about glycemic control

and management. DNEs were brought in on a part-time basis to address these unmet needs, and improvements in glycemic control were observed in patients who interacted with the educators. This observation prompted the current pilot study, in which a DNE was employed on a regular basis at the clinic to assess the impact on glycemic control and complications in extremities. We hypothesized that regular, face-to-face contact with a DNE in an MDF clinic would have a positive effect on glycemic control and lead to a decrease in diabetes-related complications in extremities.

## Methods

In this prospective cohort study, a full-time DNE was recruited to The Moncton Hospital MDF clinic for 28 months. The clinic operated on a weekly basis throughout the study, and patients were typically seen every 4 to 6 weeks. The primary outcome measure was change in A1C levels over time.

Demographic information that included age, gender, duration and type of diabetes and smoking status was collected for all patients. Diabetes-specific complications present at enrolment were also recorded.

The study was approved by the Horizon Health Network Research Ethics Board prior to recruitment, and written informed consent was obtained from all participants.

Inclusion criteria stipulated active attendance at the MDF clinic, a diagnosis of type 1 or type 2 diabetes and a history of previous or active foot ulceration. Patients were excluded if they had optimal blood glucose control at baseline, defined as A1C levels of 7.0% or lower. A total of 66 patients were included in the final analysis.

Patients were asked to bring their glucose meters or glucose diaries to each clinic visit. The presence or absence of the glucose meters or glucose diaries was recorded for each clinic visit. The DNEs documented their interactions with the study participants. Participants were also asked whether or not they had received active diabetes management from a source outside of the MDF clinic. The DNEs collected relevant historical information by using motivational interviewing techniques, evaluating glycemic management and assessing self-reported glycemic management. This information was used to plan and implement patient-centred care plans, optimize glycemic management and coordinate with other health-care providers.

Means with standard deviations and counts with percentages were used to describe continuous and categorical variables, respectively. The significant differences between the groups were examined by the t test and the chi square test for continuous and categorical variables, respectively. The Fisher exact test was used when the expected cell count was less than 5. To identify the significant risk factors of change in A1C levels over time for females and males, respectively, an interaction term between gender and each independent variable was introduced into the univariate analysis. In the multivariate regression analysis, an interaction term between gender and percentage of patient visits (PPVs) was explored in the model controlling for age, A1C levels, number of hospital days, foot complications and type of diabetes. To control for the intracorrelation among the observations for each patient over time,

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