

# Diabetic foot screening in the Bahamas and the impact of digitizing the in low diabetic foot screening form

## Abstract

**Purpose:** Diabetic foot complications continue to be one of the most costly, devastating and feared. As 25% of persons living with diabetes may develop foot complications. Therefore, it is most beneficial to screen the feet of diabetics at least annually, to detect early the presence of neuropathy, ischemia and/or foot deformity which can increase risk of ulcers and amputations. The purpose of the study is to evaluate the diabetic foot screening process in the public health setting and document the impact of digitization on improving the number of foot screenings completed and documented.

**Methods:** Consistent screening the diabetic foot has been a challenge and after training numerous groups of nurses and other health care providers to use the Inlow's 60-second Diabetic Foot Screen for the Assessment and Management of the Diabetic Foot by Wounds Canada the yield was dismal. In 2022, the training process was revised and the screening form was digitized using Google Forms and evaluated for its impact on screening behaviour of health professionals.

**Results:** A 100-fold increase was noted in the number of nurses completing the foot screening and documenting them using Google Forms. This has resulted in early detection of foot complications, referrals to the Podiatry services within the department and improved delivery of diabetic foot care and vascular interventions.

**Conclusion:** Early detection can prevent foot ulceration and related complications. Early treatment can improve the healing of diabetic foot ulcers and reduce the risk for amputation and early mortality. Primary care screening programs for diabetic foot ulcers may include risk assessment, patient education, and referral to more specialized care. Risk stratification considers the presence of neuropathy and or peripheral vascular disease to determine the risk of developing diabetic foot ulcers or amputation. Depending on the level of risk, suitable preventive measures can be undertaken.

**Keywords:** diabetic foot, diabetic foot screening, diabetic foot complications, risk stratification, inlow's 60-second diabetic foot screen, Bahamas

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## Introduction

The number of people living with diabetes is increasing exponentially worldwide and diabetic foot complications continue to be one of the costliest, most devastating and most feared. It is well documented that as much as 25% of persons living with diabetes may develop foot problems and about 10% will have a diabetic foot ulcer at some point in their lives. After a first amputation, people with diabetes are twice as likely to have a subsequent amputation as people without diabetes. Mortality rates after diabetic foot ulceration and amputation are high, with up to 70% of people dying within 5 years of having an amputation more than persons with prostate and breast cancer combined and around 50% dying within 5 years of developing a diabetic foot ulcer.<sup>1</sup> 85% of all amputations are preceded by an ulcer. Preventing these ulcers can potentially result in preventing the subsequent amputations. It is also reported that every 20 seconds, a limb is amputated somewhere in the world due to diabetes.<sup>2</sup>

Diabetes foot screening is a key component of the systematic and multidisciplinary care required by people living with diabetes and is strongly supported by evidence based best practice recommendations.<sup>3</sup> For this reason, Numerous clinical practice guidelines including the American Diabetes Association, International Diabetes Federation and countless others have outlined diabetic foot screening as a major

preventive strategy. The Canadian Diabetes Association states that early screening can detect diabetes-related complications in four key areas – (1) HbA1C blood tests measure the average blood glucose over the previous 90 days, (2) urine protein tests detect early renal disease, (3) dilated eye examination detects early signs of diabetic retinopathy and (4) **diabetic foot screening identifies people with a high-risk foot, allowing for preventive treatment to decrease the chances of ulcerations and amputations.**<sup>3</sup> Therefore, it is beneficial to screen their feet at least annually, to detect the presence of neuropathy, ischemia and/or foot deformity which can increase risk of ulcers and amputations.

Use of a standardized diabetic foot screen ensures a consistent approach to risk recognition and provides a framework for care. Strong evidence shows that up to 85% of diabetic foot amputations can be prevented, supporting the benefits of early recognition of diabetes-related foot complications.<sup>3</sup> Other studies highlight that a structured diabetes foot screening program can result in a 75% reduction in amputation rates.<sup>2</sup> A recent Australian study of primary care GPs and Credentialed Diabetes Educators (CDEs) showed only 45% removed the shoes and socks of their patients with diabetes at a consultation.(Mullan) In the presence of acute diabetes-related foot complications, primary healthcare practitioners are not always

adhering to best practice foot care recommendations. Furthermore, timely assessment, referral, and provision of evidence-informed foot care are cost saving for the healthcare system. Yet, at the present, foot screening is the most neglected and least completed of the four key recommended annual diabetes screens, with only 51% of Canadians with diabetes receiving a foot screen.<sup>3</sup>

The Bahamas is a small archipelagic nation consisting of more than 700 islands, rocks and cays, located in the Atlantic Ocean, north of Cuba, northwest of Hispaniola and southeast of Florida. The population stands at around 400,000. The 2019 Bahamas STEPS Survey put the prevalence of diabetes at 11.6% with an additional 6.8% having impaired glucose levels or prediabetes. The increased prevalence of diabetes is due to a combination of factors including changes in lifestyle, obesity, ageing population and genetic factors. Anecdotally, the prevalence of diabetic foot complications appears high but actual data to prove this is lacking. We do know that among people living with diabetes, 23.9% had a foot exam as part of their diabetic management in the last year. This is less than half of the numbers reported in Canada at 52%, Australia (57%), Germany (65%), New Zealand (66%), the United States (70%) and the United Kingdom (75%).<sup>3</sup>

Over the past 15 years attempts were made to adopt and implement clinical practice guidelines for diabetic foot screening at the primary care level in the Department of Public Health with the goal of identifying at-risk feet, early treatment for foot complications including ulcers and preventing amputations. The Inlow's 60-second Diabetic Foot Screening Tool by Wounds Canada<sup>4</sup> was selected because of its simple 10-item design, minimal tools required and it only took 60 seconds to complete. Numerous trainings in the use of the tool, written handouts and the monofilaments were provided. However the response and screening results were consistently low. There were challenges in implementing foot screening – no where to complete the screening, no tools ie monofilaments, lack of knowledge and skills, turnover of the trained persons, patients don't want their feet screened and no where to refer persons with at-risk feet. Kukinke et al also identified barriers to diabetic foot screening as time, competing clinical priorities, patients not aware of the critical importance of regular foot screening and the healthcare providers may not have the necessary assessment skills, knowledge, and systems support. We recognized that consistent widespread lack of diabetic foot screening can lead to increased ulcers, amputations and premature death of which a significant number can be prevented with screening. The aim of the study was to evaluate the diabetic foot screening process in the public health setting in The Bahamas and document the impact of digitization on improving the number of foot screenings completed and documented. Ultimately our goal is to identify at-risk feet, prevent complications or intervene early to save limbs and lives.

## Material and methods

Over the years, numerous groups of nurses and other health care providers have been trained in the use of the Inlow's 60-second Diabetic Foot Screen for the Assessment and Management of the Diabetic Foot by Wounds Canada. However, the yield in screening at the clinics and community was consistently low. The screening was paper based and completed forms were placed in the patients' chart. The only way to determine foot screening rates was to complete an audit and record review. Nurses reported screening but this was not supported with the chart audits. This could represent either the screening was not done or was done and not recorded in the patients' chart. In 2022, training was again planned and executed but this time the screening form was digitized using Google Forms. The

participants received training in screening as well as the use of the google forms documents to upload the results of the screening directly to the database immediately. Training participants were charged with completing 10 screenings when they return to their clinical setting before they can receive their certificate of completion. This was to incentivize them to complete the screening and upload it.

The study was a clinical practice study and no ethical approval was sought. The objective was to evaluate the impact of digitization on the screening process in the clinical setting. All patients identified as diabetic and who received a diabetic foot screening between January 2022 – January 2023 were included in the study. Patients who were not diabetic or who did not receive foot screening or if forms were not correctly completed were excluded from the study. Consent for care at the various facilities was used as the consent for their screening data to be included in the study.

## Results

A three-day training was conducted with 40 participants consisting of physicians, registered nurses, trained clinical nurses and patient care technicians. Directly from the training, in the three months after the training there were 120 diabetic foot screenings completed and uploaded to the Google Forms database. This represented a 100-fold increase in the number of completed foot screenings and documenting those using Google Forms. These results were joined with the previously accumulated results in the database for 2022 from private and public health care sites and analyzed.

The results revealed 31.9% males with age range of 22 – 89 years old. The years of diagnosis range from 2 months to 34 years. From the screening, 2.2 – 5.5% had an existing foot ulcer, most often seen on the Right foot. 22% of persons screened had thick, damaged and infected toenails to both feet. 29.7 – 34.1% admitted to symptoms of neuropathy while 26.4 – 28.6% patients had diabetic peripheral neuropathy when tested with Symes Weinstein Monofilament (SWM). 7.7 - 8.8% had absent pulses and 29.7 – 31.9% had cold feet. 26.4% had a deformity and 27.5 – 29.7 had limited ROM to the hallux. 17.6 – 18.7% of patients were wearing inappropriate footwear. 57.1% of patients were categorized as low risk, 23.1% moderate risk, 11% at high risk, 4.4% as Very High risk and 4.4% were at urgent risk returning for follow-up visits 12, 6, 3, 1 months and urgently (Figure 1, 2),

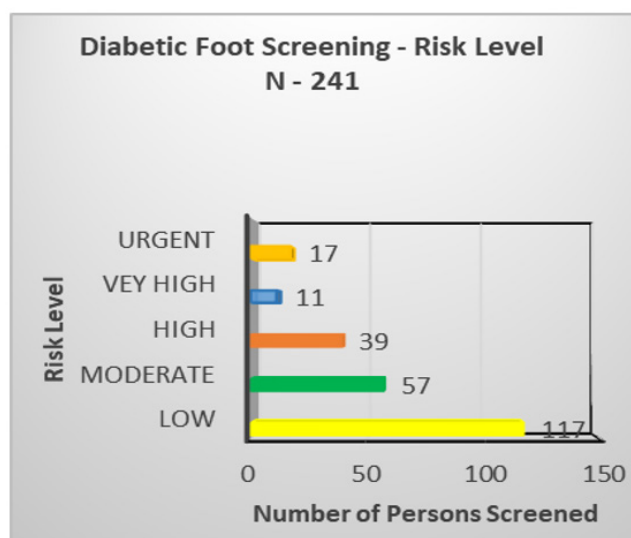


Figure 1 Risk level based on Diabetic Foot Screening N-241.

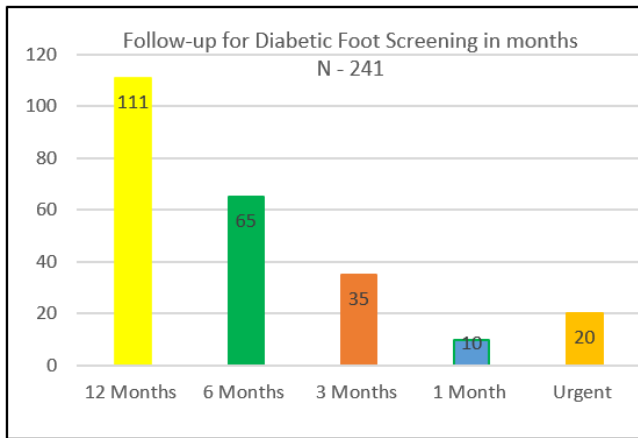


Figure 2 Follow-up schedule for diabetic foot screening in months N – 241.

The majority of the diabetic foot screening was done by Registered nurses (39%), Podiatrist (29%) and Trained Clinical Nurses (16%) (Figure 3).

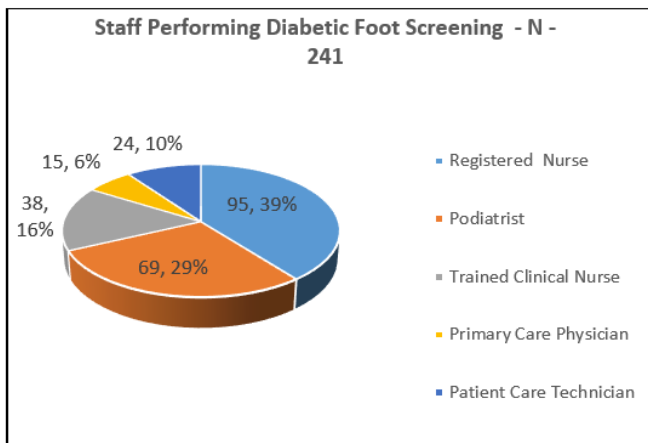


Figure 3 Staff performing diabetic foot screening N - 241

A follow-up survey with the participants in the training revealed 66.5% of respondents felt that digitizing the form encouraged them to complete the foot screening (Figure 4).

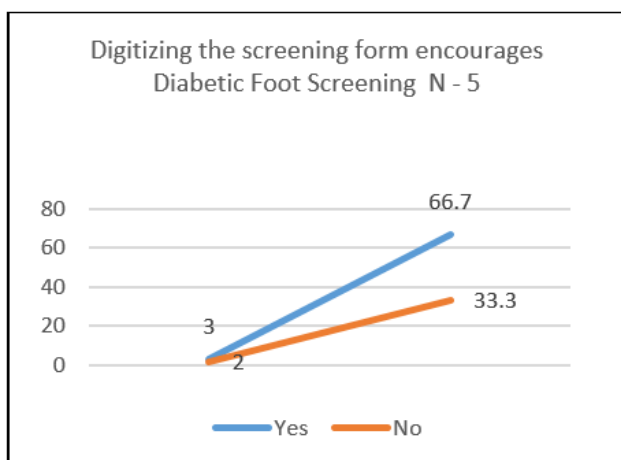


Figure 4 Digitizing the screening form encourages diabetic foot screening N – 5.

There were some challenges with completing the Google Forms document – 33% found it to be very easy, easy and difficult (Figure 5).

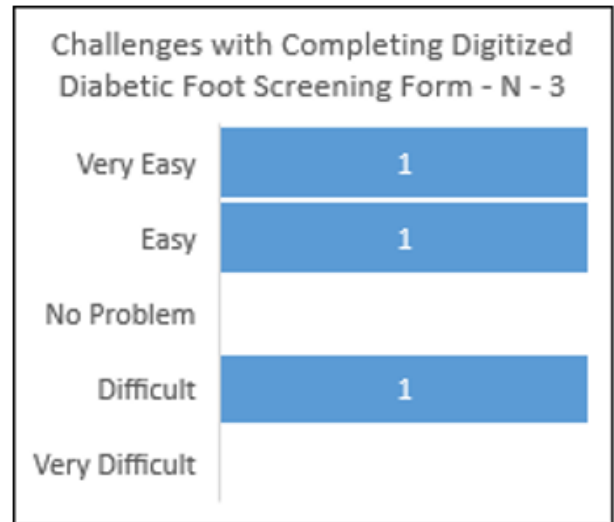


Figure 5 Challenges completing digitized diabetic foot screening N – 3.

The reasons why those professionals who did not complete the digitized Diabetic Foot Screening Form included no time, no device, no patients or place to screen, no internet access and could not find the link (Figure 6).

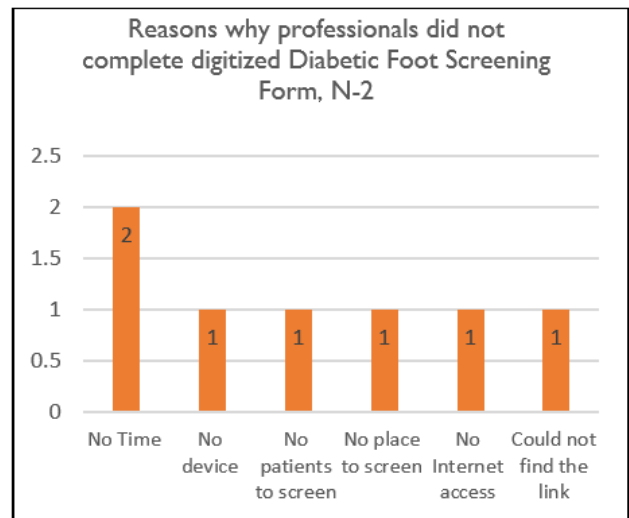


Figure 6 Reasons professionals did not complete digitized diabetic foot screening form N – 2.

## Discussion

Diabetic foot screening is examination of the feet with the objectives of identifying foot problems early, determining foot risk category, manage category for patients, and provide foot care education to patients with diabetes and their families. Experts agreed that foot screening is necessary at least annually and this recommendation is included in every diabetes management protocol. Annual foot screening is considered a primary step towards the prevention of diabetic foot complications. Foot screening alone is not associated with reduction in diabetes-related amputations, but when combined with other preventive measures significantly reduced the incidence of diabetic-foot-related complications.

All health professionals should be knowledgeable about foot screening techniques to identify at-risk feet and provide foot care education which increases patients' knowledge of self-care. Such knowledge empowers patients to join with their healthcare teams to decrease the incidence of complications including ulcers and amputations.

Foot screening is infrequently performed for people with diabetes. Internationally, diabetes foot screening rates in primary care environments vary from 50% to 86.7% suggesting potential for increasing screening uptake. Although foot examinations are a crucial part of care of diabetic patients and it is included in the national diabetes management guidelines, they are often over looked and not done. The 2019 Bahamas STEPS survey revealed only 23.9% of diabetics had their feet examined in the year prior to the survey. The neglect of diabetic foot screening is a significant health care service delivery problem that requires better understanding and strategies to increase it to prevent complications, save limbs and lives. Review of studies showed that primary providers of diabetes care were more likely to neglect foot examination than blood pressure checks.

Annual foot screening is an effective and cost saving strategy that allows the system to save money that was previously spent on the management of diabetes-related foot problems. Foot screening should be performed as early as possible in all diabetics to detect "At-Risk" feet and prevent the development of diabetic foot complications. The staff responsible for the screening is not standardized with podiatrist, nurses, and physicians being the grade of staff most often performing foot screenings. This had contributed to the variability in the efficacy, sensitivity and validity of diabetic foot screening techniques. Allied health professionals such as community health workers, patient care technicians and nursing assistants have also been trained to do basic foot screening especially when they are in the community and patients are referred to the nurse physician or podiatrists to conduct a comprehensive foot exam.

Numerous strategies have been used to increase foot screenings in various health care settings. One study at a primary care clinic showed improvement of foot screening rates from less than 10% to nearly 70% after implementation of a quality improvement project. The staff felt their confidence in conducting foot screening as well as enthusiasm for foot screening and patient education were the main reasons for the improvements and resulted in marked improvement in foot screening practices by HCWs at a primary health care clinic level. The effectiveness of diabetic foot screening in the primary care setting is irrefutable and is found to also potentially prevent lower extremity ulcers and amputations. During the study digitalizing the diabetic foot screening process increased screening and documentation by more than 163% over 2019 screenings. As a result of the increased screening, the number of attendees and referrals to the Podiatry clinic improved. More persons are receiving specialist foot care with potential limbs and lives saved. In the past, alerts and reminders were placed in patients' charts to warn practitioners of potential safety hazards of medications. They are now placed in EHRs. A similar adaptation to remind providers to perform diabetic foot examinations is now also available in EHRs. This enhancement will ultimately benefit many patients living with diabetes.

In the post COVID environment digitalization of health care has grown significantly, however the need still exists for advanced digital solutions that analyze patient data and present it in a user-friendly and meaningful way. In this study, digitalization encouraged health care professionals to complete the screening, improved reporting and

allowed immediate access to the data for participating islands. This is critical for identifying and responding to challenges in the screening process and gaps in services. Another benefit of digitizing the form and putting the data in a database is early and easy access to the data. The local health districts have the potential to see the data as a whole and by their particular island. This can lead to better decision making with resources allocation within the health system.

Evidence-based interventions aimed at increasing Annual Diabetic Foot Exam compliance should be implemented to promote early detection of foot abnormalities, prevent the development of serious foot lesions, decrease diabetes-associated complications, and reduce health care spending. In one study by Cooksey, they reported two interventions implemented for the Quality Improvement (QI) initiatives were brief training sessions on diabetic foot examination and the introduction of foot-screening tool bundles in each exam room. Additional strategies included recognizing the importance of getting buy-in from the staff and health care professional trainees who would be completing ADFEs to improve compliance rates. Challenges to maintaining engagement was frequent turnover of health professional trainees. In this study they overcame this by having regular biweekly review and meeting and continuous project improvement.

One limitation of the study was the small sample size. A larger sample size would have allowed for generalizability and application to more populations. Using the Inlow 60 Seconds Screening tool to risk stratify patients could have presented a potential challenge with communication to colleagues and peers. Because there is close alignment of the Inlow risk stratification system and that of the International Working Group for the Diabetic foot this was averted. Both systems have risk levels 0, 1, 2 and 3 which corresponded to R0 (Low Risk): No distal sensory neuropathy (PN) or peripheral arterial disease (PAD); R1 (Moderate Risk): PN or PAD, R2 (High Risk): PN and PAD, or PN and deformity, or PAD and deformity and R3 (Very High Risk): PN or PAD and a history of ulceration, amputation, or end-stage renal disease (ESCKD). The InLow system added an additional risk level called Urgent Risk for patients with an active ulcer, infection, active charcot or critical limb ischemia. There are numerous diabetic foot screening techniques and guidelines however there is need for more simple and cost effective screening techniques and studies on their efficacy and alignment with the risk stratification with the International Working Group of the Diabetic Foot.<sup>5-14</sup>

## Conclusion

This study amplified the fact that the present diabetes foot screening procedures in public sector of The Bahamian health care system is inadequate. Diabetic foot screening is a key component of the systematic and multidisciplinary care required by people living with diabetes. Along with risk stratification, patient education, and early referral and treatment the potential is great to save limbs and lives. Depending on a patient's level of risk, suitable preventive measures can be undertaken. The study recommends the revised training method and engagement of the trainees to complete screening early after the training. Training in the use of Google Forms must be improved as well.

## Acknowledgments

None.

## Conflicts of interest

No conflict of interest exists.

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