Implementation of a Comprehensive Diabetic Foot Care Program in Primary Care

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Sylvain, Peguy, "Implementation of a Comprehensive Diabetic Foot Care Program in Primary Care" (2023). Doctor of Nursing Practice Scholarly Projects. 28.
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Implementation of a Comprehensive 
Diabetic Foot Care Program in Primary Care

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May 2, 2023

Submitted in Partial Fulfillment of the Requirements for the Doctor of Nursing Practice Degree

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Abstract

BACKGROUND: Diabetes Mellitus is a growing health problem in America. Uncontrolled diabetes can result in vascular complications. One of the most common complications of diabetes is diabetic peripheral neuropathy. Early foot care screening can help prevent Diabetic peripheral neuropathy and other complications such as skin injuries, burns, falls, infection, lower-extremity amputations, and peripheral arterial disease. Interventions that have been shown to improve the identification of diabetes foot complications include staff education, screening and assessment, use of monofilament, tuning fork for diabetic foot assessment, patient education/self-care, standardization, and use of electronic medical records (EMR)/electronic reminders.

METHODS: The Plan Do Study Act method of quality improvement was used for this quality improvement project. A literature review was conducted. Data were collected and analyzed using both qualitative and quantitative methods. The data were assessed to determine the percentage of diabetic foot exams documented, the elements included in the documentation, and the number of patients referred to specialists. Huddles and staff surveys were used to determine the feasibility and value of the intervention.

INTERVENTION: A standardized diabetic foot care pathway was implemented in a primary care clinic. Adult patients with a diagnosis of diabetes were identified at non-urgent visits. Diabetic foot care was offered and carried out. Patients and staff were educated. The assessments were documented in the charts. Patients with abnormal findings on foot exams were either referred for ankle-brachial index tests and/or to specialists (podiatrist, vascular) or followed by a Primary care provider for mild abnormalities.

RESULTS: The project was implemented over 3 months. A total of 92 diabetic foot exams were completed. Of the 92 patients, 30 had abnormal exams (33%) and 15 had abnormal findings that warranted a referral to specialists. The staff was educated. The staff reported satisfaction with the pathway.

CONCLUSION: Implementing the new diabetic foot care pathway was clinically significant for the practice. It allowed the diagnosis of new conditions for the patients, which helped in the early prevention of foot complications. The new pathway consequently improved patient care.

Keywords: Diabetes, diabetes mellitus, foot exam, diabetic foot care, foot care pathway, neuropathy, peripheral neuropathy.
Introduction

Problem Description

Diabetes mellitus (DM) is a growing health problem in America. The prevalence of patients with diabetes reached about 37 million Americans in 2021, which is 11.3% of the American population (CDC, 2022). Approximately 90 to 95% have type 2 diabetes (DM2) (CDC, 2022). More people between the age of 45 and 64 are diagnosed with diabetes in the United States (US) (CDC, 2020). A low level of education and socioeconomic status were associated with a higher rate of diabetes among adults (CDC, 2020). Racial diversity was noted; about 14.5% were American Indians/Alaskan Natives; 12.1% were non-Hispanic blacks; 11.8% were Hispanics; 9.5% were Asian Americans; and 7.4% were non-Hispanic whites (American Diabetes Association, 2020). The total cost of diagnosed diabetes in the US in 2017 was US$ 327 billion. Diabetes affects a person's quality of life and social and psychological health (Feng & Astell-Burt, 2017).

Patients with uncontrolled diabetes or hemoglobin A1c greater than 7% are at high risk of developing vascular complications. Peripheral arterial disease (PAD), the occlusion of peripheral arteries in the upper and lower extremities, is a vascular complication of diabetes.

PAD is 2 to 7 times more prevalent in patients with diabetes, resulting in lower limb amputation (Soyoye et al., 2021). The cost of PAD for the healthcare system is about US$ 53 billion annually (Barnes et al., 2020). Patients of male gender and low socioeconomic status were at higher risk of diabetes and foot amputation. The incidence of diabetic foot ulcers and amputations is 2 to 3 times higher in African Americans than non-Hispanic whites (Tan et al., 2020).

One of the most common vascular complications affecting 80-90% of diabetic patients is Diabetic neuropathy (Tesfaye et al., 2013). When diabetic neuropathy affects the hands, arms, feet, and legs, it is called diabetic peripheral neuropathy (DPN). About
40% to 60% of patients diagnosed with neuropathy report diabetic neuropathic pain (DNP) (Callaghan et al., 2012).

The US's annual peripheral neuropathy cost is over $10 billion (Gordois et al., 2003). In patients with diabetes, about 20% of hospital admissions is due to foot ulcers (CDC, 2018). On average, in-hospital costs are US$ 10,827 per diabetic foot exam episode and US$ 73,813 per major amputation (Rinkel et al., 2017).

The American Diabetes Association (ADA) has recognized lower limb vulnerability associated with uncontrolled diabetes as a priority health problem and created a standard of care for preventing and managing diabetic vascular complications. Recommendations include a comprehensive foot exam at the start of diagnosis for patients with type 2 diabetes and 5 years after the diagnosis for patients with type 1 diabetes, and at least annually after that (ADA, 2020). Patients with diabetic peripheral neuropathy (DPN) suffer from loss of protective sensation (LOPS). This puts them at a greater risk of missing foot injuries, ulcers, and infections. Early detection and proper management of DPN are essential steps for preventing complications (ADA, 2020).

The exam should involve a thorough history and foot assessment. Inspection of the feet is the first step to assessing for skin integrity. A neurological exam should be done using a 10-g monofilament combined with another method, such as a pinprick test, temperature checks, or vibration tests. A 128-Hz tuning fork is used to evaluate vibration. Peripheral pulse checks are also recommended. Every visit, a foot exam should be performed for patients with sensory problems or neuropathy. Patients should be educated about proper foot care (ADA, 2020).

**Local Problem**

The prevalence of diabetes has been on the rise in Massachusetts, which mirrors the trend across the US. According to the American Diabetes Association (ADA), 9.3% of
Massachusetts residents were diagnosed with diabetes in 2017. Another 25,000 people in Massachusetts are diagnosed with diabetes every year. Black non-Hispanic (12.3%) and Hispanic (11.7%) residents have more incidence of diabetes compared to white non-Hispanic (8.7%). The annual direct medical expenses for diabetic care in Massachusetts are $5.5 billion, in addition to $2.1 billion in indirect costs (ADA, 2018).

The project site was a local primary care clinic south of Boston, Massachusetts. The clinic renders care to a racially diverse adult population with different socioeconomic statuses. A significant number of patients receive diabetic care at the clinic. Many patients have uncontrolled diabetes with an A1c higher than 7.0%. Endocrinologists follow a small percentage of diabetic patients; however, several patients referred to endocrinology and podiatry specialists do not schedule an initial appointment or do not follow up after the first visit.

Most diabetic patients are diagnosed with type 2 diabetes and are seen for routine diabetes care at the primary care clinic; however, foot exams were not routinely performed and documented despite being well-known as the standard of care.

**Available Knowledge**

A Prisma-guided literature review examined the most effective strategies to increase diabetic foot screening in the primary care setting. The search revealed 82 studies. After removing duplicates and screening the records, 13 studies were selected to address the problem.

A total of 3106 participants, aged 18 to 80, were included in the studies. About 60% of the participants were males. Most participants were not newly diagnosed with diabetes. A few studies reported diversity in participants; however, not all studies recorded ethnicity/race. The majority of studies were from outside the United States. There were two retrospective studies, two descriptive studies, four experimental studies, three quasi-experimental research studies,
two qualitative studies, and two guidelines for diabetic foot care.

Several studies were reviewed and sorted into 4 intervention strategies (Table 1, appendix A). The intervention strategies include screening and assessment, patient education/self-care, health care workers' education, and standardization/electronic medical record (EMR)/electronic reminder.

Two studies (Baraz et al., 2014; Forouzandeh et al., 2005) and two national guidelines (ADA, 2020; Shaper et al., 2020) recommended diabetic foot screening for early detection of diabetic peripheral neuropathy and prevention of diabetic foot complications; According to Forouzandeh et al. (2015), the use of the monofilament test is an appropriate tool for use in primary care because of its validity and simplicity. In the study by Baraz et al. (2014), 150 participants were screened using monofilament alone or combined with another screening method. The study showed positive results in the early detection of loss of protective sensation (LOPS).

Other studies support patient education to increase awareness and screening and prevent diabetes foot complications (Elkashif et al., 2021; Sharoni et al., 2015; Liang et al., 2012; Formosa et al., 2012). The Nottingham assessment of functional foot care (NAFF) assessed foot self-care knowledge in 100 participants (Elkashif et al., 2021). Based on the findings, implementing a self-care protocol for diabetic foot care is essential for preventing complications in patients with diabetes (Elkashif et al., 2021). A nurse-led multidisciplinary program with a diabetes nurse, endocrinologists, and dieticians has proven effective in providing appropriate foot care and patient education (Liang et al., 2012).

Multiple studies suggest that a supportive environment through education for healthcare workers helps with early diabetic foot screening (Mullan et al., 2021). The use of education for staff and patients contributes to an increase in foot exam performance by 20% in a primary clinic in South Carolina (Gallman et al., 2017; Allen et al., 2016).
Some authors support using EMR templates, electronic point-of-care, and standardization of processes to improve rates of annual foot exams (Praxel et al., 2011; Mehndiratta et al., 2020). The study by Mehndiratta et al. (2020) explored a new pathway for diabetic foot care with provider education, electronic medical records, and screening with monofilament to improve diabetic foot care. Among 848 participants, 11% were diagnosed with neuropathy (Mehndiratta et al., 2020). Praxel et al. (2011) investigated staff education, standardized documentation, and an electronic reminder to improve the frequency of diabetic foot exams. Chart audits, monofilament tests, and educational posters were utilized. The study's findings showed that providers' engagement in a standardized process could increase the frequency and consistency of diabetic foot care (Praxel et al., 2011).

The studies generally promote education, routine screening, and standardization of diabetic foot care in primary care. Since the primary care clinic does not currently have any workflow for regular diabetic foot care, standardized diabetic foot care is an appropriate intervention to benefit the patients.

Rationale

The Chronic Care Model (CCM) was used as a conceptual framework for this intervention. The model was created in 1992 by Edward H. Wagner. The model has been widely used to implement changes in the care delivery system to treat chronic diseases. CCM has six (6) components: healthcare organization to remove barriers to care, self-management to build patient confidence, decision support to implement evidence-based care, delivery system design for care coordination, clinical information systems to monitor outcomes, community resources, and policies to sustain care through the use of health policies (Bodenheimer et al., 2002).

Diabetes is a chronic condition that requires a high level of care. CCM incorporates patients, healthcare providers, and systems to provide patient-centered and evidence-based
regular care to patients in a particular setting. It focuses on prevention efforts and is proven to create more effective healthcare delivery systems in primary care.

The practice site is in an underserved community serving a diverse population. The clinic is reducing barriers to care. The project was designed to educate patients and build their skills in foot exams based on ADA recommendations.

Kurt Lewin's change theory was used to guide the implementation of this improvement change project. It includes three steps: unfreezing, moving, and refreezing. Based on Lewin's model, patients and providers agreed to change their old practices to adopt new ones and improve behaviors as part of the "unfreezing" step (Lewin, 1951).

Education of staff and patients and the implementation of regular foot exams was part of the "moving" step. The last step, "refreezing," started when everyone accepted the change and implemented new behaviors (Lewin, 1951).

**Specific Aims**

The proposed project aimed to improve the early detection of lower limb complications from diabetes. The overreaching goal was to develop, implement, and evaluate a standardized diabetic foot care pathway for patients with diabetes in a primary care clinic.

The specific aims of the intervention involved:

- Have consensus from leadership and staff on implementing a new pathway, including foot exams and patient education.
- Identify and flag at least 90% of adult patients with diabetes at non-urgent visits.
- Carry out diabetic foot exams on at least 90% of patients identified.
- Educate patients about preventive foot care.
- Refer patients with abnormal findings on foot exams to specialists (podiatrist, vascular) as appropriate.
• Evaluation of the pathway by staff as feasible and adding value to diabetic care.

Methods

The Kurt Lewin theory, combined with the model of quality improvement by the Institute of Healthcare Improvement (IHI), PDSA (Plan, Do, Study, Act), guided the development (plan/unfreeze), implementation (do/change,) and evaluation (study/act) refreeze of the project (IHI, 2015).

Context

The project was implemented in a primary care internal medicine clinic in Brockton, Massachusetts. The clinic serves about 2,500 patients residing in the south of Massachusetts. The clinic comprises one physician, one nurse practitioner, two medical secretaries, and four medical assistants. The practice serves at least 5-12 patients with diabetes most weeks. Foot exams were not routinely performed and documented in patients' charts. The providers were aware of the lack of proper diabetic foot exams and decided to implement a standardized diabetic foot care at the clinic. The patients' potential high risks for diabetes-related foot complications made it a suitable setting for the project.

The main reasons for the clinic's low rate of diabetic foot exams were explored. The factors contributing to the problem were identified through a root cause analysis using a Fishbone diagram (Appendix C). This instrument determined the categories of potential causes and their impact on the project's outcomes. The categories selected were people, method, environment, equipment, materials, and management. A diabetic foot care workflow was nonexistent at the clinic. Implementing the new pathway helped resolve the problems.

The routine visits at the clinic last about 15 to 30 minutes; adding diabetic foot exams was an extra step to the visits. Materials, including tuning forks and monofilaments, were not readily available for the foot assessment. The project received support from staff and leadership. Staff education is one of the first steps in implementing the improvement
project. The staff was educated about the importance of preventive foot care. Materials were purchased and made available in the exam rooms for the providers.

An external mapping tool was used to identify contextual factors that could affect our ability to implement the project in the primary care setting (Appendix B). The primary stakeholders for this quality improvement project are the Nurse Practitioner, one physician, four medical assistants, and two front desk staff. Leadership support was crucial for implementing this project as it empowered everyone involved to do the work. Support from Information Technology (IT) was also needed with the addition of a template in the EMR for documentation of the foot exam. A colleague, primary care doctor, well-versed in technology, helped with that step. Labs, including A1c for diabetes screening and evaluation, were ordered through the laboratory. Meeting with the different parties involved, educating the staff, and implementing regular huddles were integrated into the execution of the project.

A force field analysis (Appendix D) was conducted to determine the organizational factors that could drive or restrain the implementation of the project.

One of the positive forces is buy-in from leadership. Since diabetic foot care is a quality metric, the intervention helped the clinic achieve this goal. Staff commitment to diabetic care is also a positive factor in realizing the project.

Amid negative forces, the cost of the requested items (tuning forks, monofilaments), time restraint in implementing the change (staff education, patient education, foot exam), and resistance to change among patients and providers were noted. Also, the patients may not feel comfortable removing their shoes for the foot exam. Successful implementation required building on the driving forces, anticipating and mitigating the restraining forces.
**Intervention**

**Description of the Intervention**

The new diabetic foot care pathway (Appendix E) was implemented at the primary care clinic from August 2022 to November 2022. The initial step in the pathway is when patients check in at the reception area by the medical secretaries. Since all patient charts are updated with patients' diagnoses, the medical assistant identified all patients with diabetes at non-urgent visits based on a diagnosis of diabetes in the problem section of the chart. The medical assistants flagged the qualified patients the day before their appointments in the charts and reflected on the daily providers' schedules. On the day of their appointments, all patients diagnosed with diabetes were called into the exam rooms by the medical assistants. The participants were screened for a recent hemoglobin A1c in the charts within 90 days by reviewing the electronic medical records. The medical assistant briefly educated the patient about the need for diabetic foot care and provided an educational handout to the patient. The medical assistant prepared the necessary items, including a disposable pad, in front of the patient and asked them to remove their shoes.

The provider continued to educate the patient about preventive foot self-care, completed the diabetic foot exam, and document the assessment in the chart. An inspection of skin integrity and musculoskeletal deformity was performed. The neurological component of the exam included using a monofilament test with a tuning fork for a vibration check. A vascular assessment was done by checking both feet and legs' pulses. Patients with claudication symptoms or absence of pedal pulses were referred for an ankle-brachial index and to a vascular specialist for further evaluation.

The findings of the assessment were discussed with the patient. Patients with a new diagnosis of peripheral neuropathy were educated about the latest diagnosis and started on treatment with either duloxetine, gabapentin, or pregabalin as initial pharmacologic
treatments per ADA guidelines. Patients with foot deformities, prior foot ulcers, or a history of amputation with new abnormal findings on the foot exam were referred to specialists (podiatrists, vascular) for ongoing preventive care (Praxel & Vanderboom, E. W, 2011). Patients with minor abnormalities on the foot exam were advised to follow up at the primary care clinic.

If a patient declined the foot exam, the reason for declining was entered into the EMR by the medical assistant, and the provider reviewed self-management strategies. The medical assistant continued to offer foot exams at all future visits. A handout about preventive foot care was provided to all patients with diabetes seen at the clinic. There was no specific location to document patients' education in the chart. Patients were considered educated if they received the educational handout or received the diabetic foot exam since the providers educated the patients during the process. All diabetic patients with documentation of normal foot exams in the chart were scheduled for the next foot exam in one year.

**Implementation of the Intervention**

A logic model was developed (Appendix F) to help plan, implement, manage, and evaluate the project. Leadership buy-in was acquired in developing the new diabetic foot care pathway. Approval for staff education and acquisition of supplies (monofilaments, tuning forks, disposable pads) was obtained. Initially, the steps for proper diabetic foot care, as recommended by the ADA, were reviewed with the other provider. An education handout was printed for the patients. Posters asking diabetic patients to remove their shoes and socks for preventive foot care were placed in the exam rooms (Appendix Q). The staff was educated about the importance of preventative foot care, the component of the exam, and how to speak to patients about preventive foot care. The original pathway was reviewed with the clinic's provider and staff, and adjustments were made before implementation. Regular huddles took place to receive and provide feedback, assess challenges and
successes, and provide continuous education.

The new pathway was implemented in non-urgent visits. The medical assistants introduced the idea with the educational handout. They asked the patients to remove their socks and shoes while waiting for the providers, saving time. Tuning fork and monofilament were set up in the exam room for the providers. The foot exam, in most cases, did not take more than 2 to 3 minutes. Using the diabetic foot exam EMR template facilitated documentation of the findings (Appendix P). The template consists of all the components of the foot exam: inspection, neurological, and vascular. The providers documented all aspects for completion of the foot exam for the patients receiving the foot exam.

**Evaluation of the Intervention**

The PDSA (Plan, Do, Study, Act) Model of quality improvement guided the evaluation of this improvement project (Donnelly & Kirk, 2015). PDSA cycles were used to test, evaluate, revise, and recycle the quality improvement plans to decide whether a change has resulted in an improvement. The overarching aim for the project was to develop, implement and evaluate a comprehensive diabetic foot exam program in a primary care clinic. Successful attainment of the overarching aim was guided by several objectives. These objectives were assessed to determine the success of this improvement project.

**Measures**

**Objective 1:** *Have consensus from leadership and staff on implementing a new pathway.* Evidence of consensus from leadership and staff was drawn from meeting minutes and conversations during project huddles. The minutes were reviewed to determine participation and input from staff. Qualitative methods were used to identify common themes and outcomes.

**Objective 2:** *At least 90% of adult patients with diabetes will be identified and flagged based on the problem list at non-urgent visits by the medical assistants.* The
schedule was reviewed weekly to track the number of diabetic patients seen for non-urgent visits that week and the number of charts that were flagged for the pathway. The frequency and proportion of eligible patients whose charts were flagged was identified in relation to the number of patients eligible for the service and an overall proportion was calculated. (Appendix M). The aggregated average proportion of patients with flagged charts each week was plotted on a time series chart over the 12 weeks of the project to assess variation in the process.

Objective 3: *Diabetic foot exams will be performed on at least 90% of patients.*
Completing the foot exam was defined as documentation of all components: an inspection, a neurological exam and a vascular exam of the patient's feet. Evidence of the diabetic foot exam was drawn from the EMR, and the results were transcribed to a tracking form. Each component (inspection, neurological, and vascular exams), of the diabetic foot exam was noted and assigned a point if the element was documented in the EMR. A total score was calculated. A maximum number of three points could be calculated for the three components of the foot exam. The number of diabetic foot exams was counted if the score reached 3 points. The proportion of eligible patients receiving foot exams was calculated compared to the total number of eligible patients each week (Appendix N). In addition, each element of the foot exam was scored individually in order to determine if any one element was more difficult to achieve.

Objective 4: *Patients will be educated about preventive foot care.*
Being educated about preventive foot care was defined as the patient receiving a handout and brief educational information about foot care by the medical assistant and reinforced by the provider. Copies of the handout were located in a clear folder in all the exam rooms and provided to the patient by the medical assistant. Patients' education was considered completed if the patient was educated by the medical assistant or the provider. The EMR
diabetic foot exam template did not include education. The proportion of educated patients was calculated in relation to the number of patients examined. (Appendix N).

Objective 5: Patients with abnormal findings on foot exams will be referred to specialists (podiatrist, vascular) as appropriate.

Evidence of referral to specialists was drawn from the EMR and administrative (scheduling) records. Patients with new vascular findings (decreased pedal pulses or absent pedal pulses) were referred for an ankle-brachial index test to check for peripheral artery disease and to a vascular specialist for further vascular assessment per ADA recommendations (ADA, 2020). Patients with foot deformities were referred to a podiatrist as needed. Patients with findings of neuropathy and already being treated were advised to follow-up with their PCP if they were considered stable and at low risk for further complications. Patients with mild skin abnormalities (e.g., tinea pedis) were started on treatment and also recommended to follow-up at the clinic. At check out, the medical secretaries ensured follow-up on all provider referral orders. A tracking form was utilized to document all patients referred to specialists. The frequency of referral in relation to the number of individuals who met the criteria was described as frequency and proportion. (Appendix N).

Objective 6: Staff will evaluate the pathway as feasible and add value to diabetic care. Feasibility was described as the capacity to carry out the pathway and integrate the new pathway into routine, non-urgent visits. Value was defined as the new pathway's importance in providing quality patient care, improving staff communication, and meeting standards for ADA diabetic foot care guidelines.

Surveys (3) were developed using continuous values on a Likert scale of 1 to 5 to measure the feasibility and value of the intervention (Appendices J, K, L). Providers, medical assistants, and medical secretaries answered questions that allowed evaluation of
the project in terms of feasibility at the clinic and value-added for patient care. The surveys also collected ideas about the intervention—suggestions for improvement. Information obtained from the huddles also helped identify feasibility issues.

**Analysis**

Both qualitative and quantitative methods were used to evaluate the intervention. The data collected were entered in Microsoft Excel to calculate frequency, proportions, and aggregated means accurately. All data were de-identified, and the project director corrected any inconsistencies and errors. The project director also checked data to ensure completeness by correcting inaccuracies and missing values.

**Ethical Considerations**

The UMass Boston clinical quality improvement checklist (Appendix H) was completed to determine if the proposed intervention was a quality improvement project. As shown on the checklist, the project met the criteria for quality improvement and did not meet the definition of human subjects research because it was not designed to produce generalizable findings but rather to provide immediate and continuous improvement feedback in the local setting in which the project is carried out. The University of Massachusetts Boston IRB has determined that quality improvement projects did not need to be reviewed by the IRB.

The project site does not have a formal IRB process but does require approval for the project by the leadership team. Written permission from the Senior Director of operations was obtained. The onsite manager reviewed the proposal and deemed the project appropriate for the clinic and patient care.

**Results**

**Consensus**

The clinic's leadership team, providers, and staff approved the quality
improvement project before implementation. The initial pathway was reviewed with leadership, management, and the staff for their input. Based on the team’s input changes related to flag location in the patients' charts were made. Exclusion criteria were adjusted to include patients getting foot exams done by specialists (neurologist, endocrinologist, vascular, podiatrist) within a year, and changes were reviewed with all team members. Everyone reached a consensus on the final pathway. The project leader trained the staff at the clinic. An initial 15 minutes of training was dedicated to the staff, and regular check-ins occurred thereafter. The staff was trained about the importance of diabetic foot exams, the pathway, the steps included in the foot exam, and how to introduce the pathway to the patients. The providers agreed to use the diabetic foot exam template to document the findings. The project implementation started in August 2022 and ended in November 2022.

**Identification and Flag of Patients With Diabetes on the Schedule**

The medical assistants reviewed the daily providers' schedules. A total of 116 patients diagnosed with diabetes (N=116) were on the schedule throughout the implementation of the project. Of the 116 patients, 87% (n=101) were flagged as having a diagnosis of diabetes and, therefore, eligible to be put on the foot care pathway (Table 1). Mean aggregated completion (flagged charts) were tracked across time (baseline, 4, 8 and 11 weeks) to examine variation in the process as well as improvement. The completion rate of flagged patients was 91% for week 4, 88 % for week 8, and 94% for week 11 (Figure 2). Week 12 was not considered in this analysis because the office had minimal available staff, and the flags were consequently missed for that week. The staff shortage that started since the COVID-19 pandemic continued to affect our clinic, like many other primary care clinics.

An improvement in the completion rate of flagged patients is noted from week 4
to week 11. Only one provider worked for the 4\textsuperscript{th} week, which explains that only five diabetic patients were on the schedule. Week 9 included a holiday (Columbus Day), the office was closed for one day, and six patients were flagged. There is an increase in the number of diabetic patients listed on the schedule for week 11. The rebound in visits coincides with the return from a vacation of one of the providers. This trend did now reflect in week five because the office was closed on Labor Day and open for four days (Figure 1).

\textbf{Table 1}

\textit{Proportion of Patients Flagged per Week}

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<th>Patients Flagged</th>
<th>Proportion of Patients Flagged</th>
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</table>
Figure 1

Proportion of Patients Flagged Week

![Graph showing proportion of patients flagged over weeks with UCL, LCL, and specific cause variations indicated.]

Figure 2

Patients Flagged / Completion Rate

![Bar chart showing percentage completion over weeks with values for weeks 4, 8, and 11 indicated.]
Demographic Characteristics of Participants

The project included 103 participants with a diagnosis of diabetes who were deemed eligible for the foot care pathway. Participants self-report of sex revealed that they were fairly evenly distributed by gender; 52% (n=54) were men, and 48% (n=49) were women (Figure 3). Participants were diverse. Patients from 4 different racial and ethnic groups were part of the project: 45% (n=47) self-reported race as African Americans, 44% (n=45) self-reported race as Caucasian, 9% (n=9) and 2% (n=2) self-reported race as Asian and Hispanic ethnicity (any race) (Figure 4). The mean age was 66, ranging from 34 to 86 years. Most patients were between 60 and 79 years of age, with 35% (n=36) between ages 60 to 69 and 32% (n=33) between ages 70 to 79. The demographic characteristics of the participants in the project represented the population of the clinic where the project was carried out.

Figure 3

Gender
Figure 4

Race and Ethnicity

Diabetic Foot Exams Completed by Providers on Eligible Patients

After checking at the front desk, the patients with a diagnosis of diabetes, flagged on the providers’ schedule were placed in an exam room by the medical assistant. The medical assistants prepared the exam rooms for the eligible patients. A 128-HZ tuning fork, a disposable 10-g monofilament were set up in the exam room before the providers see the patients. The medical assistants briefly educated the patients about the diabetes foot exam and provided the handout to the patients. Disposable pads were placed in front of the patients and they were asked to remove their socks and shoes. The medical assistants documented any refusal in the “reason for visit” section of the chart.

The providers (physician and nurse practitioner) met with the patients for their non-urgent visit, including a foot exam, and documented the foot exams in the chart. The electronic medical records (EMR) were reviewed for evidence of completed diabetic foot exams including a skin inspection, a neurological exam and a vascular exam. Documentation was scored overall and in relation to the number of elements of
the foot exam that were completed/documented. The results were transcribed to an Excel tracking form and interpreted. A total of 116 patients diagnosed with diabetes were on the schedule for non-urgent visits. Of those 116 patients, 11% (n=13) were already followed by specialists for foot exams and had documented visits within a year in the chart. The medical assistants provided the educational handout to the patient while briefly educating the patient about diabetic foot exams. The providers further educated these patients, but they were excluded from the project. The remaining 103 patients constituted the patients eligible for diabetic foot exams by their PCP. They served as the denominator to calculate the percentage of diabetic foot exams completed on eligible patients. Diabetic foot exams were conducted on 89% (n=92) of eligible patients. Of the Eleven patients who did not receive a foot exam, nine exams were missed because the charts were not flagged or the provider did not have enough time, and two patients declined. The medical assistants documented the reasons in the charts. Of the two people who declined, one patient refused to remove their shoes, and the second declined because they had a complete workup and did not think this was necessary.

A review of the charts was conducted the second week into the implementation to assess for completeness of the documentation. It revealed that the inspection and neurological components of the exam were documented for all patients. However, for the vascular portion, pedal pulses were omitted or recorded in different areas in the charts for seven patients (37%). The providers discussed the findings and agreed to use the diabetes foot exam template available in the EMR to ensure that all foot exam elements were documented. Subsequent chart reviews showed that the problem was corrected.
Patients Educated about Preventive Foot Exam

A handout about preventive foot care was provided to all patients with a diagnosis of diabetes by the medical assistants as part of the introduction to the topic. The providers reinforced the educational component during the completion of the foot exams. The diabetic foot exam template in the EMR did not allow documentation of patient education. The educational piece was considered completed if they received the handout or the providers did the exam. All 92 patients who received foot exams received the brochure or were educated by the providers.

Refer all Patients with Abnormal Findings to Specialists as Appropriate

Providers completed a total of 92 foot exams. Of the 92 foot exams, 33% (n=30) were abnormal. Among the patients with abnormal examinations, about half of the group was managed by following up in the practice, and half needed referrals to specialists.

Abnormal findings that met the criteria to be referred to specialists (podiatrists, vascular specialists) were observed in 16% (n=15). This category includes patients with an abnormal pedal or posterior tibial pulse and patients with significantly decreased sensation on tuning fork or monofilament who were referred to vascular specialists. Patients (5%, n=5) with nail abnormalities (dystrophy, paronychia, changes) and calluses were referred to podiatrists. Patients (11%, n=10) with abnormal pulses, were referred for ABI and vascular specialists (Figure 5). All 15 referrals to specialists were appropriate.

The remaining patients 16% (n=15) were asked to follow up at the clinic. Out of the 15 patients, 13 were already diagnosed with peripheral neuropathy and started on medications (nortriptyline, duloxetine, gabapentin) in the past, one had mildly decreased vibration in the right foot and was scheduled for three months follow-up for re-
evaluation, and the two other patients had abnormal neurological exams, but declined to start treatment.

Normal examinations were noted in 67% (n=62) of patients among the 92 foot exams completed. They will continue to follow up at the clinic for diabetic care.

**Figure 5**

*Foot Exams*

[Graph showing percentage of foot exams over weeks 4, 8, and 11.]

**Staff Survey to Evaluate the Feasible Pathway and Add Value to Diabetic Care.**

All staff, including providers (n=1), medical assistants (n=4), and medical secretaries (n=3), completed the satisfaction surveys (Appendices J, K, L). They provided positive feedback with a mean response of 5 (strongly agreed) on the project's questions regarding the feasibility of doing foot exams for eligible patients at the clinic and value-added for patient care. Although the clinic is small and the survey was not conducted anonymously, the staff could offer suggestions for improvement during the regular huddles and individual check-ins. Communication helped answer questions about the pathway and was a critical part that allowed a review of the process and engagement in open dialogue with the staff. Some of the questions brought by the staff included how to deal with patient refusal to remove their shoes, the frequency of foot
exams recommended, and exclusion criteria. Outside of huddles and check-ins, the staff was encouraged to ask questions as they arose. Staff and providers at the clinic recommended continuing with the project. They felt that it added value to the clinic and improved patient care.

Discussion

Summary

The overall aim of this project was to improve the early detection of lower limb complications from diabetes. The overreaching goal was to develop, implement, and evaluate a standardized diabetic foot care pathway for patients with diabetes in a primary care clinic.

Overall, the project was a success. About 33% (n=30) of patients who were seen for a routine, non-urgent diabetes visit had abnormal exams that could have been missed if the patient had not had the exam. In addition to improved patient outcomes, the project brought several significant positive outcomes for the clinic. The process was new for everyone at the clinic but is now integrated into routine patient care. The project was successful because the staff were included in the project planning, were educated about the importance of diabetes foot exams and worked closely together. As noted by Lewin, given these conditions, staff embraced the change and were able to change old practices to adopt improved behaviors (Lewin, 1951). Because of the changes that occurred and the open communication between staff members, the project resulted in an improvement.

The project was clinically significant. It generated interest in the staff to improve patient care. It allowed the diagnosis of new conditions for the patients, which helped in the early prevention of foot complications. This consequently enhanced patient care.
Interpretation

The quality improvement project positively impacted patient care and the staff at the clinic. Diabetic foot care was not provided at the clinic in the past. The project initiated a new pathway for preventive foot care and captured 87% of eligible patients to be started on the pathway. While 13% (n=15) flags and foot exams, 9% (n=11) were missed, the differences were small compared to the outcomes. Over the three months of implementation of the project, the providers carried out foot exams on 92 patients which represented 87% of eligible patients. Of the 92 patients, 30 (33%) had abnormal findings, and 15 were referred to specialists for management while 15 were followed up in the practice. To establish a baseline of the number of abnormal foot exams identified prior to the project we looked at the 116 diabetic patients seen in clinic for diabetic visits during the project period who were excluded because they were already under the care of a vascular specialist or podiatrist (n=13; 11%). The observed improvement in the rate of abnormal foot exams after the project suggests that the number of patients who had abnormal foot exams identified, increased over the project period (33% vs 11% respectively). One caution is that this was a QI project and therefore could not control for confounders, however the improvement observed does suggest that some abnormal foot exams were undetected prior to the project. Early detection of abnormal physical findings facilitates early intervention to prevent complications. These findings are consistent with the results reported by Mehndiratta et al. (2020), which found that preventive foot care reduces the incidence of peripheral neuropathy and prevents foot complications.

The Chronic Care Model (CCM) highlights the significance of the relationship between the care team and the patient. The CCM focus on a preventative and collaborative approach of care. The care team is required to assess the system in place.
for weakness and improve patient care. The six elements of this model: Health System Organization of Care, Self-Management Support, Delivery System Design, Decision Support, Clinical Information Systems, and Community Resources serve as basis for managing chronic illness and prevent complications (Bodenheimer et al., 2002).

The quality improvement project was supported by the leadership team at the clinic. Providers and staff provided support to the project. The patients and the healthcare team worked together to follow the ADA guidelines and implement the necessary changes. The staff was educated about evidence-based clinical guidelines for diabetic foot exams. The staff at the clinic had specific roles to follow throughout the project to ensure that the pathway was implemented efficiently. The staff functioned coherently to ensure the delivery of high-quality care to the patients. The QI project provided self-management support to the patients. They were encouraged to actively take part in their care. Patient were educated during the diabetic foot exam to enhance their confidence in the ability to improve their quality of life and prevent morbidity.

The EMR system facilitated the implementation of the project. The EMR system reflects updated information about the patients. The medical assistants were able to effectively identify patients with a diagnosis of diabetes for adequate planning. Diabetes is a chronic disease with a high risk for complications. Having updated information about the patients during the diabetic foot exams allowed individualized treatment plan that considers the possible barriers the patients face.

The sustainability of the project depends on the providers’ adherence to document the foot exams completely and to bill appropriately. Several current procedural terminology (CPT) codes are used to bill for diabetic foot exams including CPT codes 2028F, G0245, G0246, and G9226. Most codes requires documentation of the 3 major components of the diabetic foot examination: visual inspection, sensory exam with
monofilament, vascular exam with pulse exam in addition to patient history and education. Medicare covers diabetic foot exams every 6 months for patients with a diagnosis of diabetic sensory neuropathy and loss of protective sensation (LOPS), if the individuals have not seen a foot care specialist for other reason in the interval (CMMS, 2005). Routine foot care services performed more often than every 60 days needs convincing documentation that more frequent services are appropriate.

**Challenges**

Barriers to implementation included staff shortages, which resulted in missed flags and medical assistants forgetting to set up the necessary tools (monofilaments, tuning forks) and asking patients to remove their shoes and socks to cue the providers.

**Conclusions**

This improvement project showed the importance of preventive care for diabetic patients and the impact of an improved process for detecting abnormal foot findings. An important strength of the project is that it was carried out in a safety net practice with a high proportion of historically underserved individuals. According to the CDC, 11.9% of white (non-Hispanic) people were diagnosed with diabetes in 2020 compared to 16.8% of Black (non-Hispanic) (CDC, 2020). The rate of diabetic foot amputations has been higher among African Americans than White people (Harris et al., 2019). Prevention of the diabetic foot ulcer is important, especially for that population. However, racial and ethnic minorities with diabetes are less likely to receive recommended preventive care (Haw et al., 2021). Patient education, empowerment, and the activation of patient-provider relationship were the foundation of this project (Bodenheimer et al., 2002). Patient engagement can be observed during diabetic foot care, which enhances self-care and advocacy skills. The project empowered patients to improve their quality of life through patient education and preventive care and will help reduce
diabetic foot complications, amputations, and hospital admissions.

The new diabetic foot care pathway improved staff engagement and increased adherence to the American Diabetes Association (ADA) foot care guidelines at the clinic. Communication and interprofessional relationship guided the intervention through evidence-based practices and encouraged the continuity of care among the team. The project facilitated good communication, fostered teamwork, and better patient care. When the providers are attentive with routine foot screenings, diabetic foot education, and referral to specialists in primary care, it improves patient outcomes.

During the QI project, many patients had abnormal findings and received the appropriate treatment or were referred to the appropriate specialists.

Despite the staffing shortages and other challenges, the project is sustainable for the clinic. Extending foot exams to urgent visits if time allows should be considered. A section for documenting the patient's education in the EMR template is recommended. Providers should bill for the service provided. It would also be beneficial to extend the time frame for the project to monitor the patients with abnormal findings for a more extended period. Moreover, querying patients about the process would be an excellent source of feedback and could serve as a tool to shape future improvement. A more established collaboration between the primary care practice and the vascular and podiatry specialists would help ensure proper patient follow-up and contribute to effective patient-centered care.
References


Microvascular Complications and Foot Care: Standards of Medical Care in Diabetes-2020. (2020). *Diabetes Care, 43*(Suppl 1), S135–S151. [https://doi.org/10.2337/dc20-S011](https://doi.org/10.2337/dc20-S011)
https://doi.org/10.1071/PY20241


**Appendix A**

**Synthesis Table**

**Exploratory PICO:** Among adult patients diagnosed with diabetes (P), what are some effective strategies (I) to increase diabetic foot screening and prevention of complications (O)?

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Number of studies</th>
<th>Overall quality and population</th>
<th>Significant finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening/assessment/monofilament testing</td>
<td>A. Baraz et al. (2014)</td>
<td>A. 2, B</td>
<td>Monofilament test contributes to the early detection and prevention of diabetic foot complication (A, B, C, D).</td>
</tr>
<tr>
<td></td>
<td>B. Forouzandeh et al. (2005)</td>
<td>N= 150 - 47 males (31.3%); 103 females (68.7%); Average age 55.7; Mean disease duration 6.1 years</td>
<td>Diabetes foot screening prevents diabetic foot complications in primary care setting (C).</td>
</tr>
<tr>
<td></td>
<td>C. ADA (2020)</td>
<td>B. 1, B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. Shaper et al. (2020)</td>
<td>N = 142 - Average age: 57; male: 41.5% - female: 58.5%; duration of illness: 11 years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F. Sharoni et al. (2018)</td>
<td>N= 100 - male (54%); female (46%); Mean age (46.21)</td>
<td></td>
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<tr>
<td></td>
<td>G. Liang et al. (2012)</td>
<td>F. 1, B -N= 76 participants ; n = 38 (IG) ; n = 38 (CG); Male : 63.2 % (IG) -78.9% (CG)</td>
<td>Multidisciplinary program to educate patient contributes to early screening and foot care (G)</td>
</tr>
<tr>
<td></td>
<td>H. Formosa et al. (2012)</td>
<td>Female : 36.8 (IG) - 21.1 (CG)</td>
<td></td>
</tr>
<tr>
<td>Education – health care workers</td>
<td>I. Mullan et al. (2021)</td>
<td>G. 1, B - N= 62; n = 31 (IG); n = 31 (CG) -56% male Mean diabetes duration = 11 years</td>
<td>Supportive environment through staff education help with early diabetic foot screening (I, K, M, N, L).</td>
</tr>
<tr>
<td></td>
<td>K. Gallman et al. (2017)</td>
<td>H. 1, B - N= 243; n= 134 males; n= 109 Females; mean age: 68.5 years mean duration of diabetes: 12.28 years.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L. Allen et al. (2016)</td>
<td>I. III, B - N= not provided</td>
<td></td>
</tr>
<tr>
<td>EMR/electronic reminder/standardization</td>
<td>M. Mehndiratta et al. (2020)</td>
<td>K. 2, B - N= 772; n= 416 (patients seen pre implementation); n= 356 (patients seen post implementation); age 18–75 years with diabetes (type 1 and 2)</td>
<td>Use of EMR templates, electronic point-of-care improve rates of annual foot exams (K, N).</td>
</tr>
<tr>
<td></td>
<td>N. Praxel et al. (2011)</td>
<td>L. III, B – N = not provided</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B:
Microsystem Analysis

Clinical microsystem: Diabetic foot care in Primary care
Subpopulation of patients: Adults patients with Diabetes

List of specific health care needs:
- Diabetes screening
- diabetic foot care
- staff education
- Patients education
- process standardization
- EMR documentation of diabetic foot care

Improvement ideas:
- Educate staff and patients about diabetic foot care
- Establish new process - have patients ready for providers by removing their shoes at the beginning of the visit
- Standardize the process for all providers/staff at the clinic
- Document diabetic foot exam
- Refer to podiatrist/ vascular specialist when necessary
- Start treatment when appropriate
Appendix C

Fishbone Diagram
Appendix D

Force Field Analysis

**Forces for change**
- Prevention of complications
- Staff support
- Improve communication between staff
- Leadership support
- Compliance to ADA guidelines

**Forces against change**
- Time constraints for change implementation
- Resistance to change among patients
- IT barriers
- Staff training
- Resistance to change among providers

**Standardized Diabetic Foot Care in Primary Care**
Appendix E

Intervention Process Map
Appendix F

Logic Model

**Problem:** Lack of standardization of diabetic foot exam in a Primary care clinic.

**Purpose:** Implementation of standardized comprehensive diabetic foot exam (CDFE) in a Primary care clinic to increase screening rates, improve staff engagement and adherence to the American Diabetes Association (ADA) diabetic foot exam.

### Inputs
- Project leader
- Leadership support
- Staff support (providers, Medical assistants, medical secretaries)
- IT support
- Funding for equipment (monofilament, tuning fork)

### Activities
- Include staff in project development of new diabetic foot care protocol
- Create a staff education program
- Develop protocol for diabetic foot exam
- Create a handout for patient education

### Outputs
- Providers agree on new diabetic foot techniques
- Staff agree on new standard diabetic foot exam protocol

### Outcomes

**Short-term (4 weeks)**
- Patients are identified.
- Out of all patients who agreed to diabetic foot exam, at least 50% of patients received standardized diabetic foot care.

**Intermediate (8 weeks)**
- at least 80% of patients received standardized diabetic foot care.
- Improve staff engagement

**Long-term (12 weeks)**
- 90% of patients received standardized diabetic foot care.
- Patients are educated.
- Refer all patients with abnormal findings on foot exam to specialists (podiatrist, vascular) for prevention of diabetic foot complications
- Staff identify new diabetic foot care protocol as feasible and value-added.

### Contextual factors and assumptions:
- Lack of diabetic foot care can lead to complications such as diabetic foot ulcers, amputations.
- Regular comprehensive diabetic foot exam (CDFE) can prevent diabetic foot complications.
## Appendix G
### Measures Table

<table>
<thead>
<tr>
<th>Aim or objectives</th>
<th>How operationalize/measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) consensus from leadership and staff on the implementation of a new pathway</td>
<td>Staff and leadership agree on new diabetic foot care pathway. Meeting minutes are taken and evaluated.</td>
</tr>
<tr>
<td>2) 90% of adult patients with diabetes will be identified and flagged at non-urgent visits.</td>
<td>All adult patients with diabetes are successfully identified DM patients are flagged in EMR to reflect on daily providers' schedules.</td>
</tr>
<tr>
<td>3) Diabetic foot exams will be carried out on at least 90% of eligible patients.</td>
<td>Measure the number of diabetic foot exams completed and documented (inspection, neurology and vascular exams) compared to eligible patients (excluding patients seeing specialists within the past year for foot exams).</td>
</tr>
<tr>
<td>4) 90% of patients will be educated about diabetic foot exams.</td>
<td>Measure the number of patients educated— who received handout.</td>
</tr>
<tr>
<td>5) Refer all patients with abnormal findings to specialists (podiatrist, vascular) as appropriate.</td>
<td>Measure the number of patients with a referral order placed to see specialists – review EMR records, and evaluate if appropriate.</td>
</tr>
<tr>
<td>6) Staff will evaluate the pathway.</td>
<td>Staff survey on feasibility and value-added of new pathway to diabetic care.</td>
</tr>
</tbody>
</table>
Appendix H

Clinical Quality Improvement Checklist

<table>
<thead>
<tr>
<th>Date: 03/31/2022</th>
<th>Project Leader: Peguy Sylvain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Title:</strong> Implementation of standardized diabetic foot care in primary care</td>
<td></td>
</tr>
<tr>
<td><strong>Institution where the project will be conducted:</strong> Steward Medical Group, primary care (Brockton MA)</td>
<td></td>
</tr>
</tbody>
</table>

**Instructions:** Answer YES or NO to each of the following statements about QI projects.

<table>
<thead>
<tr>
<th>Statement</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The specific aim is to improve the process or deliver of care with established/accepted practice standards, or to implement change according to mandates of the health facilities' Quality Improvement programs. There is no intention of using the data for research purposes.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>The project is <strong>NOT</strong> designed to answer a research question or test a hypothesis and is <strong>NOT</strong> intended to develop or contribute to generalizable knowledge.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>The project does <strong>NOT</strong> follow a research design (e.g. hypothesis testing or group comparison [randomization, control groups, prospective comparison groups, cross-sectional, case control]). The project does <strong>NOT</strong> follow a protocol that over-rides clinical decision-making.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>The project involves implementation of established and tested practice standards (evidence based practice) and/or systematic monitoring, assessment or evaluation of the organization to ensure that existing quality standards are being met. The project does <strong>NOT</strong> develop paradigms or untested methods or new untested standards.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>The project involves implementation or care practices and interventions that are consensus-based or evidence-based. The project does <strong>NOT</strong> seek to test an intervention that is beyond current science and experience.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>The project has been discussed with the QA/QI department where the project will be conducted and involves staff who are working at, or patients/clients/individuals who are seen at the facility where the project will be carried out.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>The project has <strong>NO</strong> funding from federal agencies or research-focused organizations, and is not receiving funding for implementation research.</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>The clinical practice unit (hospital, clinic, division, or care group) agrees that this is a QI project that will be implemented to improve the process or delivery of care.</td>
<td></td>
<td>X</td>
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<tr>
<td>The project leader/DNP student has discussed and reviewed the checklist with the project Course Faculty. The project leader/DNP student will <strong>NOT</strong> refer to the project as research in any written or oral presentations or publications.</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**ANSWER KEY:** If the answer to ALL of these questions is **YES**, the activity can be considered a Clinical Quality Improvement activity that does not meet the definition of human research. **UMB IRB review is not required. Keep a dated copy of the checklist in your files.** If the answer to ANY of these questions is **NO**, the project must be submitted to the IRB for review.
Appendix I

Meetings Minutes Template

Date: ______________________

Attendees (leadership/staff): ________________________________________
__________________________________________________________________
__________________________________________________________________

Not in attendance: _________________________________________________
__________________________________________________________________

Discussion about the pathway: _______________________________________
__________________________________________________________________
__________________________________________________________________

Consensus about the pathway: _______________________________________
__________________________________________________________________
__________________________________________________________________

Decisions taken: ____________________________________________________
__________________________________________________________________
__________________________________________________________________
Appendix J

Provider Survey

Anonymous surgery to collect impressions about the diabetic foot care pathway and assess if the pathway is optimally efficient and adds value to patient care.

1. How would you rate the time it takes to implement the new diabetic foot care pathway at the clinic?
   - Very sufficient
   - Sufficient
   - Neither sufficient nor insufficient
   - Insufficient.
   - Very insufficient

2. How would you rate your confidence to carry out the exam after completion of the project?
   - Very confident
   - confident
   - Neither confident nor diffident
   - diffident
   - Very diffident

3. How would you rate the new diabetes foot care pathway in terms of adding value to patient care?
   - Very positive
   - Positive
   - Neutral
   - Negative
   - Very negative

4. How likely would you recommend continuing the new diabetic foot care pathway now that the project is completed?
   - Very likely
   - likely
   - Neither likely nor unlikely
   - Unlikely
   - Very Unlikely

5. What improvements would you make to the new diabetic care pathway?

__________________________________________
__________________________________________
Appendix K

Staff Survey - Medical Assistants

Anonymous surgery to collect impressions about the diabetic foot care pathway and assess if the pathway is optimally efficient and adds value to patient care.

After implementing the diabetic foot care pathway,

1. I understand the need for regular diabetic foot exams:
   - Strongly agree
   - Agree
   - Neither agree nor disagree
   - Disagree
   - Strongly disagree

2. I feel more confident asking patients to participate in foot care.
   - Strongly agree
   - Agree
   - Neither agree nor disagree
   - Disagree
   - Strongly disagree

3. I feel more confident to educate patients about preventive foot care.
   - Strongly agree
   - Agree
   - Neither agree nor disagree
   - Disagree
   - Strongly disagree

4. What improvements would you make to the new diabetic care pathway?
Appendix L

Staff Survey- Medical Secretaries

Anonymous surgery to collect impressions about the diabetic foot care pathway and assess if the pathway is optimally efficient and adds value to patient care.

After implementing the diabetic foot care pathway,

1. I understand the need for regular diabetic foot exams:
   - Strongly agree
   - Agree
   - Neither agree nor disagree
   - Disagree
   - Strongly disagree

2. What improvements would you make to the new diabetic care pathway?
Appendix M

Worksheet – Flagged Patients

<table>
<thead>
<tr>
<th>Date</th>
<th>number of patients with DM2</th>
<th>Number of patients flagged</th>
</tr>
</thead>
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<td></td>
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</table>
Appendix N:

Data Collection Worksheet

<table>
<thead>
<tr>
<th>Patient ID</th>
<th>Patient #</th>
<th>Date</th>
<th>Last A1c</th>
<th>Age</th>
<th>Sex</th>
<th>Race</th>
<th>Ethnicity</th>
<th>Inspection</th>
<th>Neurology</th>
<th>Vascular</th>
<th>Total score</th>
<th>Education</th>
<th>Referral</th>
<th>Referral appropriate</th>
<th>WNL</th>
<th>(Y/N)</th>
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Total

Comments:

<table>
<thead>
<tr>
<th>Race</th>
<th>Ethnicity:</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian = 1</td>
<td>White = 4 Hispanic = 0</td>
</tr>
<tr>
<td>Native Hawaiian = 2</td>
<td>Asian = 5 non-Hispanic = 1</td>
</tr>
<tr>
<td>African American = 3</td>
<td></td>
</tr>
</tbody>
</table>
Appendix O

Patient Handout

Foot care for people with diabetes

People with diabetes have to take special care of their feet. You should have a comprehensive foot exam by your doctor at least every year. Have your feet examined during every visit. If you have problems with your feet, like loss of feeling, changes in the shape of your feet, or foot ulcers, this page shows some more things you can do on your own every day to keep your feet healthy.

Wash your feet in warm water every day. Test the water with your elbow to make sure that it is not too hot.

Dry your feet well, especially between the toes.

Keep the skin soft with a moisturizing lotion, but do not apply it between the toes.

Inspect your feet every day for cuts, sores, blisters, redness, calluses, or other problems. If you cannot see well, use a mirror or ask someone else to check your feet for you. Report any changes in your feet to you diabetes care team right away.

Ask your diabetes care team or your podiatrist (foot specialist) how you should care for your toenails. If you aren’t sure, have a pedicure, talk with your care team about whether it is safe for you.

To avoid blisters, always wear clean, soft socks that fit you. Do not wear socks or leave high stockings that are too tight below your knees.

Always wear shoes that fit well. Break them in slowly.

To avoid injuring your feet, never walk barefoot indoors or outdoors.

Before putting your shoes on, feel the inside for sharp edges, cracks, pebbles, nails, or anything that could hurt your feet. Let your diabetes care team know right away if you injure your feet.

For more information, visit Cornerstones4Care.com

Note: FootSmart, Inc. grants permission to reproduce this care for non-profit educational purposes only, in condition that the same is reproduced in its original format and that the company is given a stipend. Non-Rotable Inc. reserves the right to modify its participation at any time.
Appendix P

Exam Room Poster

Remove shoes and socks

If you have diabetes
Your provider will check your feet
Appendix Q

EMR Template

Diabetic Foot Exam

<table>
<thead>
<tr>
<th>Foot Exam:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
</tr>
<tr>
<td>Right Lower Extremity</td>
</tr>
<tr>
<td>thin</td>
</tr>
<tr>
<td>clinical signs of infection</td>
</tr>
<tr>
<td>Left Lower Extremity</td>
</tr>
<tr>
<td>thin</td>
</tr>
<tr>
<td>clinical signs of infection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diabetic Foot Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot Exam:</td>
</tr>
<tr>
<td>Right Foot</td>
</tr>
<tr>
<td>right foot was examined</td>
</tr>
<tr>
<td>no interdigital erythema</td>
</tr>
<tr>
<td>digital hair absent right</td>
</tr>
<tr>
<td>nail changes or disorders</td>
</tr>
<tr>
<td>Left Foot</td>
</tr>
<tr>
<td>left foot was examined</td>
</tr>
<tr>
<td>no interdigital erythema</td>
</tr>
<tr>
<td>digital hair absent left</td>
</tr>
<tr>
<td>amputated</td>
</tr>
</tbody>
</table>

Skin

### Sensation Right Foot

<table>
<thead>
<tr>
<th>sensation intact</th>
<th>normal monofilament wire test</th>
<th>normal sensation on the dorsum of the foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal protective sensation</td>
<td>no pain/temperature decrease on the lateral leg and dorsum of foot (L5)</td>
<td></td>
</tr>
<tr>
<td>no pain/temperature decrease on the dorsum of the foot</td>
<td>no pain/temperature decrease of the toes</td>
<td></td>
</tr>
<tr>
<td>no pain/temperature decrease on the sole of the foot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no tactile decrease on the lateral leg and dorsum of the foot (L5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no tactile decrease on the sole of the foot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no tactile decrease on the sole of the foot and posterior leg (S1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no vibration-perception threshold decrease</td>
<td>normal tuning fork test</td>
<td>ankle reflex intact</td>
</tr>
<tr>
<td>sensation diminished/absent</td>
<td>peripheral neuropathy</td>
<td>abnormal monofilament wire test</td>
</tr>
</tbody>
</table>

### Sensation Left Foot

<table>
<thead>
<tr>
<th>sensation intact</th>
<th>normal monofilament wire test</th>
<th>normal sensation on the dorsum of the foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal protective sensation</td>
<td>no pain/temperature decrease on the lateral leg and dorsum of foot (L5)</td>
<td></td>
</tr>
<tr>
<td>no pain/temperature decrease on the dorsum of the foot</td>
<td>no pain/temperature decrease of the toes</td>
<td></td>
</tr>
<tr>
<td>no pain/temperature decrease on the sole of the foot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no tactile decrease on the lateral leg and dorsum of the foot (L5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no tactile decrease on the sole of the foot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no tactile decrease on the sole of the foot and posterior leg (S1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no vibration-perception threshold decrease</td>
<td>normal tuning fork test</td>
<td>ankle reflex intact</td>
</tr>
<tr>
<td>sensation diminished/absent</td>
<td>peripheral neuropathy</td>
<td>abnormal monofilament wire test</td>
</tr>
</tbody>
</table>

Decreased sensation on the dorsum of the foot: loss of protective sensation

Pain/temperature decrease on the lateral leg and dorsum of foot (L5)

Tactile decrease on the lateral leg and dorsum of the foot (L5)

Tactile decrease on the sole of the foot

Tactile decrease on the sole of the foot and posterior leg (S1)

Vibration-perception threshold decrease

Tuning fork test indicates decreased sensation | ankle reflex absent or diminished
### Diabetic Foot Exam

#### Skin

#### Vascular:

<table>
<thead>
<tr>
<th>Right Pulses</th>
<th>Left Pulses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal dorsalis pedis pulse</td>
<td>Normal dorsalis pedis pulse</td>
</tr>
<tr>
<td>Normal posterior tibial pulse</td>
<td>Normal posterior tibial pulse</td>
</tr>
<tr>
<td>Diminished dorsalis pedis pulse</td>
<td>Diminished posterior tibial pulse</td>
</tr>
<tr>
<td>Absent dorsalis pedis pulse</td>
<td>Absent dorsalis pedis pulse</td>
</tr>
<tr>
<td>Diminished posterior tibial pulse</td>
<td>Absent posterior tibial pulse</td>
</tr>
<tr>
<td>Varicose veins</td>
<td>Varicose veins</td>
</tr>
</tbody>
</table>

#### Neurological: