

PREVENTION, RECOGNITION, AND APPROPRIATE REFERRAL OF DIABETIC FOOT  
ULCERS IN LONG-TERM CARE

By

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Prevention, Recognition, and Appropriate Referral of Diabetic Foot Ulcers in Long-Term Care

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## Abstract

Foot ulceration can lead to several health complications if left untreated, and many of these health complications are preventable with proper screening. Early recognition can prevent or delay the onset of adverse outcomes for patients. There are many different screening tools available. However, there is a lack of a systematic process and consistent training for staff nurses in a long-term care setting regarding diabetic foot assessment, leading to inadequate screening.

There were three aims of this project. The first aim was to determine the knowledge and practice needs of staff nurses in conducting diabetic foot ulcer assessment in a long-term care setting. The second aim was to develop and implement an effective education intervention for staff nurses to properly assess diabetic long-term care residents for diabetic foot ulcers. The third aim was to implement a valid and reliable diabetic foot ulcer assessment tool and assessment process for staff nurses in a long-term care setting.

This quality improvement project used a pre- and post-implementation design to assess diabetic foot ulcer prevention, recognition, and referral. An assessment form and an instructional tool were introduced during this project. This project took place at a large long-term care and rehabilitation facility in Overland Park, KS. The project occurred as part of diabetic foot assessment on residents' assigned bath day. The participants of the project included staff nurses working with diabetic patients in the facility. The data were collected using the Inlow's Simplified 60-Second Diabetic Screen. Descriptive statistics were calculated for all project variables. A paired t-test was used to assess the change in nurses' knowledge about diabetic foot ulcer assessment and a two-sample t-test was used to determine the change in the percentage of diabetic residents receiving a diabetic foot assessment.

Completion of the Pre- and Post-Test Knowledge Questionnaire demonstrated a significant increase in the mean percentage of correct answers (71.4% pre-test to 86.5% post-test). Pre-intervention, documentation of diabetic foot ulcer assessments was missing for 46.4% of residents and incomplete for 53.6%. After the intervention, 100% of the assessments were completed. The rate of diabetic foot assessment referrals significantly increased from 7.1% pre-intervention to 49.2% post-intervention.

This project improved nursing knowledge, assessment skills, documentation, and referral mechanisms for residents with diabetes. APRNs play an important role in providing education and raising nursing standards of care as they are well-positioned to be involved in quality improvement initiatives. The results of this project demonstrated improved nurses' assessment skills, proper documentation and referral process for residents with diabetes who are at risk for developing foot ulcer and its complications. Additionally, nurses' evaluation of the project yielded favorable feedback regarding future utilization and ease of use of the Simplified 60-Second Diabetic Foot Screen. Hence, this quality improvement project has met its objectives and has demonstrated positive outcomes upon its completion.

### Acknowledgments

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## Prevention, Recognition, and Appropriate Referral of Diabetic Foot Ulcers in Long-Term Care

Diabetic foot ulceration is a preventable problem. Foot ulceration can lead to several health complications, including limb amputation, if left untreated (Turns, 2011). Diabetes affects 22.3 million people in the U.S., and the annual cost of the disease was \$245 billion in 2012 (Baba, Lazzarini, & Van Netten, 2017). In addition to financial burden of a diabetic foot ulcer, untreated foot problems can trigger depression, limit independence, and reduce quality of life of older adults in long-term care settings. The prevalence of diabetes is continuing to rise in the U.S. (Baba, Lazzarini, & Van Netten, 2017). Therefore, it is essential to provide nurses with the training they need to prevent complications associated with the disease. Research shows that preventative care of foot problems can be particularly challenging in the long-term care population (Cook, Pandya, & Tewary, 2014). Staff nurses are well positioned to conduct routine foot examinations, thus helping to prevent foot complications and lower-extremity amputations (Cook, Pandya, & Tewary, 2014).

Multiple consequences of poor glycemic control, such as neuropathy, skin changes, infections, and poor circulation can result in a foot ulcer. Other risk factors may contribute to the development of foot ulcers, including deformities, trauma, previous foot ulcers, and calluses (American Diabetes Association, 2014). Diabetic foot disease is a result of three main pathologies, which can occur singly or in combination: peripheral neuropathy, peripheral arterial disease (PAD), and infection. Consequences of these pathologies include: ulceration, Charcot foot, painful neuropathy, gangrene, and amputation (Turns, 2011).



Diabetic foot ulcers affect 1% to 4.1% of patients with diabetes per year. Research by Al-Attar et al. (2011) indicates that the prevalence of diabetic foot ulcers is 4%-10%, with up to a 25% lifetime incidence. Nearly 70% of all major amputations in the U.S. are performed on patients with diabetes (Al-Attar et al., 2011). Overall, 3.3 to 11 per 1,000 patients with diabetes have had some type of lower extremity amputation (Al-Attar et al., 2011). These statistics emphasize the importance of establishing a diabetic foot assessment protocol to prevent the costly and devastating results of foot ulcers.

### **Purpose**

The purpose of this Doctor of Nursing Practice (DNP) project was to determine whether an education intervention and implementation of an evidence-based assessment tool increase the percentage of long-term care residents with diabetes who were assessed for diabetic foot ulcers by staff nurses, compared to current practices. Preventive foot care assessments for patients with diabetes are very important. According to the American Diabetes Association (2014), patients with diabetes and foot ulcers are at risk for hospitalizations, lower extremity infections, and amputations. The incidences of diabetic foot ulcers have increased nurses' and other health care providers' responsibility for early detection of changes in foot sensation and foot care (Modic, Vanderbilt, Sauvey, Kaser & Yager, 2013). Overall, research indicates that there is an urgent need to improve the design and conduct of diabetic foot screenings in the long-term care setting (Jeffcoate, Vileikyte, Armstrong, & Boulton, 2018). Therefore, nurses need to be aware of foot care standards and would benefit from an instructional, assessment, documentation, and decision-making tool to use in diabetic foot care.

### **Statement of the Problem**

Rather than a podiatrist, a staff nurse is usually patients' first point of contact. Currently, there is a lack of a systematic process and consistent training for staff nurses in long-term care facilities regarding diabetic foot assessment. This can lead to poor screening to identify residents at risk of complications, lack of treatment and appropriate referral when needed (Lakha & Lee, 2018). Assessment of foot problems and follow-up treatment is inconsistently documented in patient charts, which can pose a significant risk of future foot problems in diabetic residents. Additionally, there is a lack of protocol in place for systematic foot assessment on any specific day/time allowing for regular monitoring of current or potentially developing diabetic foot problems. This is a problem because there is a lack of structure and a lack of adoption of a single foot assessment tool, which can lead to patients receiving poor screenings and inadequate care.

Diabetic foot ulcers place a huge financial burden on both public and private payers, ranging from \$9-13 billion (Birnbaum et al., 2014). In 2001, the U.S. healthcare system recorded a \$10.9 billion expenditure towards diabetic foot care management and treatment (Ahmad, 2018). In addition to the direct expenditure towards foot ulcers, there are also indirect expenditures that can contribute to loss of productivity, family costs, family status, and loss of quality of life (Ahmad, 2018). There are also costs associated with increased mortality and morbidity that occur due to foot ulcers.

### **Project Organization**

The quality improvement project utilized one-group pretest-posttest design. A convenience sampling method was used. The sample included nursing staff consisting of RNs and LPNs. Exclusion criteria for nurses were those that did not work in the capacity of direct

patient care, such as nurse managers. In addition, a convenience sampling method was used to identify charts for review. Inclusion criteria for chart reviews included residents 65 and older with a diagnosis of diabetes.

### **Literature Review**

A literature review was conducted utilizing an integrative approach with key words contained within the PICO question. The key words were: *LTC setting, diabetic foot care program, nurses' foot care knowledge, diabetes education in LTC and podiatry referrals*. Searches were conducted utilizing Boolean and combination phrasing. All searches included only the English language and use of human studies. The electronic databases searched included: ProQuest, Cumulative Index of Nursing and Allied Health Literature (CINAHL), PubMed, Medline, and EBSCO. The search included the use of foot care knowledge assessment and skills assessment tools.

### **Improving Nurses' Knowledge and Assessment**

The review of the literature revealed areas of concern for nurses and patients regarding diabetic foot management with emphasis on preventive care. The studies revealed that interventions could contribute to improved skill sets, knowledge, and lead to positive diabetic foot care outcomes. These studies provide evidence of improved nursing diabetes foot care knowledge with the implementation of diabetes-focused educational program.

Diabetic foot disease can be a complication of diabetes and is associated with major side effects, which include decreased quality of life, increased mortality and morbidity, and increased

costs (Baba, Lazzarini, & Van Netten, 2017). However, research indicates that nurses are not properly trained to conduct diabetic foot assessments. According to Lakha and Lee (2018), “diabetic foot assessments are increasingly provided by practice nurses, yet a survey shows that nurses receive little training in how to do these assessments” (p. 36). In a recent research study, 66% of nurses did not receive training in diabetic foot care, 80.9% did not educate patients with diabetic foot problems, and 77.5% did not perform foot examinations on diabetic foot patients (Karaca & Kaya, 2018). Education and hands-on training facilitated nurses’ involvement in diabetic foot care (Karaca & Kaya, 2018). In a comparable evidence-based study by Tewary, Pandya, and Cook, (2014), chart reviews and analysis of pre- and post-test scores indicated significant increase in diabetic foot knowledge for staff in long-term care facilities. Additionally, when chart audits were completed post-training, significant differences (30%) were found in documentation of foot problems with respect to skin checks, ulcers, history, accurate documentation of pedal pulses, and specialist referrals.

A study by Stolt, Routasalo, Suhonen, and Leino-Kilpi (2011) sought to determine whether a foot care educational program would improve nursing staff foot care knowledge and their foot care activities. Interventions used in this study aimed to improve nurses’ foot care knowledge. The “Nursing Staff’s Knowledge and Foot Care Activities Questionnaire” was used along with lectures, foot exams, and discussions. The results revealed significant increase in nursing staff foot care knowledge from a mean score of 12 to a mean score of 13.36. Similarly, the purpose of the descriptive study by Modic et al. (2014) was to examine nurses’ comfort, familiarity, and knowledge of diabetes management principles. A paired t-test was used to examine differences in diabetes management knowledge before and after the Diabetes

Management Educational Program. The results revealed a significant increase in scores ( $t=90.59$ ;  $p < .001$ ) from pre-test ( $x=11$ ) to post-test ( $x=20$ ). This diabetes management intervention program included education, hand on demonstration and a quiz.

### **Diabetic Foot Assessment**

There are many important aspects of diabetic foot ulcer prevention. The primary preventative measures include patient education, life-style modification, and management of diabetes and other health conditions (such as high blood pressure and lipid management). Blood pressure control, lipid management, glycemic control, and smoking cessation are necessary to avoid diabetic complications, including diabetic foot ulcers (Askari, Ebnesahidi, Iraj, & Khorvash, 2013).

Once an ulcer has developed, there is an increased risk of wound progression, which may lead to amputation. In addition to neurological, circulatory, and radiological assessment, visual assessment and patient history must be determined by nurses. A visual assessment may include many different elements of the foot. Visual elements include: color, skin appearance, presence of callus, lesions, maceration between toes, hair growth, toenail thickness, range of motion, footwear examination, musculoskeletal examination, and foot deformity, among other possible assessments depending on the assessment tool used (Registered Nurses' Association of Ontario, 2013). Patient history should include history of vascular systems, such as edema, previous hospitalizations for vascular issues, and intermittent claudication. Nurses may also assess the pain level of the patient (Registered Nurses' Association of Ontario, 2013).

**Foot Assessment Tool: Simplified 60-second Diabetic Foot Screening Tool**

Research indicates that Inlow's 60-Second Diabetic Foot Screening Tool is effective at detecting high risk diabetic feet (Lowe, Ostrow, Persaud, Sibbald, & Woodbury, 2015).

Implementation of the tool has the potential to significantly decrease the incidence of disability and mortality of diabetes-related foot ulcers. Research also shows that Inlow's tool is effective in a multitude of settings, including the long-term care setting, and offers many benefits of foot screening in patients with diabetes (Girdharan, Parasuraman, & Vijayalakshmi, 2017).

Research shows that while Inlow's tool is an excellent tool to aid nurses in identifying patients at risk for ulcerations, it is not always the best option for long-term care settings. Inlow's tool was originally designed by family physicians in Canada to be used in private practice. Field observations demonstrated that the Inlow's 60-Second Screen required 7 minutes on average to complete, with a range of 2-21 minutes (Woodbury et. al., 2015). The Simplified 60-Second Diabetic Foot Screening Tool was designed by one of the authors of Inlow's 60-Second Diabetic Foot Screening Tool to minimize assessment time in clinical care settings. Comparison of the original tool with the simplified tool shows equal validity and inter-rater reliability while being able to complete the exam in 60-second time frame (Woodbury et. al., 2015). This tool is validated and pilot tested with intra-rate reliability value of 0.60,  $\alpha$ -level of 0.05, and  $\beta$ -level of 0.20 for 18 test participants and total of 216 examinations. Cronbach's alpha was utilized as a measure of consistency among the assessors (Woodbury et. al., 2015). According to Woodbury et. al., the high inter-rater reliability of the tool demonstrates it to be a reliable tool to be used in clinical practice. The Simplified 60-Second Diabetic Screening Tool "is user friendly and time

efficient, facilitating adoption in routine clinical practice in all settings” (Woodbury et. al., 2015, p. 12).

There are five components in the Simplified 60-Second Diabetic Foot Screening Tool (see Appendix A). The first step is to complete a resident’s history of previous ulcer or amputation. Then the physical exam is completed to look for deformity, ingrown toenails and absent pedal pulses. The third step is to check for lesions, such as, active ulcer, blisters, calluses, and fissures. Assessment for neuropathy follows and includes monofilament assessment. Upon completion of the assessment tool, a treatment plan and referral are made, if necessary. One or more “Yes” responses result in a positive screen and subsequent referral to the long-term care facility’s leadership for prevention; treatment and follow up are recommended.

### **Project Aims and Questions**

The project question guiding this project was: Can an education intervention and implementation of an evidence-based assessment tool increase the percentage of long-term care residents with diabetes who are effectively assessed for diabetic foot ulcers by staff nurses, compared to current practices? There were three project aims to be accomplished with this project:

**Specific Aim 1)** to determine the knowledge and practice needs of staff nurses in conducting diabetic foot ulcer assessments in a long-term care setting,

**Question A)** What are the knowledge gaps of staff nurses in assessing for diabetic foot ulcers among long-term care residents with diabetes?

**Specific Aim 2)** to implement an effective educational intervention for staff nurses to educate on proper assessment of diabetic long-term care residents for diabetic foot ulcers,

**Question B)** What is the average pre- to post-test increase in knowledge change among staff nurses after the implementation of an evidence-based education presentation about the assessment of diabetic patients for diabetic foot ulcers?

**Specific Aim 3)** to implement a valid and reliable diabetic foot ulcer assessment tool and assessment process for staff nurses in a long-term care setting,

**Question C)** What is the pre-project percentage of diabetic long-term care residents who had received a diabetic foot ulcer assessment consistently on a weekly basis?

**Question D)** What is the post-project change in long-term care residents who received a diabetic foot ulcer assessment on a weekly basis?

**Question E)** What are the facilitators, barriers, and unanticipated issues faced by staff nurses in using diabetic foot ulcer assessment tool in a long-term care setting?



## Theoretical Framework

The theoretical framework that guided this quality improvement project was the plan-do-study-act (PDSA) cycle. This framework lays out the steps necessary for testing a change. This framework consists of four steps (see Figure 1). Step one is to plan, in which the intervention is planned and a plan is developed for collecting data. Step two is to do, in which the test of change is tried on a small scale. Step three is to study, in which time is set aside to analyze the data and study the results. Step four is to act, in which the change is refined, based on what was learned from the test (Agency for Healthcare Research and Quality, 2013). Overall, “plan” explains

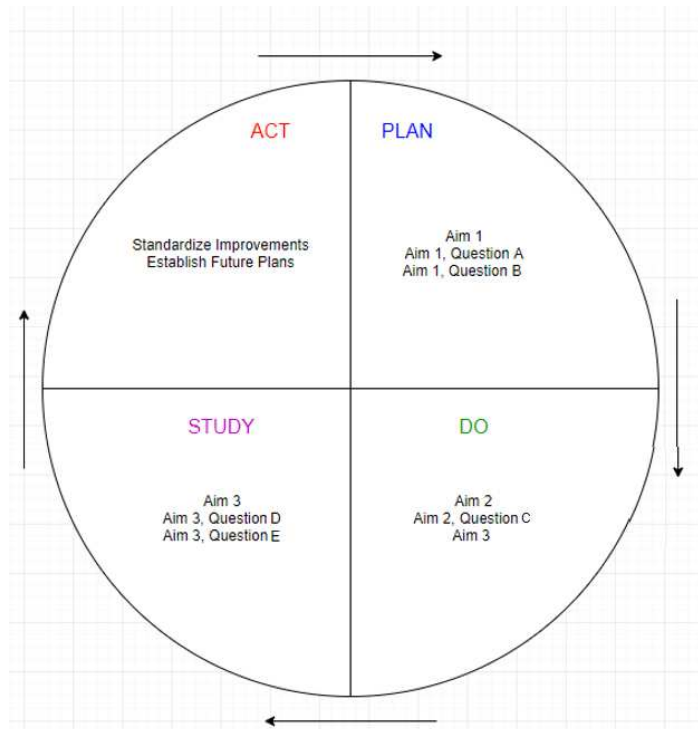


Figure 1

what is going to be done, “do” explains when and how it is done, “study” explains what the results are, and “act” explains the changes to be made based on the findings (Centers for Medicare & Medicaid Services, 2018).

The planning phase consisted of the development of an assessment tool to perform diabetic foot assessment and the introduction of an instructional tool for nurses. The measures to be used were created, including outcomes, processes, and balance. The doing phase consisted of the Simplified 60-Second Diabetic Screening Tool implemented during a one-month period to

determine its effectiveness. The study phase consisted of data analysis, which will occur after the intervention has been conducted. The acting phase consisted of recommendations for changes to the healthcare facility.

### **Definitions**

A long-term care nurse (RN and LPN) is a nursing professional that is dedicated to caring for patients who need extended care. This includes patients with severe illnesses, injuries, and other disabilities.

A diabetic foot ulcer is a red sore that most commonly occurs on the ball of the foot or the bottom of the big toe (Kim, 2016). A diabetic foot assessment is a physical examination of the foot based on assessment of the skin and the vascular, neurological, and musculoskeletal systems (Alexiadou & Doupis, 2012).

### **Methods**

#### **Design**

A post-intervention design was used. Residents with diabetes were asked to participate in the project prior to completing informed consent (see Appendix B). For those residents who were not able to give his/her consent, resident's Durable Power of Attorney or responsible party was to be informed about the purpose and details of the project and asked to complete the written consent on the resident's behalf.

The project began with a staff meeting. During the meeting, each of the volunteer participating nurses completed the written consent (see Appendix C).

The next step consisted of collecting baseline data related to nurses' knowledge and interventions related to diabetic foot care using Pre-test Knowledge Questionnaire. After the

knowledge pre-test, the project involved the presentation on diabetic foot assessment and the use of the Simplified 60-Second Diabetic Foot Screening Tool to staff nurses. Monofilaments and written instructions were used in the demonstration of the assessment and documentation of neuropathy. “Using the Monofilament” handout (see Appendix D) was created by this project manager based on *Appendix K: Use of Semmes-Weinstein Monofilament*, (Registered Nurses’ Association of Ontario, 2013).

Baseline assessment data were collected to determine the impact of the intervention on the screening and referral rates. The Simplified 60-Second Diabetic Foot Screen tool was then implemented to be used as part of the foot assessment on residents’ designated bath day weekly. One month after implementation of the diabetic foot assessment tool, the charts of diabetic patients were reviewed to determine the post-intervention rate of diabetic foot assessment. Clinical documentation and referral outcomes were measured for all patients with diabetes through methodical review of patients’ charts before and after foot education training. The Post-test Knowledge Questionnaire was used to measure nurse knowledge change upon completion of the project. Nurses were then given a survey to provide feedback about their perceptions of using the Simplified 60-Second Diabetic Foot Screen tool. The findings were documented in the patient's record according to a comprehensive diabetic foot exam and data were collected and reviewed at that time.

### **Setting and Sample**

This project took place at Delmar Gardens of Overland Park, a large long-term care nursing and rehabilitation center in a suburb of Kansas City, KS (Appendix E). The target population included registered nurses (RNs) and licensed practical nurses (LPNs) who were

employed by the long-term care facility. Twenty-five staff nurses working at the facility and 40 diabetic residents in the facility were invited to participate. Following the educational intervention, the nurses participating in the project performed foot assessments on diabetic patients on their designated bath days weekly for one month.

### **Data Collection**

Pre- and Post-Test Knowledge Questionnaires (see Appendix F and G) were developed by the project manager based on *Table 4: Nurses' Knowledge Level Form on Diabetic Foot Management* (Karaca & Kaya, 2018). For Project Aim 1, Question A (What are the knowledge gaps of staff nurses in assessing for diabetic foot ulcers among long-term care residents with diabetes?) nurses were given a paper questionnaire (Appendix F) with questions to assess their knowledge of diabetic foot ulcer assessment. For Project Aim 1, Question B (What is the pre-project percentage of diabetic long-term care residents who had received a diabetic foot ulcer assessment consistently on a weekly basis?), 28 charts of diabetic residents were reviewed using a data collection tool for the one month prior to implementation of the Simplified 60-Second Diabetic Foot Screen (Appendix A). To collect data to address Aim 2, Question C (What is the average post-test knowledge change among staff nurses after the implementation of an evidence-based education presentation about the assessment of diabetic patients for diabetic foot ulcers?), staff nurses were given a post-education paper questionnaire (Appendix G). For Project Aim 3, Question D (What is the post-project change in long-term care residents who received a diabetic foot ulcer assessment on a weekly basis?), one month of charts were reviewed post-implementation using a data collection tool. Data collection forms were created by the project

manager (see Appendix H). Lastly, data for Project Aim 3, Question E (What are the facilitators, barriers, and unanticipated issues faced by staff nurses in using diabetic foot ulcer assessment tool in a long-term care setting?) were collected using a questionnaire to obtain nurses' opinions about the intervention (Appendix I).

Assessment data were collected using the Simplified 60-Second Diabetic Foot Screen. This tool was modified by the project manager based on the *Simplified 60-Second Screen for the High-Risk Diabetic Foot 2012* (Woodbury et. al., 2015) (see Appendix A). Nurses marked "Yes" or "No" on the form and made a referral if necessary. This form was modified to fit the facility's referral procedures. There are ten items on the assessment. The key variables measured included visual, touch, and sensation. Visual assessment included analysis of the skin, nails, and presence of deformity. Assessment of sensation was analyzed through monofilament examination. Nurses conducted the assessment and completed the assessment tool during routine foot examinations on diabetic residents' assigned bath days.

## **Evaluation**

The evaluation plan was closely related to the project aims and questions. Descriptive statistics were calculated for the project variables, including items on the pre- and post-tests of nurses' diabetic foot ulcer knowledge, pre- and post-intervention diabetic foot ulcer assessment items obtained through chart review, and the items on the post-implementation questionnaire of nurses' opinions of the Simplified 60-Second Diabetic Foot Screen intervention. To determine the increase in nurses' knowledge before and after the education, paired t-tests were used on the items of the pre- and post-education questionnaires. Nurses were asked to provide a self-created four-digit number (i.e. last 4 digits of their phone number) so that the questionnaires can be

matched yet remain anonymous. One-sample *Z*-test of proportions was used to evaluate the change in the percentage of diabetic residents receiving a diabetic foot assessment from pre-intervention to post-intervention based on chart review.

### **Human Subject Protection**

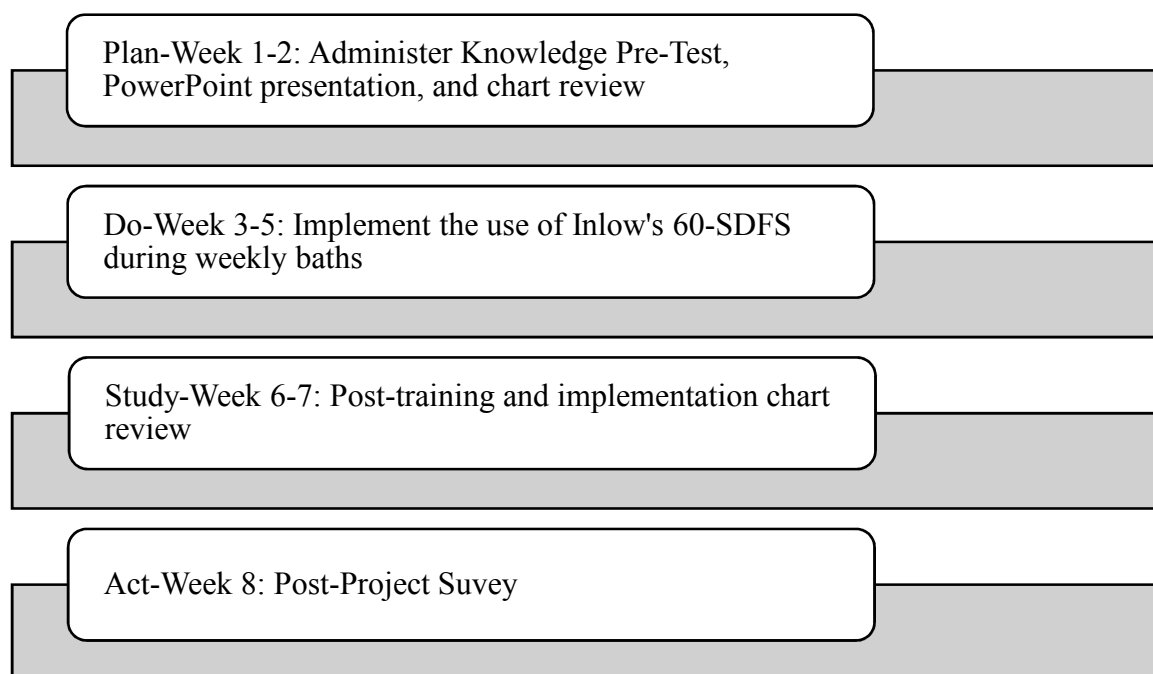
The privacy of the project participants was protected. This initiative was approved as a quality improvement project by the Institutional Review Board at the University of Kansas Medical Center. The project commenced after approval and consents from nurses and residents were received. If the resident was not able to consent, a responsible party was asked for consent. All the nurses at this long-term care facility were invited to participate in this project. No identifiable or sensitive information was collected or recorded. In addition, there was no direct interaction between the project director and patients. Project and data collection forms were placed and stored in a secure location in a locked medication room.

### **Timeline**

The project implementation phase commenced in January 2019 (see Figure 1). During the first two weeks of January, charts from the month of December 2018 were reviewed to collect pre-intervention data and obtain a baseline percentage of residents with diabetes who received a foot assessment. The pre-test of nursing knowledge of diabetic foot assessments, education presentations, and post-tests of knowledge were conducted during the third and fourth weeks of January. The 60-Second Diabetic Foot Screen was used in practice throughout the month of February. The post-implementation chart review of diabetic foot ulcer assessment prevalence was collected in March 2019, along with distributing the post-implementation

questionnaire of nurses' opinions of the diabetic foot assessment tool. Data analysis occurred in April 2019 and the findings will be disseminated in May 2019.

Figure 1: Timeline



## Results

### Demographics

The nursing staff consisted of LPNs and RNs. The nurses' years of experience ranged from 2 to 20 years. Twenty-five staff nurses were invited to participate in the project and 18 consented, representing 72% of the nursing staff. Ten (10) nurses were LPNs and 8 nurses were registered nurses. Four of the registered nurses had BSN degrees.

Twenty-eight (70%) residents with diabetes signed their consent to participate in the project. Two (2) out of 28 residents had a diagnosis of dementia and were not able to sign the consent. Therefore, their respective DPOA was contacted and signed the consent on residents' behalf. The residents' age ranged from 66 to 92 years old, 20 females and 8 males. The average age of the residents was 81.41 years old.

### **Diabetic Foot Ulcer Screening Knowledge**

Eighteen nurses returned the Pre-Test Knowledge Questionnaire and the Post-Test Knowledge Questionnaire. The Pre-Test Knowledge Questionnaire was administered prior to the education, practice intervention (Simplified 60-Second Diabetic Foot Screen). The Post-Test Knowledge Questionnaire was completed 1 month after the intervention. The mean Pre-test percentage correct was 71.4% (SD 0.13, range 42.9%-100%) and the mean Post-test percentage correct was 86.5% (SD 0.12, range 57.1%-100%). Paired t-test showed a significant increase in the mean percentage correct from the pre-test to the post-test, ( $t(17) = -7.00$ ,  $p < 0.001$ ), however none of the individual items showed significant increases from pre- to the post-education.

Table 1

#### *Percentage Change in Nurse Pre- and Post-test Knowledge*

| Item  | Pre-test Number<br>(Percent)<br>Correct | Post-test Number<br>(Percent) Correct |
|---|---|---------------------------------------|
| A patient with a previous ulcer or amputation should receive the Simplified 60-Second Diabetic Foot Screen. | 11 (61.1%)                              | 14 (77.8%)                            |
| The patient's feet should be checked for deformity, ingrown toenail, and pedal pulses.                      | 16 (88.9%)                              | 18 (100%)                             |



|   |            |            |
|---|------------|------------|
| The skin fissure (cracking), thick calluses, injury, poorly fitting shoes, and poor nail cutting techniques are risk factors for diabetic ulceration. | 13 (72.2%) | 16 (88.9%) |
| Anti-Diabetic medication should be taken regularly to prevent complications.  | 11 (61.1%) | 16 (88.9%) |
| The active ulcer, blisters, calluses, and fissures are risk factors diabetic ulcerations  | 14 (77.8%) | 15 (83.3%) |
| Sensation testing requires testing how many sites on each foot?   | 14 (77.8%) | 16 (88.9%) |
| If the assessment comes back negative, how soon should the patient be re-tested?  | 11 (61.1%) | 14 (77.8%) |
| Overall**   | 71.4%      | 86.5%      |
| **p < 0.001   |            |            |

### Diabetic Foot Ulcer Screening

Twenty-eight diabetic patients' charts were audited for evidence of podiatry or wound care referrals prior to intervention and 28 charts were reviewed post intervention (Table 1). The pre-intervention chart audit found that five (17.9%) residents required a high-risk diabetic foot referral. Of those, two (7.1%) patients received a referral. The post-intervention chart audit revealed a significant increase in the number of residents ( $n = 15$ , 53.6%) identified for referrals ( $z = 2.42$ ,  $p = 0.01$ ). Twelve (42.9%) residents received a new referral. Consequently, the rate of diabetic foot assessment referrals went from 7.1% pre-intervention to 49.2% post-intervention ( $z = 3.07$ ,  $p = 0.002$ ). Before the intervention, diabetic foot ulcer assessments were not documented for 13 (46.4%) residents and incomplete for 15 (53.6%) residents. There were no complete diabetic foot ulcer assessments before the intervention. After the intervention, there were 28 (100%) complete diabetic foot ulcer assessments.

Table 2

*Percent of Diabetic Foot Ulcer Assessment Components Before and After Intervention*

|   | Before Intervention<br>n (%) | After Intervention<br>n (%) |
|---|------------------------------|-----------------------------|
| Residents who Warranted Referral*         | 5 (17.9%)                    | 15 (53.6%)                  |
| Residents who Received Referral*          | 2 (7.1%)                     | 12 (42.9%)                  |
| Complete Assessment*                      | 0 (0%)                       | 28 (100%)                   |
| History of Amputation                     | 0 (0.0%)                     | 0 (0.0%)                    |
| History of Foot Ulcer                     | 6 (21.4%)                    | 12 (42.9%)                  |
| Swelling or deformity*                    | 5 (17.9%)                    | 12 (42.9%)                  |
| Ingrown toenails                          | 4 (14.3%)                    | 7 (25.0%)                   |
| Loss of Sensation - Monofilament Testing* | 0 (0.0%)                     | 10 (35.7%)                  |
| Pedal Pulses Present*                     | 1 (3.6%)                     | 25 (89.3%)                  |

\* p&lt;0.05

**Facilitators, Barriers, and Issues in Diabetic Foot Ulcer Screening**

An Opinion Survey was used to evaluate the program (Table 3). There were 18 evaluation forms (100% response rate) returned. The responses were positive with all item responses ranging between 2-Agree and 1-Strongly Agree. Staff buy-in and active engagement was initially an issue. Re-dissemination of the assessment tool and staff reminders were needed initially. However, the results of the program evaluations suggested that nurses perceived the implementation of the foot care protocol as a positive move towards improving nursing knowledge and referral protocols.

Table 3

*Nurse Opinion Survey of Diabetic Foot Ulcer Assessment and Referral Intervention*

| Item   | Min. Score | Max. Score | Mean | SD   |
|--|------------|------------|------|------|
| The Simplified 60-Second Diabetic Foot Screen is very easy to use in practice.   | 1          | 2          | 1.39 | 0.50 |
| The form was easily accessible to me for examination.  | 1          | 2          | 1.67 | 0.49 |
| The residents seemed to be cooperative during the examination.   | 1          | 2          | 1.67 | 0.49 |
| The information collected from the Simplified 60-Second Diabetic Foot Screen was valuable to the prevention of diabetic foot ulcers in your residents. | 1          | 2          | 1.83 | 0.38 |

| Item  | Yes<br>n (%) | No<br>n (%) |
|---|--------------|-------------|
| Will you continue to use the Simplified 60-Second Diabetic Foot Screen in your role?                                | 14 (77.8%)   | 4 (22.2%)   |
| Did you notice any time constraints or challenges when conducting this assessment?                                  | 3 (16.7%)    | 15 (83.3%)  |
| Did you feel that the Simplified 60- Second Diabetic Foot screen is an effective tool for diabetic foot assessment? | 18 (100.0%)  | 0 (0.00%)   |
| Did you feel this quality improvement chart was helpful in improving diabetic foot ulcer assessment?                | 18 (100.0%)  | 0 (0.00%)   |

**Discussion**

Overall, this quality improvement project resulted in improvement in nurse knowledge of diabetic foot ulcer screening, along with improvement in foot screening practice and referral.

The chart audits focused on the relationship of improved referral rates with the use of the implementation of the Simplified 60-Second Diabetic Foot Screen. Results of the Post-test Knowledge Questionnaire were reviewed and revealed improved nurses' diabetic foot care knowledge as evidenced by statistically significant results in the Post-Knowledge Questionnaire

scores after the implementation of the screening tool. Also, the chart audit results revealed an increase in the number of referral rates after the implementation of the intervention. As a result of the education and implementation of the evidence-based screening tool, these findings reflected an improvement in the appropriate and timely referrals. Before the implementation process, only two of the residents were referred by nursing staff to be seen by a podiatrist or a wound care nurse. After the implementation of an EBP protocol, 15 residents had received new referrals.

This project was formed due to the results of the facility needs assessment that revealed a lack of a systematic foot care referrals. This issue stems from the fact that nurses are not properly trained to conduct diabetic foot assessments, according to research (Lakha & Lee, 2018). Evidence-based studies found that education and training of nurses in long-term care facilities significantly increased documentation of foot problems and hands-on foot examinations of patients with diabetes (Tewary, Pandya, & Cook, 2014) This DNP project took this a step further by implementing a referral process whereby nurses were expected to objectively score a resident's diabetic foot status and make a timely referral based on that resident's needs. According to studies, a foot education program is an important component of nurses' preparation in performing proper assessments (Stolt, Routasalo, Suhonen, & Leino-Kilpi, 2011). The foot care educational program improved nursing staff foot care knowledge and their foot care activities. In this project, diabetic foot education also served as a motivator for the nurses prior to starting the "doing" phase; for example, upon re-dissemination of educational materials, nurses were more receptive to change and apt to be engaged in this project.

One of the strengths of this project was the use of an evidence-based screening tool at the point of care. There were several limitations related to this quality improvement project. This quality improvement project was restricted to a single facility in Overland Park, KS; therefore, this project could not be generalized to other populations. Additionally, there were limitations related to the sample size and the motivation of the staff to participate. Regarding sample size, a larger number of participants would have enhanced validity of the results. Nurses were reluctant to introduce another care component that would also require additional documentation that they may have perceived as extraneous. However, after implementation, nurses' perceptions of the practice change were very positive. Another limitation may have been due to the scope of the project. The incorporation of a protocol for routine diabetic foot assessment and referral would have been more seamless had the nurses not been as resistant to change and added responsibility. On the other hand, the administration and residents were very supportive of this project. Overall, despite the limitations, this project still deemed meaningful results that could be translated into practice.

As this project demonstrated, the incorporation of a diabetic foot screening tool could improve nursing knowledge, assessment skills, documentation, and referral mechanisms for residents with diabetes. More emphasis placed on the daily management of diabetic foot care by the nursing staff should raise an awareness of residents and their families of the importance of regular screening. Additionally, utilizing this screening tool in the residents' foot assessment reduced the duration of the exam while increasing cooperation and comfort level, thereby enhancing their quality of care.

The referral report to the Director of Nursing who serves as a liaison between the nursing staff and foot care specialists (i.e. podiatrist and/or wound care nurse) is an important step toward verification and implementation of necessary follow up. Ultimately, the facility should benefit through the reduction of diabetic foot ulcers and related complications. One of the suggestions for improving this project and its sustainability for the facility is to include diabetes foot care education for all new employees during orientation. The education will include discussion and hands-on assessment skills seminars using the foot models, monofilaments, skin assessment and diabetic foot care. Another suggestion to improve project sustainability is to continue with the development process to have all patients diagnosed with diabetes be referred based on a referral protocol in place at the facility. The Director of Nursing will receive all potential referrals on a daily communication form and relay them to the attending physician who will then write orders for the referrals. These practices will remain ongoing. Continued use of the Simplified 60-Second Diabetic Foot Screen will remain under review by the facility's corporate representatives.

The APRNs play a critical role in providing education and implementation of nursing standards of care. APRNs can impact the development of EBP in a long-term facility including the education, documentation, procedural processes and protocols for care management including referrals. This DNP project's findings provided a clinician perspective relative to the successful integration, application and implementation of a structured foot care program. The results demonstrated the use of an intervention that improved clinical skillsets of nurses in this facility. Consequently, evidence-based documentation of a diabetic foot assessment was facilitated. The decision-making tool directed the actions for systematic referrals. This quality

improvement project proved to be a catalyst in the initiative for the early prevention, detection and appropriate timely referral of diabetic foot ulcers.

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## Appendix A

### Simplified 60-Second Screen for the High-Risk Diabetic Foot

ID: \_\_\_\_\_

Facility: \_\_\_\_\_

Gender: Male or Female (circle)

Years with diabetes: \_\_\_\_\_

Date of exam (dd/mm/yy): \_\_\_/\_\_\_/\_\_\_

|   | Left Foot-<br>Yes or No | Right Foot-<br>Yes or No | Unable to<br>Respond |
|---|-------------------------|--------------------------|----------------------|
| Previous Ulcer  |                         |                          |                      |
| Deformity   |                         |                          |                      |
| Ingrown Toenail   |                         |                          |                      |
| Absent Pedal<br>Pulses  |                         |                          |                      |
| Active Ulcer  |                         |                          |                      |
| Blister   |                         |                          |                      |
| Calluses  |                         |                          |                      |
| Fissure   |                         |                          |                      |
| Monofilament<br>Exam (record<br>negative<br>responses, 4<br>negatives/10=<br>yes) |                         |                          |                      |

**Plan:**

**Positive Screen:** Results when there are more than 1 “yes”. Refer to the Director of Nursing for follow-up. (Bone deformity, active ulcer, and absent pulse are most urgent.)

**Negative screen:** Results when there are all “no” responses. No referral needed. Educate patient to report any changes to their healthcare provider.

## **Appendix B**

### **Resident Consent Form**

I volunteer to participate in a Quality Improvement (QI) project conducted by Maya Dolnik, RN, BSN, a student in a doctoral program at the University of Kansas School of Nursing. I understand that the project is designed to gather information about foot ulcer risk in long-term care residents with diabetes. I will be one of approximately 40 people with diabetes who will be asked to participate.

1. My participation in this project is voluntary. I understand that I will not be paid for my participation. I may withdraw and discontinue participation at any time without penalty. If I decline to participate or withdraw from the study, no one in the facility will be told.

2. I understand foot exams will be involve visual and tactile examination and will include sensory testing using monofilament. If, however, I feel uncomfortable in any way during the exam, I have the right to decline to answer any question or to end the interview.

3. Participation involves having my feet examined by staff nurses (RNs, and LPNs) at Delmar Gardens of Overland Park on my bath days weekly. The exam will last approximately 60 seconds. Notes will be written during the interview.

4. I understand that the researcher will not identify me by name in any reports using information obtained from this exam, and that my confidentiality as a participant in this study will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals and institutions.

5. Faculty and administrators from my facility will neither be present at the exam nor have access to raw notes or transcripts. This precaution will prevent my individual comments from having any negative repercussions.

6. I understand that this research will be reviewed and approved by the Institutional Review Board (IRB) for Studies Involving Human Subjects: Behavioral Sciences Committee at the Century University. For research problems or questions regarding subjects, the Institutional Review Board may be contacted through [information of the contact person at IRB office of Century University].

7. I have read and understand the explanation provided to me. I have had all my questions answered to my satisfaction, and I voluntarily agree to participate in this study. 8. I have been given a copy of this consent form. \_\_\_\_\_

\_\_\_\_\_ My Signature Date \_\_\_\_\_

\_\_\_\_\_ My Printed Name Signature of the Investigator

For further information, please contact: Maya Dolnik, RN, BSN

## Appendix C

### Nurse Consent Form

I, \_\_\_\_\_, have been asked to participate in a quality improvement (QI) program at Delmar Gardens of Overland Park. Maya Dolnik, who is conducting this project to fulfill the requirements for a doctoral program in Nursing at the University of Kansas School of Nursing, has explained the study to me and answered my questions satisfactorily.

The purpose of this program is to improve prevention, recognition and referral of diabetic foot ulcers by Registered Nurses (RNs) and Licensed Practical Nurses (LPNs) caring for the *diabetic residents while improving the diabetic foot care outcomes for the residents in long-term care.*

The objectives are: 1) to determine the knowledge and practice needs of staff nurses in conducting diabetic foot ulcer assessments in a long-term care setting, 2) to introduce and implement an effective educational intervention for staff nurses to educate on proper assessment of diabetic long-term care residents for diabetic foot ulcers, and 3) to implement a valid and reliable diabetic foot ulcer assessment tool and assessment process for staff nurses in a long-term care setting.

All volunteer long-term care licensed nursing staff will receive a tutorial on diabetic foot assessment and care, and will be asked to participate in short pre- and post-assessment questionnaires. In addition to questionnaires, volunteer nursing staff will be asked to use a hands-on assessment tool, “Simplified 60-Second Screen for the High-Risk Diabetic Foot” as an assessment tool on diabetic residents’ bath days weekly for one month.

I understand that any information obtained as a result of my participation in this project will be kept as confidential as legally possible. Participation in this study is voluntary. I understand that I may withdraw from this study at any time. I have been given the opportunity to ask questions about this project, and I have received answers concerning areas I did not understand. Upon signing this form, I will receive a copy.

I willingly consent to my participation in this study.

---

Signature of Participant

---

Date

---

Signature of Investigator

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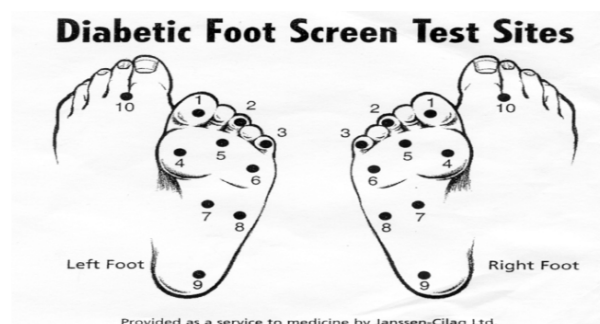
Date

## Appendix D

### Using the Monofilament

The examination should be done in a quiet and relaxed setting and the patient should not be able to see if and where the examiner applies the filament.

- First apply the monofilament on the inner wrist so the patient knows what to expect. This also serves to 'warm' the monofilament up.
- Apply sufficient force to cause the filament to bend or buckle (see diagram below about 1 cm).
- The total duration of the approach, skin contact, and departure of the filament should be approximately 2 seconds.
- Apply the filament along the perimeter and NOT ON an ulcer site, callus, scar or necrotic tissue. Do not allow the filament to slide across the skin or make repetitive contact at the test site.
- Press the filament to the skin such that it buckles at one of two times as you say "time one" or "time two." Have patients identify at which time they were touched. Randomize the sequence of applying the filament throughout the examination. The site can be repeated to ensure accuracy.
- The 10 sites to be tested are shown below:







November 20, 2018

Memoranda of Agreement

Delmar Gardens of Overland Park agrees to allow Maya Dolnik, RN, BSN, to conduct a Quality Improvement Project at this location, pending approval of IRB. This organization understands the Quality Improvement project is implementing an evidence-based assessment tool to promote prevention, recognition, and appropriate referral of foot ulcers in diabetic Residents. Maya will be allowed to disseminate educational material and surveys to staff pre- and post- implementation of foot assessments by nursing staff.

This intervention will span over approximately two months, and require a brief education session for the nursing staff. Although Resident contact will be primarily through the nursing staff, and not the researcher, written consent will be needed to be obtained by the Researcher, from both nursing staff and Residents and/or responsible party of those participating in the Quality Improvement Project.

Comparisons will be made using retrospective analysis of assessment tool use and compliance prior to initiation of the intervention, and then again at one month and two months after the start of the intervention. Results will be provided to the facility. Any referrals made as a result of this project will be handled by Bree Richard, DON.

A solid black rectangular box redacting the signature of the Director of Nursing.

Director of Nursing

### Appendix F

| <b><u>Pre-Test Knowledge Questionnaire</u></b>  |            |            |            |
|---|------------|------------|------------|
| Please provide your 4-digit study number here. Please remember this number and use on all study forms.<br>Study #: _____  |            |            |            |
| <b>The purpose of this questionnaire is to evaluate the base knowledge of diabetic foot ulcers among staff nurses. The responses from this survey will be anonymous and your participation is voluntary. Thank you.</b> |            |            |            |
| Are you an RN or LPN?   |            |            |            |
| How many years of long-term nursing care experience do you have?  |            |            |            |
| Do you currently assess your patients for Diabetic foot ulcers?   |            |            |            |
| <b>For the statements below, please select an answer from the choices given.</b>  |            |            |            |
| A patient with a previous ulcer or amputation should receive the Simplified 60-Second Diabetic Foot Screen.   | True<br>1  | False<br>2 | Don't Know |
| The patient's feet should be checked for deformity, ingrown toenail, and pedal pulses.  | True       | False      | Don't Know |
| The skin fissure (cracking), thick calluses, injury, poorly fitting shoes, and poor nail cutting techniques are risk factors for diabetic ulceration.   | True       | False      | Don't Know |
| Anti-Diabetic medication should be taken regularly to prevent complications.  | True       | False      | Don't Know |
| The active ulcer, blisters, calluses, and fissures are risk factors diabetic ulcerations  | True       | False      | Don't Know |
| Sensation testing requires testing how many sites on each foot?   | Four       | Eight      | Don't Know |
| If the assessment comes back negative, how soon should the patient be re-tested?  | Six Months | One Year   | Don't Know |

### Appendix G

| <b>Post-test Knowledge Questionnaire</b>  |               |             |               |
|---|---------------|-------------|---------------|
| Please provide your 4-digit study number here. Please remember this number and use on all study forms.<br>Study #: _____                              |               |             |               |
| When using the Simplified 60-Second Foot Screening Tool, what should be looked for upon physical examination?   |               |             |               |
| How many “Yes” responses warrant a referral to the Director of Nursing?   |               |             |               |
| A patient with a previous ulcer or amputation should receive the Simplified 60-Second Diabetic Foot Screen  | TRUE<br>1     | FALSE<br>2  | DON'T<br>KNOW |
| The patient’s feet should be checked for deformity, ingrown toenail, and pedal pulses.  | TRUE          | FALSE       | DON'T<br>KNOW |
| The skin fissure (cracking), thick calluses, injury, poorly fitting shoes, and poor nail cutting techniques are risk factors for diabetic ulceration. | TRUE          | FALSE       | DON'T<br>KNOW |
| Anti-Diabetic medication should be taken regularly to prevent complications.  | TRUE          | FALSE       | DON'T<br>KNOW |
| The active ulcer, blisters, calluses, and fissures are risk factors diabetic ulcerations  | TRUE          | FALSE       | DON'T<br>KNOW |
| Sensation testing requires testing how many sites on each foot?   | FOUR          | EIGHT       | DON'T<br>KNOW |
| If the assessment comes back negative, how soon should the patient be re-tested?  | SIX<br>MONTHS | ONE<br>YEAR | DON'T<br>KNOW |
| Comments:   |               |             |               |





## Appendix I

### Opinion Survey

|  |                     |            |              |               |                        |
|--|---------------------|------------|--------------|---------------|------------------------|
| Please provide your 4-digit study number here. Please remember this number and use on all study forms.   |                     |            |              |               |                        |
| Study #:   |                     |            |              |               |                        |
| The Simplified 60-Second Diabetic Foot Screen is very easy to use in practice.   | Strongly Agree<br>1 | Agree<br>2 | Neutral<br>3 | Disagree<br>4 | Strongly Disagree<br>5 |
| The form was easily accessible to me for examination.  | Strongly Agree      | Agree      | Neutral      | Disagree      | Strongly Disagree      |
| The residents seemed to be cooperative during the examination.   | Strongly Agree      | Agree      | Neutral      | Disagree      | Strongly Disagree      |
| The information collected from the Simplified 60-Second Diabetic Foot Screen was valuable to the prevention of diabetic foot ulcers in your residents. | Strongly Agree      | Agree      | Neutral      | Disagree      | Strongly Disagree      |
| Will you continue to use the Simplified 60-Second Diabetic Foot Screen in your role?   | Yes                 |            | No           |               |                        |
| Did you notice any time constraints or challenges when conducting this assessment?   | Yes                 |            | No           |               |                        |
| Did you feel that the Simplified 60-Second Diabetic Foot screen is an effective tool for diabetic foot assessment?                                     | Yes                 |            | No           |               |                        |
| Did you feel this quality improvement chart was helpful in improving diabetic foot ulcer assessment?   | Yes                 |            | No           |               |                        |