Factors Related to Diabetic Foot Ulcers in Persons with Type 2 Diabetes*

Tran Thi Bich[1], Orapan Thosingha, RN, DNS[1], Wimolrat Puwarawuttipanit, RN, PhD[1]

Abstract

Purpose: To investigate the relationship between age, duration of diabetes, HbA_1C, co-morbidity, self-efficacy, and diabetic foot ulcer among persons with type 2 diabetes.

Design: Descriptive correlational design.

Methods: The sample consisted of 136 persons with type 2 diabetes in the outpatient department, at the Bach Mai Hospital, Hanoi, Vietnam. Data were collected using hospital record and a structured questionnaire. The diabetic foot ulcer was assessed using 60 second Diabetic Foot Screen. Spearman's Rho correlation was employed to test the relationship among variables.

Main findings: More than half of subjects were female (60.3%) with mean age of 65.3 years. The majority had type 2 diabetes more than 10 years; hypertension was the most common co-morbid disease with 89%. The mean score of self-efficacy was 54.49 (SD = 8.34) while the mean of diabetic foot ulcer score was 6.05 (SD = 3.14). Age, duration of type 2 diabetes, and co-morbidity were significant positively correlated with the diabetic foot ulcer score (r_s = .29, r_s = .31, r_s = .30; $p < .05$, respectively) while self-efficacy was negatively correlated with the diabetic foot ulcer score (r_s = - .42, $p < .05$).

Conclusion and recommendations: Nurses should routinely assess persons with type 2 diabetes using the 60 second Diabetic Foot Screen, control their co-morbid diseases, and promote their self-efficacy. Standard guidelines to take care feet of diabetic persons concerning those related factors should be developed and implemented.

Keywords: type 2 diabetes, self-efficacy, diabetic foot ulcer

ปัจจัยที่มีความสัมพันธ์ต่อความเสี่ยงในการเกิดแผลเบาหวานที่เท้าในผู้ป่วยเบาหวานประเภทที่ 2*

Tran Thi Bich[1] อรพรรณ โตสิงห์, พย.ด.[1] วิมลรัตน์ ภู่วราวุฒิพานิช, PhD[1]

บทคัดย่อ

　　วัตถุประสงค์: เพื่อศึกษาความสัมพันธ์ระหว่าง อายุของผู้ป่วย ระยะเวลาของการเป็นโรคเบาหวาน ระดับเฮโมโกลบิน เอวันซี โรคร่วม ความเชื่อมั่นในความสามารถของตนเอง และความเสี่ยงในการเกิดแผลเบาหวานที่เท้าในผู้ป่วยเบาหวานประเภทที่ 2

　　รูปแบบการวิจัย: การวิจัยเชิงบรรยายแบบหาความสัมพันธ์

　　วิธีดำเนินการวิจัย: กลุ่มตัวอย่างประกอบด้วยผู้ป่วย เบาหวานประเภท 2 จำนวน 136 คน ที่มารับการรักษาตัว ณ แผนกผู้ป่วยนอก โรงพยาบาลบัคมาย กรุงฮานอย ประเทศเวียดนาม เก็บข้อมูลด้วยการใช้แบบสัมภาษณ์และแบบบันทึกข้อมูลจากแฟ้มผู้ป่วย วัดความเสี่ยงในการเกิดแผลที่เท้าด้วยการใช้แบบประเมิน 60 second Diabetic Foot Screen วิเคราะห์ความสัมพันธ์ระหว่างตัวแปรที่ศึกษาด้วยการใช้สถิติ Spearman's Rho

　　ผลการวิจัย: ผู้ป่วยร้อยละ 60.3 เป็นเพศหญิง มีอายุเฉลี่ย 65.3 ปี ส่วนใหญ่เป็นโรคเบาหวานประเภท 2 มานานกว่า 10 ปี โรคร่วมที่พบมากที่สุด (ร้อยละ 89) คือ โรคความดันโลหิตสูง ค่าเฉลี่ยของคะแนนความเชื่อในการดูแลตนเอง เท่ากับ 54.49 และค่าเฉลี่ยของคะแนนความเสี่ยงในการเกิดแผลที่เท้า เท่ากับ 6.05 อายุ ระยะเวลาการเป็นโรคเบาหวาน และโรคร่วมมีความสัมพันธ์ทางบวกกับค่าคะแนนความเสี่ยงของการเกิดแผลที่เท้า (r_s = .29, r_s = .31, r_s = .30; $p <$ .05 ตามลำดับ) ค่าคะแนนความเชื่อมั่นในความสามารถของตนเอง มีความสัมพันธ์ทางลบกับค่าคะแนนความเสี่ยงในการเกิดแผลเบาหวานที่เท้าในผู้ป่วยเบาหวานประเภทที่ 2 (r_s = - .42, $p <$. 05)

　　สรุปและข้อเสนอแนะ: พยาบาลควรใช้แบบประเมิน 60 second Diabetic Foot Screen เพื่อประเมินความเสี่ยงของการเกิดแผลที่เท้าในผู้ป่วยเบาหวานอย่างสม่ำเสมอ หาวิธีการในการควบคุมการกำเริบของโรคร่วม และส่งเสริมให้ผู้ป่วยมีความเชื่อมั่นในการดูแลตนเอง และควรพัฒนาแนวปฏิบัติในการดูแลเท้าสำหรับผู้ป่วย และนำไปใช้ในการสอนให้ผู้ป่วยป้องกันตนเองไม่ให้เกิดแผลที่เท้า

　　คำสำคัญ: ผู้ป่วยเบาหวานประเภท 2 ความเชื่อมั่นในการดูแลตนเอง แผลเบาหวานที่เท้า

Background and Significance

Diabetes Mellitus (DM) is a significant metabolic disease worldwide.[1] International Diabetes Federation (IDF) estimated that there were 175 million people with diabetes globally and approximately half of them were unaware of their disease.[2] Type of DM that most frequenty found among adults were Type 2 diabetes mellitus (T2DM). In Asia, the incidence of T2DM has been increasing in the past 2 decades. In 2011, there were ninety million or 9% of population in China having T2DM, followed by India with 61.3 million and Bangladesh with 8.4 million.[2] An extensive literature review in Vietnam showed that in the year 2012 the prevalence of diabetes was 5.4% while the prevalence of pre-diabetes was 13.7%. The author also stated that the increase in the diabetes prevalence rates was correlated with changes in risk factors, such as Westernized dietary pattern.[3]

T2DM caused a number of complications that affected blood vessels, eyes, kidneys, and nerves.[2] The most common complication in patients with T2DM was diabetic foot ulcers (DFUs). Wounds of DFUs are severe and chronic, affecting physical health and quality of life of patients, and increasing the risk of death due to sepsis and septicemia.[4,5] Foot ulcerations and subsequent amputation were associated with high diabetes-related hospitalizations, emotional reactions, physical suffering, as well as loss of productivity, and huge financial losses both in developed and developing countries.[4] There were many factors affecting the occurrences of DFUs such as age, duration of T2DM, level of HbA_1C, numbers of co-morbid diseases, and self-efficacy.[5-7]

Age of the patient with T2DM was hypothesized to be related to DFUs. Previous systematic review found that patients with T2DM who had higher ages would have higher chance to develop DFUs.[8]

Duration of T2DM plays a vital role in development of DFUs. A study of Deribe, Woldemichael and Nemera showed that patients suffering diabetes more than 10 years had higher risk of developing DFUs than patients who had T2DM less than 10 years.[5]

Level of HbA_1C has been used to investigate plasma glucose level over the previous 8-12 weeks which reflected patient's control of their glucose. Previous research demonstrated that patients who could control level of HbA_1C would have less complications from diabetes including DFUs.[9]

Co-morbid diseases have profound effects on the occurrence of DFUs. According to study of Bedilu and the others, T2DM patients with co-morbid diseases such as heart disease and hypertension were 7.8 times to have DFUs more than those who did not have co-morbid diseases.[5]

Self-efficacy is defined as persons' beliefs about their abilities to acheive ultimate levels of action influences over the events that affect their lives.[7,10] Persons with diabetes need to have judgment on their capability to take care of themselves in order to prevent and control complications such as DFUs. The self-efficacy theory defines 4 sources of self - efficacy including enactive attainment, vicarious experience, verbal persuasion, and physiological feedback.[7] Each source is associated with others. The theorist believes that persons will demonstrate any behavior if they believe that they have capabilities to perform those behaviors. In addition, the theorist believes in cognitive process that will affect individual behaviors and the behaviors can be modified by verbal persuasion and outcome expectation. Self-efficacy is the amount of confidence that a person believes he or she has to perform a set of specific activities or behaviors.[10]

Studies showed that persons with T2DM who had higher self-efficacy could perform desirable self care so that they could prevent foot complications and amputations.[11-14] Self-efficacy reflects the individual's belief on his or her own succesful behaviors to accomplish the certain task.[11]

This study aims to explore the relationships

between age, duration of DM, HbA_1C, co-morbidity, self-efficacy, and diabetic foot ulcers in persons with T2DM. The results will be able to lead to design strategies to prevent complications and promote health among persons with T2DM which is an important role of nurses.

Objective

To investigate the relationships between age, duration of DM, HbA_1C, co-morbidity, self-efficacy, and diabetic foot ulcers among persons with T2DM.

Hypotheses

1. Age, duration of DM, HbA_1C, co-morbidity were positively related to DFUs among persons with T2DM.

2. Self-efficacy was negatively related to DFUs among persons with T2DM.

Methodology

Population and Sample

Population of this study included persons who were diagnosed with T2DM and received treatment at outpatient department for diabetic patients of Bach Mai Hospital, Hanoi, Vietnam.

Sample was recruited from the population with the following inclusion criteria: 1) age was 18 years and older, 2) was able to verbally communicate in Vietnamese. Patients with limb amputation were excluded from the study.

Sample size was calculated using G* power program to determine the minimum number of participants needed for correlational design,[15] the level of significance was .05, the power of the statistical test was .80. There were five independent variables in this study and medium effect size ($r = .3$, $f^2 = .099$)[16] was used for calculation sample. Base on G* power, sample size was 136 patients.

Research Instruments

Research instruments used for collecting data were as follows:

1. Demographic and Health Information Record Form:

The researcher collected demographic data and health information from hospital chart including patients' present illness, treatment, duration of DM, duration of DFUs, list of co-morbid diseases, blood pressure, body temperature, HbA_1C, smoking behavior and exercise behaviors.

2. Self-efficacy for Diabetes: The 8-items self-efficacy for diabetes scale covered essential activities related to diabetic management, it was originally developed and tested for psychometric property in Spanish, and was translated into English by Stanford Patients Education Research Center, USA in 2009. The English scale was tested in 186 patients with diabetes and yielded Cronbach's alpha of .83.[17] Each patient was asked "How much confidence he or she feel about his or her self-management on diabetes?" The response ranged from 1 to 10. One referred to having very low confidence in performing activities related to diabetic management, while 10 referred to having very high confidence. The scale was published and owned by Stanford Patient Education Research Center, USA and is offered for free access without asking for permission to use in practice or research.[17]

3. The 60 Second Diabetic Foot Screen: It is an assessment tool developed by Dr. Inlow, a clinical expert in the field of diabetic foot ulcers in Canada. This tool has been widely used in practice by nurses or other health care professions for screening by performing inspection, palpation, and asking some specific questions related to foot ulcers that would occur in patients with T2DM.[18] The 60 second diabetic foot screen comprises three domains with 12 items divided into 1) Look – 20 seconds composes of 4 items; 2) Touch - 10 seconds composes of 3 items; 3) Assess - 30 seconds composes of 5 items. This tool is offered for free access online without asking for permission to use in practice or research.[18] The researcher used this scale to detect risk on developing DFUs in patients with T2DM.

The instruments were translated from English to Vietnamese. Content validity was

reviewed and approved by six experts in area of diabetes. Cronbach's alpha coefficient was employed to test reliability of instrument. The results showed that Cronbach's alpha of self-efficacy for diabetes scale was .87.

Protection of Human Subjects

This project was approved by the Institutional Review Board (IRB) of Faculty of Nursing, Mahidol University, Thailand (COA No.IRB-NS2016/337.0205) and IRB of Vietnam National University, Vietnam. The researcher recruited subjects as standard process specified by the IRB. The issues of making decision to consent independently, anonymity, and confidentiality were warranted.

Data Collection Process

1. After getting permission to collect data from the director of Bach Mai Hospital, the researcher met the head of out-patient department for diabetic patients, head nurse, physician, and staffs to explain details of the research project; as well as asking for the assistance to recruit potential subjects.

2. The researcher self-introduced, made relationship with potential subjects; then informed them about objectives of the study, data collection procedure, let them to read participant information sheet, and invited them to join the study. After the subjects agreed to join the study, they were asked to sign the consent form.

3. The researcher recorded demographic data and health information from the patient's medical record.

4. The researcher organized the private room to interview and assess feet of the subjects. The total time for interview and foot assessment in each subject was 30 to 45 minutes.

Data Analysis

Data were analyzed using the computer statistical package as follows:

1. Demographic data and health information were analyzed with descriptive statistics: frequency, percentage, mean, standard deviation.

2. For the relationship of studied variables, the researcher originally planned to use the Pearson product moment correlation coefficient. However, after testing for normal distribution, all studied variables did not show normal distribution. Therefore, the Spearman's Rho was employed to test correlation among studied variables with the level of significance .05.

Findings

Demographic data and health information

About sixty percent of the sample (60.3%) was female with the mean age of 65.3 years (SD = 8.6). Most of them were married (79.4%), 80.1% retired from their work, 27.2% finished secondary school, and 60.3% resided in the city. All subjects had health insurance; more than half of them (57.4%) received entire health expense payment by government health insurance. About 68.4% of them never smoked.

The majority of sample had experienced T2DM more than 10 years with the mean duration of 11.9 years (SD = 5.9). Only 5.1% of subjects had history of previous foot ulcers. Overweight and obese subjects accounted for 29.4% and 21.3%, respectively. The first three co-morbid diseases among these studied subjects were hypertension (89.0%), dyslipidemia (79.4%), and peripheral neuropathy (22.1%).

Self-efficacy and diabetic foot ulcers score

The mean score of self-efficacy was 54.5 (SD = 8.3) while the mean score of diabetic foot screen was 6.1 (SD = 3.1). (Table 1) The majority of subjects had problems with foot skin mainly dry skin foot with fungus or light callus (75.7%), 11.0% had heavy callus build up and 5.1% had open foot ulcers or recent history of foot ulcers. Similarly figure with nails, 71.3% had un-kept and ragged nails while 13.2% had thick, damaged, or infected nails. In regard to foot wear, 84.6% of the subjects wore inappropriate foot wear such as slippers or very tight shoes resulted in foot trauma for 3.6%. More than 30.0% of foot trauma had limitation of foot movement, they could not perform full range of motion due to hallux (33.1% had hullux

limitus and 1.5% had hallux rigidus). About 30.0% showed abnormal sensation on 10 points monofilament test. Dorsalis pedal pulse could not be palpated in only 3.7% of subjects. According to the scores from foot assessment, 3.7% and 33.8% required foot screening every 6 months and 3 months respectively. (Table 2)

Table 1: Range, mean, SD of age, duration of DM, HbA$_1$C, self-efficacy, the 60 second diabetic foot screen (n = 136)

Variables	Range	Mean	SD
1. Age	37 - 83	65.3	8.6
2. Duration of DM	1 - 32	11.9	5.9
3. HbA$_1$C	5.7 - 12.9	7.5	1.5
5. Self-efficacy	36 - 80	54.5	8.3
6. The 60 second diabetic foot screen	2 - 17	6.1	3.1

Table 2: Total scores of samples from the 60 second diabetic foot screen presented in group according to the risk and or severity of DFUs (n = 136)

Group	Number	Percentage
Group 1: 0-6 (Recommend screening yearly)	85	62.5
Group 2: 7-12 (Recommend screening every 6 months)	46	33.8
Group 3: 13-19 (Recommend screening every 3 months)	5	3.7
Group 4: 20-25 (Recommend screening every 1 to 3 months)	0	0

Correlation between age, duration of DM, HbA$_1$C, co-morbidity, self-efficacy and diabetes foot ulcer scores

The findings indicated that age, co-morbidity, and duration of DM are significantly positive correlated with diabetic foot ulcer scores (r_s = .29, r_s = .30, r_s = .30, $p < .05$, respectively); while self-efficacy is significantly negative correlated with diabetic foot ulcer scores (r_s = .42, $p < .05$). HbA$_1$C is not statistically significant correlated with diabetic foot ulcer scores ($p > .05$). (Table 3)

Table 3: Correlation between age, duration of DM, HbA$_1$C, co-morbidity, self- efficacy, and diabetes foot ulcer scores (n = 136)

	Age	Duration of DM	HbA$_1$C	Co-morbidity	Self-efficacy	Diabetic foot ulcer
Age	1.00					
Duration of DM	.331*	1.00				
HbA$_1$C	.146	.395*	1.00			
Co-morbidity	.254*	.177*	.096	1.00		
Self-efficacy	- .184*	- .122	- .292*	- .127	1.00	
Diabetic foot ulcer scores	.287*	.306*	.059	.300*	- .415*	1.00

*$p < .05$, Spearman's Rho Correlation

Discussion

Although, the occurrence of diabetic foot ulcers in this study is very low (5.1%) comparing with previous studies,[19-21] majority of subjects demonstrate risk on developing diabetic foot ulcers. Their skin integrity is prone to breakdown because of the dryness with fungal infection or light callus. As stated by Alavi et al., the presence

of callus on the sole led to decrease protective sensation of the feet from any external forces such as very hot or cold subjects or some traumatic forces. Consequently, patients with T2DM who had callus are more likely to develop foot ulcers.[22]

The International Diabetic Association and the American Diabetic Association[2] recommend that all individuals with diabetes should receive an annual foot examination to identify risk of ulcerations; if any risk factor is detected, patients should be informed to prevent the occurrence of foot ulcers. In addition, the 60-second foot ulcer screening tool should be used in clinical settings to evaluate the foot status of patients.

Hypotheses testing

Hypothesis 1: Age, duration of DM, HbA_1C, and co-morbidity were positively related to DFUs among persons with T2DM.

The findings supported hypothesis 1 that there was a statistical positive correlation between age and diabetic foot ulcers scores (r_s = .29, p < .05). Patients with T2DM whose age are older will have higher diabetic foot ulcers scores which refer to higher risk or prone to DFUs. This finding is similar to the study of Molvær et al., in Norwegian population between the year 2006 to 2008 which found that patients with T2DM whose age were 75 years were more likely to develop DFUs which required more than 3 weeks to heal and created huge burden to patients and their caregivers.[20]

Duration of DM was positively related to DFUs (r_s = .30, p < .05); which was also found the same result in other studies.[22,23] Patients who suffered with diabetic for a long time were presumed to be at more risk due to the development of long term diabetic complications such as peripheral vascular disease (PVD), neuropathy, nephropathy, and retinopathy which could lead to the occurrence of foot ulcers. There were evidences to support that long duration of diabetes was also significantly associated with foot infection and gangrene due to decrease blood flow to the peripheral part and finally, these patients would require lower limb amputation.[8]

The finding showed that nearly half of patients in this study (47.8%) had HbA_1C level of greater than 7 with the mean of 7.47 (SD = 1.47); however, level of HbA_1C was not correlated with diabetic foot ulcers scores. The finding of this study was not congruent with those found in previous studies.[24]

Co-morbidity was significantly positive correlated with diabetic foot ulcer scores (r_s = .30, p < .05). This finding was similar to the findings in previous studies. Bruun et al., indicated that peripheral neuropathy, peripheral arterial disease, micro-albuminuria, retinopathy, and impaired vision or blindness at diabetes diagnosis were independent predictors of later amputation.[25] Patients with T2DM who had high numbers of co-morbid diseases will be high risk of developing DFUs.

Hypothesis 2: Self-efficacy was negatively related to DFUs among persons with T2DM.

In this study, the result indicated that self-efficacy had negative relation with diabetic foot ulcers scores (r_s = - .415, p < .05); which could be interpreted that patients with T2DM who had high self-efficacy would show lower diabetic foot ulcers scores. The finding was similar to previous studies which supported that patients who had high self-efficacy always had high capability in self-care and were able to manage themselves and deal with their illnesses very well.[26,27] The study of McCleary-Jones identified that self-efficacy was associated with foot self-care,[25] those patients with higher self-efficacy were more likely to perform regular foot self-care behaviors[4], so that they tend to have low risk for DFUs. Gao aet al.,[12] in China and Walker and colleagues in the United States found that the patients with higher self-efficacy had better control of their HbA_1C. Moreover, the self-confidence score was positively correlated to foot care score. This adds to the evidence that increasing diabetic patient's self-confidence and self-efficacy is of great importance in improving foot complications.[13] A study in Taiwan gave evidence of the positive effect of increasing diabetic patients' self-efficacy on their practice of foot care.[14]

Conclusion and Implication for Nursing Practice and Further Study

The findings of this study support self-efficacy theory in that when patients with chronic illness such as T2DM had high level of self-efficacy, they would be able to perform appropriate self-care leading them to achieve positive health outcomes. In this study, it refers to proper foot care to prevent the occurrence of DFUs. Evidences from the study can be summarized that the proper self-care behaviors that should be emphasized included keeping foot skin to be moist, clean and free from infection. If infected nail and skin are detected, the prompt and proper management should be performed. Proper foot wear should also be highlighted.

In addition, patients with older age, having more co-morbid diseases and have longer duration of T2DM are ones who have higher risk of DFUs. They should be closely monitored and receive foot examination during their follow up care. Patients and family education on foot inspection is one strategy that can be implemented to prevent the occurrence of DFUs.

Clinical practice guidelines to improve self-efficacy in regard to DFUs detection and prevention should be developed and tested for its effectiveness. In addition, the 60 seconds diabetic foot screen in Vietnamese version should be used in larger group diabetes patients to assess the risk for foot ulcerations.

References

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2013;36 Suppl 1:S67-S74.
2. International Diabetes Federation. IDF Diabetes Atlas. 6th ed. Brussels, Belgium: International Diabetes Federation; 2013.
3. Khue NT. Diabetes in Vietnam. Ann Glob Health. 2015;81(6):870-3.
4. Driver VR, Fabbi M, Lavery LA, Gibbons G. The costs of diabetic foot: the economic case for the limb salvage team. J Vasc Surg. 2010;52 Suppl 3:S17-S22.
5. Deribe B, Woldemichael K, Nemera G. Prevalence and factors influencing diabetic foot ulcer among diabetic patients attending Arbaminch Hospital, South Ethiopia. J Diabetes Metab. 2014;5(1):1-7. doi:10.4172/2155-6156.1000322.
6. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. Diabetes Res Clin Pract. 2010;87(1):4-14.
7. Bandura A. The explanatory and predictive scope of self-efficacy theory. J Soc Clin Psychol. 1986;4(3):359-73.
8. Mohammad Z, Abida M, Jamal A. Diabetic foot ulcer: a review. American Journal of Internal Medicine. 2015;3(2):28-49.
9. Croxson S. Diabetes in the elderly: problems of care and service provision. Diabetic Med. 2002;19 Suppl 4;66-72.
10. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. Psychol Rev. 1977;84(2):191-215.
11. Shi Q, Ostwald SK, Wang S. Improving glycaemic control self-efficacy and glycaemic control behaviour in Chinese patients with type 2 diabetes mellitus: randomised controlled trial. J Clin Nurs. 2010;19(3-4):398-404.
12. Gao J, Wang J, Zheng P, Haardorfer R, Kegler MC, Zhu Y, et al. Effects of self-care, self-efficacy, social support on glycemic control in adults with type 2 diabetes. BMC Fam Pract. 2013 May 24;14:66. doi: 10.1186/1471-2296-14-66.
13. Hussen Ali Z. Effect of self-efficacy enhancing intervention training on clinical health status of diabetic patients at high-risk for leg problems. Journal of Patient Care. 2016;2:111. doi:10.4172/2573-4598.1000111.

14. Chin YF, Huang TT, Hsu BR. Impact of action cues, self-efficacy and perceived barriers on daily foot exam practice in type 2 diabetes mellitus patients with peripheral neuropathy. J Clin Nurs. 2013;22(1-2):61-8.

15. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods. 2009;41(4):1149-60.

16. Cohen J. Statistical power analysis for the behavioural sciences. New York: Academic Press; 1969.

17. Lorig K, Ritter PL, Villa FJ, Armas J. Community-based peer-led diabetes self-management: a randomized trial. Diabetes Educ. 2009;35(4):641-51.

18. Orsted HL. Development of the Inlow 60-second diabetic foot screen: a practice-ready bedside tool to guide assessment and care. Wound Care Canada. 2009;7(2):40-2.

19. Assaad-Khalil SH, Zaki A, Abdel Rehim A, Megallaa MH, Gaber N, Gamal H, et al. Prevalence of diabetic foot disorders and related risk factors among Egyptian subjects with diabetes. Prim Care Diabetes. 2015;9(4):297-303.

20. Molvær AK, Graue M, Espehaug B, Ostbye T, Midthjell K, Iversen MM. Diabetes-related foot ulcers and associated factors: results from the Nord-Trondelag Health Survey (HUNT3) (2006-2008). J Diabetes Complications. 2014;28(2):156-61.

21. Mamo T, Yifter H, Lemessa T. Risk factors assessment of diabetic foot ulcer using the sixty seconds screening tool: a hospital based cross-sectional study at Tikur Anbessa Specialized Hospital. Ethiop Med J. 2015;Suppl 2:45-9.

22. Alavi A, Sibbald RG, Mayer D, Goodman L, Botros M, Armstrong DG, et al. Diabetic foot ulcers: Part I. Pathophysiology and prevention. J Am Acad Dermatol. 2014;70(1):1.e-18; quiz 9-20.

23. Shailesh K, Shahi M, Ashok KM, Sushil KM, Surya KS, Sanjeev K, et al. Prevalence of diabetic foot ulcer and associated risk factors in diabetic patients from North India. Journal of Diabetic Foot Complications. 2012;4(3):83-91.

24. Shahbazian H, Yazdanpanah L, Latifi SM. Risk assessment of patients with diabetes for foot ulcers according to risk classification consensus of International Working Group on Diabetic Foot (IWGDF). Pak J Med Sci. 2013;29(3):730-4.

25. Bruun C, Siersma V, Guassora AD, Holstein P, de Fine Olivarius N. Amputations and foot ulcers in patients newly diagnosed with type 2 diabetes mellitus and observed for 19 years. The role of age, gender and co-morbidity. Diabet Med. 2013;30(8):964-72.

26. Hiltunen EF, Winder PA, Rait MA, Buselli EF, Carroll DL, Rankin SH. Implementation of efficacy enhancement nursing interventions with cardiac elders. Rehabil Nurs. 2005;30(6):221-9.

27. Galik EM, Resnick B, Gruber-Baldini A, Nahm ES, Pearson K, Pretzer-Aboff I. Pilot testing of the restorative care intervention for the cognitively impaired. J Am Med Dir Assoc. 2008;9(7):516-22.