

**FOOT CARE FOR PATIENTS WITH TYPE 2 DIABETES:
EVIDENCE - BASED NURSING**

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Thematic Paper
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FOOT CARE FOR PATIENTS WITH TYPE 2 DIABETES: EVIDENCE - BASED NURSING**MD. ABDUR RAHIM 5538727 NSAN / M****M. N. S. (ADULT NURSING)****THEMATIC PAPER ADVISORY COMMITTEE: ORAPAN THOSINGHA, D.N.S., WIMOLRAT PUWARAWUTTIPANIT, Ph.D.****ABSTRACT**

In the last decades, diabetic foot ulcers have become dramatically increased global medical issue. The increase in foot ulcers has created devastating complications among patients with type 2 diabetes.

The aim of this study was to summarize the collection of current evidence based from guidelines for foot care among patients with type 2 diabetes. This author used a PICO (Population Intervention Comparison Outcome) framework as a guideline for this study. The collection of guideline used was published on different English databases and websites found in the Mahidol University library system. The author searched PubMed, CINAHL, ScienceDirect, and www.guideline.gov website for available guidelines between the years 2004 to 2014.

A total 33 guidelines were retrieved but only 12 guidelines relevant to the objective of this study were selected. These included 4 international guidelines, 7 national guidelines, and 1 consensus statement. All guidelines were appraised by using AGREE II instrument. The results from guidelines synthesis revealed that the main activities for foot care were 1) assessment of feet including inspection and examination of the feet, 2) assessment of risk and the classifying into different categories, 3) providing patients and family members with information about foot care, appropriate footwear and nail care, 4) advise patients about blood glucose control, and 5) refer patients to multidisciplinary healthcare team if there was any risk for serious wound infection and peripheral arterial disease (PAD).

The author suggests that recommendations on foot care should be used to develop foot care guidelines for patients with type 2 diabetes in a clinical setting in Bangladesh. Strategies to make the implementation of this guideline possible should be taken into consideration. Distribution of foot care guideline for patients with type 2 diabetes among nurses and other related health care personnel is also suggested.

**KEY WORDS: TYPE 2 DIABETES/DIABETIC FOOT ULCERS/
FOOT CARE/EVIDENCE BASED NURSING**

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CHAPTER I

INTRODUCTION

1.1 Background and significance of the clinical problem

Nowadays, diabetes is a worldwide health problem. Among numerous complications, diabetic foot ulcer is the most common complication among patients with diabetes which creates many problems on the patient's health, families, society, as well as the country's ability to perform necessary tasks. Most of the patients who suffered from foot ulcers are ones who have inadequate knowledge and lack proper management in regard to diabetes and foot ulcer care. There is evidence to support the notion that foot care education and proper foot ulcer management are effective strategies to promote the patient's knowledge on foot care and prevent foot amputation. It was found in previous scientific studies that when patients and health care providers had knowledge about foot care, they would perform effective foot care practices, adopt proper foot ulcer management, and have prevention of diabetic foot ulcers. Accordingly, foot complications will be reduced as well as the incidence of foot ulcers and foot amputation rates.

1.1.1 Prevalence of diabetes

In the past decades, diabetes prevalence increased dramatically worldwide. In 2000, the total diabetes population was 171 million, making up 3% of the total world population. It has been estimated that the prevalence rate will reach 366 million by the year 2030, which will represent 37% of the total population. The most remarkable change occurred in those older than 65 years of age and were urban population (Unwin, 2008; Wild, Roglic, Green, Sicree, & King, 2004). In 2013, diabetes affected 382 million people, and it has been estimated that the number will rise to 592 million by 2035, among them mostly will be adults (Guariguata et al., 2014; International Diabetes Federation [IDF], 2013; Zabetian, Sanchez, Narayan, Hwang, & Ali, 2014). People are commonly affected by diabetes everywhere, in both

developed and developing countries. The majority of diabetic people lived in low and middle-income countries (Guariguata et al., 2014; Unwin, 2008). About 3% of the British people and 9.3% of the American people suffer from diabetes (Bindraban et al., 2008; Centers for Disease Control and Prevention [CDC], 2014). On the other hand, 70% of 171 million diabetic people lived in developing countries and by the year 2030, the number of diabetic people will be more than 80% of the world diabetes population (Unwin, 2008). Several studies have revealed that most of the patients were those with type 2 diabetes (Al-Maskari & El-Sadig, 2007; CDC, 2014; Rocha, Zanetti, & Santos, 2009).

Bangladesh is a developing country located in South East Asia and about 5.6 million people in the country suffered from diabetes in 2010, with the prevalence rate of 6.1%. The number is predicted to increase to 10.4 million by 2030 (Shaw, Sicree, & Zimmet, 2010). If this trend continues, Bangladesh will be in top 10 countries in the world in the year 2030 with diabetic population (Wild et al., 2004). In addition, in the past 10 years, diabetes prevalence has increased from 2.3% to 7.9% in the rural Bangladeshi population (Bhowmik et al., 2013). This rising trend of prevalence in type 2 diabetes is expected to result in greater risks of diabetic foot ulcers in the future.

1.1.2 The significance of diabetic foot ulcers and amputation

Diabetic foot ulcer is a significant complication in diabetic patients. It is considered the most devastating chronic complication and a leading cause of lower limb amputations, which affect approximately half of all diabetes patients (Metteling et al., 2013; Vamos, Bottle, Majeed, & Millett, 2010). Most of the amputations are performed in type 2 diabetes patients (Vamos et al., 2010). In general, a diabetes patient has 10% to 25% risk for foot ulcer development in their lifetime (Madanchi et al., 2013; Singh, Armstrong, & Lipsky, 2005).

Several studies have highlighted that diabetic foot ulcer prevalence ranges from 4% to 10% in diabetic patients (Abbott et al., 2005; Alexiadou & Doupis, 2012; Madanchi et al., 2013; Reiber, Boyko, & Smith, 1995; Singh et al., 2005; Wang, Sun, Wang, & Jiang, 2014). But according to Alexiadou, and Doupis (2012), Deribe, Woldemichael, and Nemera (2014), and Leung (2007), older patients suffered more

(10.4%) from foot ulcers and 8.5% of diabetic patients suffered from diabetic foot syndrome (Lauterbach, Kostev, & Kohlmann, 2010). Recently one study was conducted in South Ethiopia and found that the prevalence rate was high (Deribe et al., 2014).

Diabetic patients were several times more vulnerable for amputations than non-diabetic patients (IDF, 2013; Singh et al., 2005). Heel ulcers and amputations are closely related. From the studies of Pickwell, Siersma, Kars, Holstein, and Schaper (2013), and Wang et al. (2014), it was found that amputation rates were high among the patients who suffered from heel ulcers compared to ulcers in other parts of the foot. The book “*Diabetes in America*” has stated that about 85% of amputations are done in diabetic patients with foot ulcers and commonly amputated parts are the toe, foot, and ankle in diabetic patients than non-diabetic patients (Reiber et al., 1995). Also, the limb that is affected most is the right leg (Madanchi et al., 2013; Wang et al., 2014). According to CDC (2014), and Tabatabaei-Malazy, Peimani, Heshmat, and Pajouhi (2011), most of the amputations were done for non-traumatic reasons in diabetic patients. Foot ulcer patients are admitted frequently and stay at the hospital for a longer time than non-ulcer patients (Morshed, 2012; Tomlin, Dovey, & Tilyard, 2008).

However, most of the foot ulcers are curable, yet 10% to 15% continue to have ulceration and 5% to 24% undergo amputations within six to 18 months after the first evaluation (Lauterbach et al., 2010; Wang et al., 2014), but some patients take more than 16 weeks for healing (Iversen, 2009). Every 30 seconds one amputation is done, and globally over 2,500 diabetic patients lost their limbs in one day (Madanchi et al., 2013).

Despite the progress of diabetic care and new medication, the amputation has increased gradually (Beard, Ghatrif, Samper-Ternent, Gerst, & Markides, 2009; Pscherera, Dippelb, Lauterbachc, & Kostevd, 2012). Every year, this rate increases by 1.37 times compared to the rate in the previous year (Pscherera et al., 2012). After 12 months of the first amputations, 9% to 20% of patients experience amputations in their second leg and after five years the rate increase between 28% and 51%.

The mortality rates are in fact higher in the patients who have suffered from foot ulcers compared to those without diabetes and those with diabetes but

without foot ulcers (Iversen, 2009) and among amputee patients; after five years the mortality rates were 39%-68%, but in the first year it was only 13%-40% (Madanchi et al., 2013; Reiber et al., 1995; Singh et al., 2005).

Similarly, available data in Bangladesh show that foot related complications have been rising day by day among diabetic patients. One study was conducted in Bangladesh by Habib, Biswas, Akter, Saha, and Ali (2010), found that the ulcer development rate was 2.8% but Bangladeshi females suffered more from foot ulcers and mostly were affected between 45-65 years of age. Furthermore, a study of Viswanathan et al. (2010), has revealed that minor amputation rates were high in Bangladeshi diabetic patients and most of the artificial limb users after amputations were found in Bangladesh compared with Tanzania and India. After amputations, the rates of recurrence of foot ulcerations, infections, and amputations were 32%, 11%, and 3%, respectively (Viswanathan et al., 2010). Globally, diabetes incidence rates have increased; in addition, diabetes related complications are mounting equally, especially diabetic foot ulcers which have considerable effects on public health (Leung, 2007).

1.1.3 Risk factors of diabetic foot ulcers

Several factors contribute to development of diabetic foot ulcers. An increasing trend of diabetes has been associated with rising prevalence of diabetic foot complications, especially foot ulcers. Both age and sex have been found to be statistically significant risk factors of ulcer development (Reiber et al., 1995). There were more males who suffer from foot ulcers than females (Al-Maskari & El-Sadig, 2007; Iversen, 2009; Lauterbach et al., 2010; Tabatabaei-Malazy et al., 2011; Tomlin et al., 2008; Wang et al., 2014). Several studies have described the relationship between age and history of diabetes with foot ulcers; older diabetic patient are at a higher risk for foot ulcers than younger ones, and longer duration of diabetes is significantly associated with an increased risk for ulcer occurrence (Al-Maskari & El-Sadig, 2007; Frykberg et al., 2006; Iversen, 2009; Lauterbach et al., 2010; Leung, 2007; Pscherera et al., 2012; Tabatabaei-Malazy et al., 2011; Tomlin et al., 2008; Wang et al., 2014).

Moreover, peripheral neuropathy and peripheral vascular diseases are common causes of foot ulcers (Al-Maskari & El-Sadig, 2007; American Diabetes Association [ADA], 2013; Frykberg et al., 2006). Visual impairment, foot deformity, history of previous foot ulcers or amputations, diabetic nephropathy especially in patients on dialysis, and poor glycaemic control are also related to ulcers. Furthermore, ADA has stated that smoking is another significant risk factor for diabetic foot ulcers (ADA, 2013). Infection, trauma, Charcot foot, improperly fitted shoes, and callus are also risk factors for foot ulcer development (Frykberg et al., 2006; van Houtum, 2012). Socioeconomic and education were related to amputation, lower income and educational group were more risk for amputation than higher income and higher education group (Venermo et al., 2013). Without appropriate knowledge about disease process, effective prevention programs, and proper wound management techniques, the burden and the risk will be increased.

1.1.4 Mechanism of diabetic foot ulcers

When blood sugar level is not well controlled, diabetic patients will have deteriorating vascular and neurologic disorders, which will eventually lead them to some degree of vascular involvement with or without metabolic complications of diabetes in lower extremity and proneness to infection and scarring, with or without deep tissue damage (Aalaa, Malazy, Sanjari, Peimani, & Mohajeri-Tehrani, 2012; Alexiadou & Doupis, 2012; Benbow, 2012).

The Pathophysiology of diabetic foot ulcer is complex (Aalaa et al., 2012; Benbow, 2012; Clayton & Elasy, 2009). In the development of neuropathy of diabetic patients, the hyperglycaemic condition promotes the exploitation of the enzymes aldose reductase and sorbitol dehydrogenase. As a result of this process, the intracellular glucose converts into sorbitol and fructose. This increasing level of serum glucose results in decline in production of nerve cell myoinositol and reduces neuron cell conduction. At a time, the converting outcome of glucose lead to depletion of nicotinamide adenine dinucleotide phosphate stores that is required for the detoxification of reactive oxygen species and nitric oxide separation. In this situation, oxidative pressure risen in the nerve cell and vasoconstriction cause ischemia, which, in turn, increases nerve cell damage and nerve cell death. This condition is known as

diabetic neuropathy. Hyperglycaemia and oxidative stress, moreover, add unusual glycation of nerve cell proteins and unsuitable function of protein kinase C, hence more nerve cell dysfunction and ischemia. Diabetic neuropathy has an impact on mechanisms of the nervous system and changes and causes injury to the basic foot muscles. This change creates disproportion among flexion and extension of the affected parts and formation of anatomic foot deformities that lead to one-by-one formation of irregular bony prominences, pressure points, skin breakdown, and ulceration. After the ulcers have occurred, wound infection and sepsis are expected. Moreover, if the ulcers are not properly managed, amputation is usually a treatment of choice (Clayton & Elasy, 2009).

1.1.5 The classification of diabetic foot ulcers

Diabetic foot ulcer classification system is required for several purposes. Among them the most important purpose is to adequately describe the lesions that need treatment in order to study patient outcomes. It is also helpful to achieve further understanding of the diabetic foot.

There are several wound classification methods such as Meggitt-Wagner ulcer classification system; The University of Texas wound classification system; European Wound Management Association (EWMA); the Site, Ischemia, Neuropathy, Bacterial Infection and Depth (SINBAD); Kings College Hospital classifications; PEDIS (Perfusion, Extent/Size, Depth/Tissue Loss, Infection, Sensation/Neuropathy) classification; and the Kobe classification (Clayton & Elasy, 2009; Ho, Leigh, & Tsui1, 2013; Jain, 2012). However, the two well recognized classification systems are the Meggitt-Wagner and the University of Texas wound classification systems.

The University of Texas wound classification system is a more effective classification system than the Wagner ulcer classification system because there are some limitations about the identification and description of vascular disease as an independent risk factor. In addition, infected or dysvascular superficial wounds are not able to be classified by this system (Armstrong, Lavery, & Harkless, 1998; Clayton & Elasy, 2009; Ho et al., 2013; Jain, 2012; Turns, 2013).

The University of Texas classification system helps to move forward in the management of the diabetic foot. It has four grades and four stages which help to

assess depth of ulcers, identify wound infection, and determine the presence of clinical signs of lower-extremity ischemia (Turns, 2013). In the review of Ho et al. (2013), and Armstrong et al. (1998), the University of Texas classification system is a better predictor of outcomes which include wound healing and degree of lower limb amputations.

As regards diabetic foot ulcers measured by application of the University of Texas wound classification system, when foot ulcers' grade is 0 (zero), that means pre or post-ulcerative site that has healed; grade 1 indicates that ulcers are only superficial, not involving tendon, capsule, or bone; grade 2 points out that ulcers are going deep and are involved in the ligament, tendon, and joint capsule, but not in bones; and grade 3 specifies that ulcers are going into deep and are involved in the ligament, tendon, joint capsule, and bones.

In terms of stages, stage A means there are no infection or ischemia, stage B indicates that the ulcer is infective, stage C means ischemia is present in the ulcerative area, and stage D describes that there are both infection and ischemia present in the ulcer affected part (Armstrong et al., 1998; Turns, 2013). Accurate wound caring based on ulcer severity will help reduce impacts and lower chances of amputations of diabetic foot ulcer patients.

Table 1.1 The University of Texas wound classification (Armstrong et al., 1998; Ho et al., 2013; Turns, 2013).

Grading	Description
Grade 0	Pre-ulcerative or post-ulcerative lesion completely epithelialized
Grade 1	Superficial wound, not involving tendon, capsule, or bone
Grade 2	Deep ulcer/Wound penetrating to tendon or capsule
Grade 3	Wound penetrating to bone or joint
Stages	Description
Stage A	No infection or ischemia
Stage B	Infection present
Stage C	Ischemia present
Stage D	Infection and ischemia present

1.1.6 The impact of diabetic foot ulcers

Diabetic foot ulcers are severe and complex health problems that slow down economic growths, thus inhibiting the country's progress. Moreover, they have impacts on income caused by lifelong disabilities caused by amputations and extra financial load due to the rising demand of rehabilitation. The treatment cost of diabetes is increasing every additional years and a large amount of money is spent on management of complications. It has been expected that this growing expenditure will continue in the future (Zhang et al., 2010) and create burden and impacts on patients, family, society, and the country at large. According to Zhang et al. (2010), globally between US\$ 376.0 billion and US\$ 672.2 billion was spent on treatment and care of diabetes in 2010, which was 12% of the world's total health expenditure. This expenditure would be increased to US\$ 490.1 billion to US\$ 893.0 billion by 2030. An average of US\$ 1330 is spent on each diabetic person for management of only diabetes.

In Bangladesh, a large amount of money is spent on diabetes management in 2010, between US\$ 116,472.49 and US\$ 202,764.06. It was 10% of the total local health expenditure, and it is expected that the expenditure will increase in the future (Zhang et al., 2010). When a diabetic patient develops foot ulcers and amputation is needed, the increased cost is always expected (Hoffmann et al., 2013). One study was conducted by Habib et al. (2010), in Bangladesh and showed that a total cost of ulcer treatment was US\$ 13,308.16 with an average of US\$ 443.60 per patient, but in amputee patients, the cost was different, equal to US\$ 6657.74, which was 5.54 times higher than the usual treatment. The average cost per patient care was US\$ 134, which was significantly related to complications (Habib et al., 2010). But it is worth noting that all costs and burdens are relevant to complications. If complications have developed and patients require amputations, they need a long stay in the hospital, extra medication, and further diagnostic investigation. Thus, the total health care expenditure will be higher than that for usual foot care (Viswanathan et al., 2010; Wang, Xu, Mu, & Ji, 2014).

The rising cost burden factor is responsible for development of psychological stress, so early detection and prevention from amputations are a more cost effective and cost saving process to reduce this stress. Diabetic foot ulcers have a

negative effect on patients' emotion and quality of life as well. Those increasing financial burdens lead to development of anxiety and depression and affect physical functioning of diabetic persons (Dejene, Negash, Tesfay, Jobset, & Abera, 2014; Iversen, 2009; Palizgir, Bakhtiari & Esteghamati, 2013; Salome, Blanes, & Ferreira, 2011; Williams et al., 2010). They also interfere with patients' ability to perform common daily living activities (Salome et al., 2009). In terms of the health-related quality of life (HRQoL), a study was conducted in Malaysia in 2011 and found that the score of physical functioning domains, social functioning domains, and mental health domains were significantly low in foot ulcer patients than in patients without foot ulcers (Mazlina, Shamsul, & Jeffery, 2011).

1.1.7 Foot care program

Foot complication is always dangerous and it leads to morbidity and mortality in diabetic patients. In other words, diabetic patients are at a higher risk when complications have developed (Iversen, 2009). Foot care education helps increase knowledge and reduces risks for foot ulcers and amputations among diabetic patients (Iversen, 2009; Singh et al., 2005). Once an ulcer has developed, there is an increased risk of wound progression that may ultimately lead to amputations. According to Chellana et al. (2012), Saleh, Mumu, Ara, Begum, and Ali (2012), and van Houtum (2012), most ulcers occur due to inadequate knowledge and education about foot care.

Foot care education and wound care are the most effective ways to early detect and prevent complications, ulcers, and amputations (Aalaa et al., 2012). Comprehensive foot care includes preventive education, care by multidisciplinary team members for treatment of foot ulcers, and close monitoring, which are effective enough to reduce 49% to 85% of the amputation rates (Bakker, Apelqvist, & Schaper, 2012). There is strong evidence to support the assumption that foot care is cost effective (Vatankhaha et al., 2009). In the studies of Morshed (2012), and Heitzman (2010), have declared that maximum foot ulcers can be preventable through preventive foot care and about 40% of amputations are protectable through proper wound care in diabetic patients (Clayton & Elasy, 2009). A pilot study conducted at King Abdul Aziz Medical City in Riyadh, Saudi Arabia, has found that a diabetic foot care education

program had an effect on patients' knowledge and helped decrease amputation rates (Al-Wahbi, 2010). Footwear is another key factor for ulcer development so that selection of proper footwear through education is considered one measure for foot ulcer prevention (Habib et al., 2010).

Early detection is important because it initiates an early management of the disease to minimize the complications and prevent foot amputation (Habib, Saha, Mesbah, Alauddin, & Paul, 2013). However, if the ulcers have occurred and progressed to their advanced stage, amputation is unavoidably required; the cost will be more than five times higher than usual ulcer treatment.

In this thematic paper, foot care refers to the foot care educational program and foot ulcer management for patient with type 2 diabetes. This program was developed to improve knowledge, skills, and practice on foot care in patients with type 2 diabetes. In addition, the program covered early detection, referral criteria as well as ulcer management. The aim of this program is to prevent foot ulcers and amputation.

It can be summarized that diabetes has already become serious health problems not only in the author's clinical setting but also countrywide. Moreover, the aforementioned evidence has indicated that diabetic foot ulcers are complications commonly found that lead to more severe health problems such as infections, sepsis, limb amputations, and deaths among this group of patients. There are a lot of existing guidelines on both diabetic care in general and foot care in particular. Accordingly, activities through those guidelines should be taken into serious consideration because it can help prevent or ensure early management of diabetic foot complications among patients with type 2 diabetes.

1.2 Clinical problems of the study

While patients have diabetes that is not well controlled, there are a lot of chances for them to develop diabetes-related complications especially diabetic foot ulcers. Adequate preventive foot care education for prevention of complications and proper wound care to reduce severity is an effective management technique for

diabetic patients suffering from foot ulcers. Otherwise, amputations are the ultimate choice to save life. Therefore, an action is called for to prevent this problem by providing preventive foot care to increase diabetic patients' knowledge and skills about foot care.

The author's workplace is Rajshahi Medical College Hospital (RMCH). It is one of the well-equipped tertiary care level and referral hospitals in the western region of Bangladesh. According to the perspectives of Bangladesh and the author's experiences that have existed from his own clinical setting, most of the diabetic patients have limited knowledge about foot care, which implies that more education is needed to equip them with necessary knowledge about foot care to prevent foot complications, especially foot ulcers and amputations. However, no program about foot care has been provided to the patients in the author's clinical setting.

There are a lot of evidence-based guidelines on diabetic foot care education or diabetic foot care management for patients with type 2 diabetes available. Nevertheless, nurses working at the hospital have never implemented the guidelines. They have limited resources and knowledge on evidence-based practice and standard practice. Nurse practices are only based on their own knowledge, experiences, and the doctor's prescriptions. In this situation, the author needs to find an appropriate guideline on a foot care that is applicable to the setting. As a result, this setting will have a foot care program to prevent foot ulcers and amputations so that the diabetic and foot ulcers patients will get better foot care.

Therefore, the author would like to review the best available evidence and summarize the contents regarding foot care among this group of patients.

1.3 Purpose of the study

The purpose of this study is to summarize current evidence-based guidelines on foot care among patients with type 2 diabetes.

1.4 Expected benefits of the study

1.4.1 The recommendations regarding diabetic foot care from the available evidence will be concluded in order to develop an effective foot care program for Bangladeshi patients with type 2 diabetes.

1.4.2 Nurses in the clinical setting will have an appropriate evidence-based foot care program to more effectively provide care to patients with type 2 diabetes in Bangladesh.

CHAPTER II

METHODOLOGY

In this chapter, search strategy including search framework and scope of searching will be described in details following with method and principle to appraise the quality and levels of evidences. Details of the methodology are described below.

2.1 Search Strategy

The author searched and selected evidences to promote foot care in patients with type 2 diabetes by using the PICO framework (Melnyk & Fineout-Overholt, 2005).

2.1.1 Search framework

By using the PICO framework, the author searched and selected evidence to improve patients' knowledge and practice on foot care to prevention and management of diabetic foot ulcers through foot care among patients with type 2 diabetes which details bellow:

P (Population) = patients with type 2 diabetes

I (Intervention) = foot care

C (Comparison) = usual care

O (Outcome) = prevention and management of diabetic foot ulcer

2.1.2 Scope of searching

Evidence-based guidelines on foot care to prevent and manage diabetic foot ulcer for patients with type 2 diabetes were searched by using PICO framework and relevant key words to find out the best available evidences.

1) The keywords used in the search according to the PICO format

P (Population) = patients with type 2 diabetes /type 2 diabetes/ type 2 diabetes mellitus/diabetes mellitus type 2 /type 2 diabetic patients.

I (Intervention) = foot care/foot care program/foot examination /foot screening/ foot care course/foot care education/foot ulcer management/foot ulcer prevention program/ foot ulcer prevention education/ preventable ulcers/no further complications.

C (Comparison) = none.

O (Outcome) = prevention and management of diabetic foot ulcers.

For find out related evidences, the author selected scope by following PICO framework and made search by relevant key words which help to gets relevant evidences. The author used “Boolean operator” as a searching technique. For each PICO element, the author used different synonyms and linked the terms with “OR”, then located citations that are relevant to all the PICO elements by linking with “AND”.

2) The databases/sources used for the search

The author used electronic databases of Mahidol University library system and expected to get available guidelines on foot care included PubMed, Wiley online library and ScienceDirect, [www. guideline. gov](http://www.guideline.gov), and Institute for Health and Care Excellence websites specially for guidelines.

3) Type of evidence

The author searched and selected best available guidelines published in English from 2004 to 2014.

2.2 Appraisal method and levels of evidence

A clinical practice guideline is developed to help health care providers and patients about appropriate health care for specific health problem that helps to develop health policy to cover health promotion, screening, diagnosis, and management. The Appraisal of Guidelines for Research & Evaluation (AGREE II) is one of the best

instruments for appraised any guideline to assess the guideline quality, internally and externally validity and feasibility for practice, judgments of methodology, and components of the final recommendations. AGREE II is composed by 6 quality domains including 23 items. For evaluation of whole guideline, it has scoring system. Each item carry score range from 1-7; while item hold 1 score, it indicates strongly disagree and score 7 mentions strongly agree with the items. Each domain captures a unique dimension of guideline quality as follows (Brouwers et al., 2009).

Domain 1: Scope and purpose

In this domain describe how to justify the scope and purpose of a guideline included the overall aim, health questions, and the target population of the guideline. This domain consist items no 1-3. The items included;

1. The overall objective(s) of the guideline is (are) specifically described.
2. The health question(s) covered by the guideline is (are) specifically described.
3. The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.

Domain 2: Stakeholder involvement

In this part explain about the stakeholder involvement for example, funding, developer agency and body which composed 3 items (items 4-6) included;

4. The guideline development group includes individuals from all the relevant professional groups.
5. The views and preferences of the target population (patients, public, etc.) have been sought.
6. The target users of the guideline are clearly defined.

Domain 3: Rigour of Development

Accuracy of Development relates to gather and synthesize the evidence, the methods to formulate the recommendations, and to update them which made 8 items (items 7-14) were included;

7. Systematic methods were used to search for evidence.

8. The criteria for selecting the evidence are clearly described.
9. The strengths and limitations of the body of evidence are clearly described.
10. The methods for formulating the recommendations are clearly described.
11. The health benefits, side effects, and risks have been considered in formulating the recommendations.
12. There is an explicit link between the recommendations and the supporting evidence.
13. The guideline has been externally reviewed by experts prior to its publication.
14. A procedure for updating the guideline is provided.

Domain 4: Clarity of Presentation

In this area highlight about clarity of presentation included language, structure, and format of the guideline, consist by 3 items (items 15-17) were included;

15. The recommendations are specific and unambiguous.
16. The different options for management of the condition or health issue are clearly presented.
17. Key recommendations are easily identifiable.

Domain 5: Applicability

Domain 5 stated about applicability of guideline such as barriers and facilitators to implementation, strategies to improve uptake, and resource implications of applying the guideline. It has 4 items (items 18-21) were consist;

18. The guideline provides advice and/or tools on how the recommendations can be put into practice.
19. The guideline describes facilitators and barriers to its application.
20. The potential resource implications of applying the recommendations have been considered.
21. The guideline presents monitoring and/ or auditing criteria.

Domain 6: Editorial Independence

In this part explain about editorial independence is concerned with the formulation of recommendations not being unduly biased with competing interests and consist 2 items (items 22-23) were composed;

22. The views of the funding body have not influenced the content of the guideline.

23. Competing interests of guideline development group members have been recorded and addressed.

CHAPTER III

FINDINGS

In this chapter, the search results and summary of evidence are described in order to elaborate the structure and components of the intervention regarding effective foot care for patients with type 2 diabetes to prevent foot ulcers and amputations. The details are described as follows:

3.1 Search results

The samples of evidence-based practice were searched from different databases and websites through the Mahidol University Library system for selecting the best available guidelines on foot care for patients with type 2 diabetes. The author searched PubMed, CINAHL, Science Direct and www.guideline.gov websites for available samples of evidence-based practice published from 2004 to 2014. A total of 33 guidelines were primarily selected based on titles and abstracts. After reading each article as well as the details for the selection and elimination of the samples of evidence-based practice, 12 guidelines were finally selected for inclusion in the study composed of 4 international guidelines, 7 national guidelines and 1 consensus statement. All of the selected guidelines were focused on foot care for patients with type 2 diabetes. The reason for exclusion of some guidelines were inadequate details for foot care. Other guidelines were rejected for their development agency. Therefore, only 12 guidelines were selected for the purpose of this study. All of the collected guidelines were appraised by using the AGREE II instrument. Table 3.1 lists the 12 guidelines yielded by the search.

Table 3.1 - Samples of evidence-based practice presented guidelines by authors, year of publication, title, and type of evidence-based practice

No	Author/Year	Title of Evidence-Based Practice Guidelines	Type of Evidence
1.	Bakker, K., Apelqvist, J., & Schaper, N. C./2012	Practical Guidelines on the Management and Prevention of the Diabetic Foot 2011.	International guideline.
2.	Bowering, K. & Embil, J. M./2013	Clinical Practice Guidelines: Foot Care.	Canada national guideline.
3.	IDF Clinical Guidelines Task Force./2012a	Global Guideline for Type 2 Diabetes.	International guideline.
4.	The American Diabetes Association (ADA)./2014	Executive Summary: Standards of Medical Care in Diabetes – 2014.	US national guideline.
5.	Diabetes Australia./2012	Diabetes Management in General Practice: Guidelines for Type 2.	Australia national guideline.
6.	Pinzur, M. S., Slovenkai, M. P., Trepman, E. & Shields, N. N./2005	Guidelines for Diabetic Foot Care: Recommendations Endorsed by the Diabetes Committee of the American Orthopaedic Foot and Ankle Society.	International guideline.
7.	Agency for Healthcare Research and Quality (AHRQ)./2013	Standards of Medical Care in Diabetes. VI; Prevention and Management of Diabetes Complications.	US national guideline.
8.	Steed, D. L., Attinger, C., Brem, H., Colaizzi, T., Crossland, M., Franz, M., . . . Wiersma-Bryant, L./2008	Guidelines for the Prevention of Diabetic Ulcers.	US national guideline.
9.	Amod, A., Ascott-Evans, B. H., Berg, G. I., Blom, D. J., Brown, S. L., Carrihill, M. M., . . . Young, M./2012	The 2012 SEMDSA Guideline for Management for Type 2 Diabetes.	South Africa national guideline.
10.	McInnes, A., Jeffcoate, W., Vileikyte, L., Game, F., Lucas, K., Higson, N., . . . Anders, J./2011	Foot Care Education in Patients with Diabetes at Low Risk for Complications: A Consensus Statement.	Consensus statement.

Table 3.1 - Samples of evidence-based practice presented by authors, year of publication, title, and type of evidence-based practice (cont.)

No	Author/ Year	Title of Evidence-Based Practice	Type of Evidence
11.	International Diabetes Federation (IDF)./2012b	Global Guideline for Managing Older People with Type 2 Diabetes.	International guideline.
12.	National Institute for Clinical Excellence (NICE)./2004	Type 2 Diabetes Prevention and Management of Foot Problems.	UK national guideline.

3.1.1 Content summary of each sample of evidence-based practice

Evidence number: 1

Title: Practical guidelines on the management and prevention of the diabetic foot 2011.

Author/year: Bakker, K., Apelqvist, J., & Schaper, N. C./2012

Publication source: Diabetes Metabolism Research and Review.

Type of evidence: International Guideline.

Objectives: To create awareness with improved care and prevention of diabetic foot ulcers.

Main activities:

The main activities were as follows:

1. Foot inspection and examination were performed once for patients at risk, but high risk patients were required to visit a foot care clinic at 1–6-month intervals.

2. Foot risks were evaluated, including sensory neuropathy, foot deformities, bony prominences, peripheral ischemia, history of ulcers or amputation and non-sensory neuropathy.

3. Education was provided for patients and family members, including daily foot inspection, washing with warm water ($<37^{\circ}\text{C}$), drying, especially between the toes, avoiding barefoot walking, wearing shoes with socks and not using chemical agents or plasters to remove corns and calluses with inspection of the inside of shoes and avoidance of tight shoes with socks below the knees, maintenance of skin moisture by using oils or creams and daily sock changes.

4. Advice for appropriate footwear such as selecting footwear that is neither too tight nor too loose, independent selection, extra care during footwear fitting, especially for neuropathy, ischemia and foot deformity patients, sufficient space inside shoes and fitting shoes in a standing position. Also the end of the day is the perfect evaluation period. If the fit is too tight refer to special footwear, including insoles and orthoses.

5. Treatment of non-ulcerative pathology for high-risk patients, regular treatment for calluses, nails and skin by a foot care specialist. If possible, treat deformities by non-surgical procedures.

6. Refer the patients at high risk and those with foot ulcers to a multidisciplinary foot care team.

7. Principles of ulcer treatment

a) Relief of pressure and protection from ulcers; off-loading by contact casting, footwear, insoles and fitted shoes, non-weight bearing, limited standing, walking and use of crutches.

b) Restoration of skin perfusion by revascularization, pharmacological treatment, cessation of smoking, treatment of hypertension, dyslipidaemia and use of aspirin.

c) Treatment of infections, superficial ulcers with skin infections, cleansing, debriding all necrotic tissue and surrounding calluses and oral antibiotic therapy. For deep infections such as infected bones drain abscesses, use arterial revascularization, remove necrotic tissue by surgical drainage and prescribe a broad-spectrum antibiotic therapy through an intravenous route.

d) Metabolic control and treatment of co-morbidity, optimal blood glucose level and edema with malnutrition correction by treatment.

e) Local wound care: wound inspection, debridement, moist environment, negative pressure and dressing.

f) Education for patients and relatives.

g) Discover the cause and prevent recurrence.

Evidence number: 2

Title: Clinical practice guidelines: Foot care.

Author/ year: Bowering, K. & Embil, J. M./2013

Publication source: Canadian Journal of Diabetes.

Type of evidence: Canadian national guideline.

Main activities:

1. Foot examinations to identify persons at risk for ulceration once a year.

For patients at risk, however, examine the feet more frequently to assess any changes in skin and abnormal structural changes, including the range of motion for ankles and toe joints, the shape of calluses, deformities in the bones, temperature of the skin, neuropathy and PAD evaluation, evaluation of ulcerations and infections.

2. The University of Texas wound classification system was used as the risk assessment tool.

3. For high risk patients, foot care education was provided with well-fitted footwear and early referrals to foot care specialists for management of foot complications.

4. Wound management by dressing: create a moist wound environment and remove necrotic tissue by debridement with relief of pressure from the ulcerated areas.

Evidence number: 3

Title: Global guideline for type 2 diabetes.

Author/ year: IDF Clinical Guidelines Task Force./2012

Publication source: International Diabetes Federation. Retrieved April 21th, 2014, from: <http://www.idf.org/webdata/docs/IDF%20GGT2D.pdf>.

Type of evidence: International guideline.

Main activities:

1. Annual foot assessment, including history of ulceration or amputation, foot deformity, footwear, neuropathy, ischemia and foot pulses.

2. Discuss the importance of foot review and education with patients.

3. Provide foot-care education according to patient needs and risks for ulcer and amputation.

4. Manage according to risk level; if patients have no risk, perform foot inspection, correct footwear and provide foot-care education. If, however, patients are at risk, teach about how to inspect foot, select appropriate footwear, vascular assessment and educate on accurate foot care processes.

5. Foot ulceration or infection: Refer foot ulcer patients to the multidisciplinary foot-care team within 24 hours for the following:

a) Appropriate ulcer management by dressing and debridement.

b) Classification of infection includes mild, moderate and severe levels as well as treatment with systemic antibiotics.

c) Assessment of osteomyelitis.

d) Reduce pressure by using crutches, resting and casting.

e) Identify the causes of vascular insufficiency and treat accordingly.

f) Provide orthopedic care for insoles and select proper footwear by specialists. After wound recovery, discuss the prevention of recurrence.

g) Control blood glucose at an optimal level.

Evidence number: 4

Title: Executive summary: Standards of medical care in diabetes–2013.

Author/ year: American Diabetes Association (ADA)./2014

Publication source: Diabetes Care.

Type of evidence: US national guideline.

Main activities:

1. Identification of risks by inspection, foot pulse and testing for loss of protective sensation (LOPS) by annual foot examinations for all diabetes patients.

2. Foot care education about foot self-examination for all diabetes patients.

3. Refer patients with a history of prior ulcers or amputation, smokers, loss of protective sensation (LOPS), abnormal foot structures and history of complications in the lower limbs to a multidisciplinary foot-care team to prevent complications.

4. Identify the patients who have claudication history for primary selection to assess peripheral arterial disease and evaluate pedal pulses.

5. If claudication is in the advanced stages, refer to a specialist for vascular assessment and consider exercise, medications and surgical options.

Evidence number: 5

Title: Diabetes management in general practice guidelines for type 2.

Author/ year: Diabetes Australia./2012

Publication source: Diabetes Australia. Retrieved April 20th, 2014, from <http://www.diabetesaustralia.com.au/Documents/DA/Publications/13.04.08%20DMiG%20Web%20Version.pdf>

Type of evidence: Australian national guideline.

Main activities:

1. Foot care every six months to identify the factors causing vulnerability to developing complications, including reduced circulation or sensation, structural changes in the feet, poor hygiene, foot care and footwear.

2. High risk patients were reviewed by a podiatrist.

3. Education and supervision.

4. Abnormal structure, neuropathy, vascular disease or deformity patients should be referred to a specialist as soon as possible.

5. Refer patients with vessel disease, both small and large nerve damage and mechanical instabilities, injury and infection to a multidisciplinary foot-care team.

6. A podiatrist is useful for assessing foot structure.

7. If vascular disease exists, avoid surgical intervention.

8. Ulcer management:

a) Superficial ulcers: keep moist and minimize pressure.

b) Deep ulcers or cellulites: hospitalization and bed rest.

c) Ulcers should be managed with the following key points: If neuropathy or/and vascular issues are problems for the patients, send them to endocrine and surgical specialists, swab for culture and sensitivity, identify boney connections by X-ray, select proper antibiotics such as amoxicillin/potassium clavulanate/metronidazole plus cephalexin. Pus should be drained immediately with post-operative irrigation of wounds, control blood-glucose levels, proper education about footwear and reassessment, removal of excess calluses, minimal pressure and

redistribution of weight with casting if no infection is present and the ulcer is superficial.

Evidence number: 6

Title: Guidelines for diabetic foot care: Recommendations endorsed by the diabetes committee of the American orthopedic foot and ankle society.

Author/year: Pinzur, M. S., Slovencik, M. P., Trepman, E. & Shields, N. N./2005

Publication source: Foot Ankle International.

Type of evidence: International guideline.

Main activities:

1. Screening for risk factors: peripheral neuropathy, pedal pulses, including skin changes, changes in toenails, color changes in the skin, claudication, leg pain, amputation, foot ulcers, previous history of hospitalization with foot infections, deformity, peripheral edema and skin temperature changes.

2. Foot examination: history, skin examination, deformity and vascular examination.

3. Footwear: size, shape, toe box, daily inspection.

4. Patient education.

5. Nail care: Use of commercial straight nail clippers and trimming the nails transversely.

6. Basic treatment guidelines using the American Academy of Orthopedic Surgeons of 1995, including the following:

a) Risk Category 0: foot education, yearly examination, normal footwear.

b) Risk Category 1: daily self-examination of the foot, patient education, pressure litter and non-custom insoles, appropriate footwear and follow-up every 6 months.

c) Risk Category 2: carefully self-examination of the foot every day, patient education, Custom-fabricated pressure-dissipating accommodative foot orthoses, shoes should be made by soft-leather, evaluation for any new pathological change in skin or nail, follow-up every 4 months.

d) Risk Category 3: careful foot self-examination each day, scheduled clinical examination, patient education, custom fabricated pressure reducing accommodative foot orthoses, used soft leather shoes, checkup every 2 months, immediate clinical evaluation for any new onset pathological change skin or nail, consideration of evaluation by orthopaedic specialist.

7) Ulcer care should include;

- a) Removed callus.
- b) Thick callus, death tissue, and infection should remove by debridement.
- c) Small ulcers should be managed by combined dry and moist dressing.
- d) Larger ulcers; dressings, antibiotic ointments, topical medications, total contact cast.
- e) Deeper ulcers with osteomyelitis; surgical debridement.
- f) If osteomyelitis present surgical debridement must be considered.
- g) If pedal pulse absent, refer the patients to vascular specialist.
- h) If infections are present, antibiotics should be used.

Evidence number: 7

Title: Standards of medical care in diabetes. VI. Prevention and management of diabetes complications.

Author/ year: Agency for Healthcare Research and Quality (AHRQ)./2013

Publication source: Diabetes Care. Retrieved May 2nd, 2014, from <http://www.guideline.gov/content.aspx?id=45154>

Type of evidence: USA national guidelines.

Main activities:

1. Annual comprehensive examination of the foot includes foot inspection, foot pulses should be assessment, and loss of protective sensation should be tested (LOPS).

2. Foot care education.

3. Refer multidisciplinary team: High risk foot, history of ulcers or amputation, smoke, protective sensation loss (LOPS), and abnormal foot structural.
4. For assessment of peripheral arterial disease (PAD) find out the history of claudication, examine pedal pulses, and measure and evaluate ankle-brachial index (ABI).
5. If claudication or a positive ABI: Refer to vascular specialist for further vascular assessment.

Evidence number: 8

Title: Guidelines for the prevention of diabetic ulcers.

Author/ year: Steed, D. L., Attinger, C., Brem, H., Colaizzi, T., Crossland, M., Franz, M., . . . Wiersma-Bryant, L./2008

Publication source: Wound Repair and Regeneration.

Type of evidence: International guidelines.

Main activities:

1. Identification of the complications encountered in diabetes patients by
 - a) Palpable pedal pulses.
 - b) Color duplex ultrasound scanning to confirm atherosclerotic occlusive disease.
 - c) Neuropathy assessment.
 - d) Examination any foot deformities.
 - e) Evaluation of symmetric sensory level, and
 - f) Observation of laboratory values including glucose and HbA1c.
2. Foot examinations: annual foot exams should include examination of any deformities, abnormal skin, changes in nails, sensation loss, foot pulse and shoes as well as examination for callus formation and fungal toenails.
3. Surgery to prevent ulcerations: removal of calluses.
4. Proper footwear to prevent foot ulcers.
5. Good foot care: daily inspection of the feet.
6. Patient education to prevent foot ulcers.

Evidence number: 9

Title: The 2012 SEMDSA guideline for management for type 2 diabetes.

Author/year: Amod, A., Ascott-Evans, B. H., Berg, G. I., Blom, D. J., Brown, S. L., Carrihill, M. M., . . . Young, M./2012

Publication source: Journal of Endocrinology, Metabolism and Diabetes of South Africa.

Type of evidence: South Africa national guideline.

Main activities:

1. General prevention measurement as follows:

- a) Control of blood glucose, blood pressure and cholesterol.
- b) Cessation of smoking.
- c) Daily inspection and examination of feet and shoes.
- d) Provision of education for patients and family members.
- e) Treatment of non-ulcerative and ulcerative feet.

2. Regular inspections of the shoes as follows:

- a) Accurate length and width.
- b) Sufficient space for toes.
- c) Smooth line.
- d) Flexible sole.
- e) Heels less than 4 cm high, and
- f) Avoidance of skid full shoes and slippers.

3. Regular examination of the feet, including assessment of the foot skin, bones, nerves and vasculature.

4. Risk stratification and follow-up: examine and classify the following foot risks:

- a) Category 0-No sensory neuropathy and no PAD: examine once annually.
- b) Category 1-Sensory neuropathy present, but no foot deformity or PAD: examine at six-month intervals.
- c) Category 2-Sensory neuropathy and signs of foot deformity and PAD: Present to a foot care clinic for evaluation for every three months.

- d) Category 3-Previous ulceration or amputation patients: check-ups at 1-3-month intervals.
- 5. Provide patients and families with information regarding foot care.
- 6. Foot ulcer management:
 - a) Investigate the causes of foot ulcers such as inappropriate shoes.
 - b) Classify wounds by using the University of Texas grading system.
 - c) Ulcer treatment includes releasing pressure.
 - d) Return skin perfusion by arterial revascularization; treatment for hypertension, dyslipidaemia and smoking.
 - e) Control glucose levels and treatment of co-morbidities such as edema and malnutrition.
 - f) Treatment of infections-If ulcers are superficial then manage by debridement and oral antibiotics; for deep infection, manage by surgical drainage and broad-spectrum antibiotics.
 - g) Provide local wound care by wound inspection, debridement, and dressings. For foot infection and infected ulcers, the following measures are required: non-antimicrobial treatment including consultation with a specialist, correction of any metabolic derangements and hospitalization for patients with severe infections. In severe infections, consult appropriate specialists for antimicrobial therapy based on wound condition.
 - h) Provide therapy for osteomyelitis management by surgery and send for microbiology and culture with histology examination.

Evidence number: 10

Title: Foot care education in patients with diabetes at low risk for complications: A consensus statement.

Author/ year: Mc Innes, A., Jeffcoate, W., Vileikyte, L., Game, F., Lucas, K., Higson, N., Anders, J./2011

Publication source: Diabetic Medicine.

Type of evidence: Consensus statement.

Main activities:

Four key educational priorities emerged for low-risk patients:

1. Foot evaluation once a year.
2. Proper control of blood glucose levels.
3. Daily foot examinations.
4. Immediate reports of any changes occurring.

Evidence number: 11

Title: Global guideline for managing older people with type 2 diabetes

Author/year: International Diabetes Federation (IDF)./2012

Publication source: International Diabetes Federation. Retrieved April 20th, 2014 from <http://www.diabetesblog.gr/wp-content/uploads/2014/02/IDF-Guideline-for-older-people-T2D.pdf>

Type of evidence: International guideline.

Main activities:

1. Visual inspection, especially at abnormal pressure, infection or ulceration sites.

2. Annual foot examinations, including evaluation of foot pulses and neuropathy assessment.

3. Doppler-measured ankle-brachial pressure to identify ischemia.

4. Classification of the risks for ulcer or amputation such as no risk, at risk, and high risk.

5. Care plan based on risk level as follows:

a) Patients without risk require foot care education and foot examination by health care personnel once a year.

b) At risk patients require follow up visits at 6-month intervals for foot examination and footwear with education for patients and relatives.

c) High-risk patients require frequent examination every 3-6 months, proper footwear, vascular assessment and education on foot care for both patients and family members.

6. Refer patients with ulcers and wound infections to a multidisciplinary team.

7. Provide foot care education to patients' family, and caregivers. Inform patients and their families to perform daily foot inspection.
8. Manage foot ulcer and infection patients as follows:
 - a) Patients should be referred to a foot ulcer specialist within 24 hours for debridement, reduced pressure and infection control.
 - b) X-ray for osteomyelitis, gas formation, foreign bodies and fracture identification.
 - c) Biopsy to identify ulcer nature.
 - d) Classify infection as mild, moderate or severe and select an antibiotic based on the severity in order to effectively control infection.
 - e) Use and follow weight bearing procedures for pressure relief, including crutches, rest, casts, walkers, shoes and orthotics.
 - f) Exploration and appropriate action for vascular insufficiency.
 - g) Maintain blood sugar at an optimal level.
 - h) After wound healing, discuss footwear and orthotic care, e.g., insoles to prevent ulcer recurrence.

Evidence number: 12

Title: Type 2 diabetes prevention and management of foot problems.

Author/ year: National Institute for Clinical Excellence (NICE)./2004

Publication source: Royal College of General Practitioners. Retrieved May 7th, 2014, from <http://www.nice.org.uk/nicemedia/live/10934/29241/29241.pdf>

Type of evidence: UK national guideline.

Main activities

1. Monitor and examine the foot once in a year as follows:
 - a) Regular visual inspection: assessment of foot sensation and palpation of foot pulse.
 - b) Examination of patients' feet such as foot sensation, foot pulses, foot deformity and footwear.
2. Encourage self foot inspection and monitoring.
3. Classify foot risks.

4. Activities to minimize risks as follows:

- a) Care for current low risk patients, improve knowledge, encourage self-care, avoid inadvertent self-harm and offer education about foot care.
- b) Care for increased risk patients at each review-foot inspection: vascular assessment, footwear evaluation, foot care education, refer risk patients to a foot protection team, organization of a foot care program and review every 3–6 months by a foot care specialist.
- c) Care for high risk patients: refer high risk patients to a foot care team.
- d) Organized regular foot evaluation program every 1–3 months by a group of specialists and review each foot inspection performed, perform vascular assessment, provide education about foot care, suggest special footwear and insoles based on situations with skin and nail care.
- e) Arrangement of special foot care program for disabilities or immobility patients.

5. Refer to the multidisciplinary foot care team immediately if foot ulcers or any abnormalities are present.

Summary of the evidence appraisal:

All of the selected guidelines were appraised by using the AGREE II instrument composed of six domains with 23 items. Each guideline was read thoroughly and appraised based on validity, reliability and applicability. With regard to validity, emphasis was placed on the rigor of the guideline development process, the clarity of the recommendations and the expected outcomes and benefits of the guidelines. Reliability was measured by the members of the development body, objectives, development authority, funding agency and the implementation of the samples of evidence-based practice. Applicability was measured by matching with the setting conditions, resource availability and abilities of the health care providers implementing the guidelines with the acceptance of patients and families. After the author performed guideline appraisal, the appraisal results were confirmed with the author's thesis advisor in order to receive approval. The results of the appraisal

revealed that all of the guidelines were relevant for foot care, demonstrated scientific merit and are applicable to clinical practice.

3.2 Conclusion

The following conclusions can be drawn from the above samples of evidence-based practice:

3.2.1 Brief summary of all evidence-based practice

Nearly every guideline suggested that all diabetic patients require annual foot examinations. Three guidelines recommended that patients at risk should be encouraged to visit foot care clinics regularly. Ten guidelines emphasized patient and family education on foot care. “Using appropriately fitted shoes” was recommended by nine guidelines. Patients at risk were referred to multidisciplinary foot care teams in seven guidelines. Other recommendations were regular foot inspections, callus removal by specialists, ischemia diagnosed by Doppler and sensory tests done by a 10-g monofilament, vascular assessment performed by vascular staff, self-monitoring, special foot care programs for people with disabilities or immobility and control of blood glucose levels. Among two widely accepted wound classification systems, the author selected the University of Texas Wound Classification System as an ulcer measuring instrument because it was focused on ischemia. The Practical Guidelines on the Management and Prevention of the Diabetic Foot of 2011 by Bakker et al. were selected as the main guideline. Finally, it can be concluded that multidisciplinary foot care teams for systematic foot care programs offer effective ways of detecting foot abnormalities and helping reduce foot complications as well as foot ulcers and amputations.

3.2.2 Recommendations of selected guidelines:

From the above twelve guidelines developed by expert consensus based on the best available samples of evidence-based practice and published in English from 2004-2014, diabetic foot care recommendations for patients with type 2 diabetic were offered as measures for prevention, early detection and early treatment for both no-risk

and at-risk patients. The main objectives of these guidelines emphasized prevention, early detection of new ulcers and prevention of limb amputation. The main activities synthesized from the guidelines are presented as follows:

1. Foot examination (ADA, 2014; AHRQ, 2013; Bakker et al., 2012; Bowering & Embil, 2013; Diabetes Australia, 2012; IDF, 2012a & IDF, 2012b; McInnes et al., 2011; NICE, 2004 & Steed et al., 2008). Foot examination is recommended to detect foot problems and identify risks. The following activities should be included in foot examinations:

1.1 Thorough foot inspection (Bakker et al., 2012; NICE, 2004; Pinzur et al., 2005).

1.2 Asking if patients have a history of ulcers or amputation (Bakker et al., 2012; IDF, 2012a; Pinzur et al., 2005) and hospitalization (Pinzur et al., 2005).

1.3 Performing foot skin examinations (Bowering & Embil, 2013; NICE, 2004; Pinzur et al., 2005; Steed et al., 2008).

1.4 Looking for deformities in foot contour or any deviation (Bakker et al., 2012; Bowering & Embil, 2013; Diabetes Australia, 2012; IDF, 2012a; NICE, 2004; Pinzur et al., 2005, Steed et al., 2008).

1.5 Examination of position while patients are lying down and standing up (Bakker et al., 2012).

1.6 Vascular assessment (ADA, 2014; Bakker et al., 2012; Bowering & Embil, 2013; NICE, 2004; Pinzur et al., 2005).

1.7 Proper foot pulse palpation (ADA, 2014; AHRQ, 2013; Bakker et al., 2012; McInnes et al., 2011; NICE, 2004; Pinzur et al., 2005; Steed et al., 2008).

1.8 Examination and assessment of foot calluses (Bowering & Embil, 2013; Steed et al., 2008).

1.9 Foot sensation testing (ADA, 2014; AHRQ, 2013; NICE, 2004; Steed et al., 2008).

1.10 Neuropathy assessment by a specialist (Bakker et al., 2012; Bowering & Embil, 2013; Diabetes Australia, 2012; IDF, 2012a; IDF, 2012b; Pinzur et al., 2005; Steed et al., 2008).

1.11 Assessment of leg pain and checking for lower extremity edema (Pinzur et al., 2005).

1.12 Taking history for identification of claudication (ADA, 2014; Pinzur et al., 2005).

1.13 Evaluation of laboratory values such as blood glucose, cholesterol (Steed et al., 2008).

1.14 If patients have risk factors for ulcers, they should be encouraged to come for follow-up visits every 1–6 months based on risk categories (Bakker et al., 2012; Diabetes Australia, 2012).

2. Foot wear (Amod et al., 2012; Bakker et al., 2012; IDF, 2012a; McInnes et al., 2011; Pinzur et al., 2005 & Steed et al., 2008).

Appropriate footwear should be chosen based on the following criteria:

2.1 The footwear should be neither too tight nor too loose (Bakker et al., 2012; Pinzur et al., 2005). If the shoes are too tight for the feet, refer to special footwear (Bakker et al., 2012; IDF, 2012a; McInnes et al., 2011).

2.2 Give priority to having patients select the shoes (Bakker et al., 2012).

2.3 Provide extra care during footwear fitting, especially in neuropathy, ischemia and foot deformity patients (Bakker et al., 2012).

2.4 The inside of the shoes should be 1-2 cm longer than the feet (Bakker et al., 2012).

2.5 Correct length and width is equal at the site of the metatarsal phalangeal joints (Bakker et al., 2012).

2.6 Check for smoothness of the shoe's lining and try to select seamless, flexible soles; avoid slippers (Amod et al., 2012).

2.7 The shoe's heels should be no higher than 4 cm (Amod et al., 2012; Bakker et al., 2012).

2.8 The feet should be examined carefully in a standing position; the end of the day is the perfect time for selecting footwear (Bakker et al., 2012).

3. Classify risk categories (Amod et al., 2012; Pinzur et al., 2005).

Diabetic feet are divided into different risk categories as follows:

3.1 Risk Category 0: Normal appearing foot, sensation, no sensory neuropathy or peripheral arterial disease (PAD) and minor deformity.

3.2 Risk Category 1: Normal appearing foot, sensory neuropathy present, but no foot deformity or PAD.

3.3 Risk Category 2: Sensory neuropathy and signs of foot deformity and PAD, but without presence or history of ulcers.

3.4 Risk Category 3: Insensate foot with deformity and history of ulcers, infections or amputation.

4. Risk assessment tools (Amod et al., 2012; Bowering, & Embil, 2013).

The University of Texas Wound Classification System is the risk assessment tool recommended for use in diabetic patients (Amod et al., 2012; Bowering, & Embil, 2013).

5. Frequency of foot examination (Amod et al., 2012; Pinzur et al., 2005). Diabetic patients should have their feet examined once a year. If patients fall within any of the risk categories for feet, the intervals of foot examinations will depend on the risk categories. If patients meet the criteria for Risk Category 0, they should be encouraged to visit the clinic at least once annually. If risk patients meet the criteria for Risk Category 1, they should be encouraged to examine their feet twice a year. For Risk Category 2, the patients should be encouraged to follow up every three months and the patients who demonstrate signs and symptoms of Risk Category 3 need to visit the clinic for follow-up every two months for foot examination by a foot care specialist (Amod et al., 2012; Pinzur et al., 2005).

6. Patient education (ADA, 2014; AHRQ, 2013; Amod et al., 2012; Bakker et al., 2012; Bowering & Embil, 2013; Diabetes Australia, 2012; IDF, 2012b; McInnes et al., 2011; Pinzur et al., 2005 & Steed et al., 2008). Education for patients and their family members is an important part of foot care and should include the following:

6.1 Feet should be frequently inspected and examined daily by patients (Amod et al., 2012; Bakker et al., 2012; IDF, 2012b; McInnes et al., 2011; NICE, 2004; Steed et al., 2008).

6.2 During foot care, patients should learn the following:

- a) Feet should be washed and dried properly (Bakker et al., 2012).
- b) Patients should avoid walking barefoot (Bakker et al., 2012).
- c) Always wear shoes with socks (Bakker et al., 2012).
- d) Carefully inspect the inside of shoes before wearing (Amod et al., 2012; Bakker et al., 2012) and avoid tight shoes with below-knee socks (Bakker et al., 2012).
- e) Maintain skin moisture by using oils or creams (Amod et al., 2012; Bakker et al., 2012).
- f) Motivate patients to change socks daily to maintain dryness (Bakker et al., 2012).
- g) Encourage patients to select appropriate footwear (Bakker et al., 2012).
- h) Do not use chemicals or plaster for removed callus (Bakker et al., 2012).
- i) Always avoid tight shoes (Bakker et al., 2012).

7. Ulcer management (Amod et al., 2012; Bakker et al., 2012; Bowering & Embil, 2013; Diabetes Australia, 2012; IDF, 2012a; IDF, 2012b; Pinzur et al., 2005). Proper wound management is an effective procedure for healing ulcers and preventing amputation. Wound should be managed by different processes such as the following:

7.1 Relieve pressure from the wound area (Amod et al., 2012; Bakker et al., 2012; Bowering & Embil, 2013; Diabetes Australia, 2012; IDF, 2012a & IDF, 2012b) by using the following:

- a) Contact casting of the affected limb (Bakker et al., 2012; Diabetes Australia, 2012; IDF, 2012a; IDF, 2012b; Pinzur et al., 2005).
- b) Selection of proper footwear, insoles and fitted shoes to prevent re-ulcerations (Bakker et al., 2012; IDF, 2012a; IDF, 2012b).

- c) Advice for standing limitations (Bakker et al., 2012), and walking (IDF, 2012a; IDF, 2012b).
- d) Crutches should be used to prevent pressure on the wound area (Bakker et al., 2012; IDF, 2012a; IDF, 2012b).
- e) Keep the limbs in resting positions (Diabetes Australia, 2012; IDF, 2012a; IDF, 2012b).
- f) Redistribute weight from the affected limb (Diabetes Australia, 2012).

7.2 Restoration of skin perfusion should be done as follows:

- a) Revascularize to relieve pressure and increase circulation (Amod et al., 2012; Bakker et al., 2012).
- b) Pharmacological treatment should be administered (Bakker et al., 2012).
- c) Encourage cessation of smoking (Bakker et al., 2012).
- d) Treat hypertension, dyslipidaemia and use aspirin (Amod et al., 2012; Bakker et al., 2012).

7.3 Provide appropriate treatment for infection control (Amod et al., 2012; Bakker et al., 2012; Diabetes Australia, 2012; Pinzur et al., 2005).

- a) For superficial ulcers with skin infection, manage by cleansing and debriding all necrotic tissue and surrounding calluses. Recommend oral antibiotic therapy (Amod et al., 2012; Bakker et al., 2012) with combined dry and moist dressing (Pinzur et al., 2005).
- b) For ulcers with deep infections, remove necrotic tissue such as infected bone and drain abscesses by surgical drainage (Amod et al., 2012; Bakker et al., 2012), arterial revascularization and broad-spectrum antibiotic therapy through intravenous route (Amod et al., 2012; Bakker et al., 2012 & Pinzur et al., 2005), hospitalization (Amod et al., 2012; Diabetes Australia, 2012), If osteomyelitis is present, perform surgical debridement (Pinzur et al., 2005).

7.4 Encourage metabolic control and treatment of comorbidities (Bakker et al., 2012) by advise maintenance of blood glucose at optimal

levels (Amod et al., 2012; Bakker et al., 2012; Diabetes Australia, 2012; IDF, 2012a & IDF, 2012b).

7.5 Local wound care should be performed as follows:

a) Proper wound inspection (Amod et al., 2012; Bakker et al., 2012), and Appropriate wound debridement (Amod et al., 2012; Bakker et al., 2012; Bowering & Embil, 2013; IDF, 2012b; Pinzur et al., 2005).

b) Keep the wound environment moist (Bakker et al., 2012; Bowering & Embil, 2013; Diabetes Australia, 2012).

c) Apply negative pressure (Bakker et al., 2012; Diabetes Australia, 2012).

d) Properly dress the wound (Amod et al., 2012; Bakker et al., 2012; Bowering & Embil, 2013; IDF, 2012a; Pinzur et al., 2005).

7.6 Provide education for patients and relatives (Amod et al., 2012; Bakker et al., 2012; Diabetes Australia, 2012).

7.7 Discover the cause in order to solve the problem (Amod et al., 2012; Bakker et al., 2012; IDF, 2012a; IDF, 2012b) and prevent recurrence of the ulcers (Bakker et al., 2012; IDF, 2012a; IDF, 2012b).

7.8 Refer foot ulcer patients to a multidisciplinary foot-care team within 24 hours (IDF, 2012a; IDF, 2012b; NICE, 2004).

7.9 Assess osteomyelitis and take necessary actions (Amod et al., 2012; Diabetes Australia, 2012; IDF, 2012a; IDF, 2012b) to detect gas formation, foreign bodies and fractures (IDF, 2012b).

7.10 Refer neuropathy and vascular disease patients to a specialist for further evaluation (Diabetes Australia, 2012; Pinzur et al., 2005; IDF, 2012b).

7.11 Collect specimens from the wound area and send for culture and sensitivity testing (Amod et al., 2012; Diabetes Australia, 2012); biopsy (IDF, 2012b).

7.12 Immediately drain pus if there is abscess formation (Diabetes Australia, 2012).

7.13 Remove calluses properly (Diabetes Australia, 2012; Pinzur et al., 2005).

CHAPTER IV

CONCLUSION AND SUGGESTIONS

4.1 Conclusion

The incidences of diabetes are rising worldwide day by day and diabetic foot complications especially foot ulcers are also increasing comparatively with diabetes. Despite the progression of new medications and diabetic and foot care, the rate of diabetic foot ulcers has continued to increase, and this problem is the leading cause of lower limb amputation. In Bangladesh, there are limited health care facilities for diabetic and diabetic foot ulcers patients. Diabetic foot ulcers are treated as other usual ulcers. In author's setting, there are no any special foot care facilities for diabetic patients or diabetes specialist nurses. Evidence-based practice is therefore an important integration of scientific papers, clinical experience, and patients' performance, and it is now accepted and can be used to develop foot care knowledge and practice in order to improve quality of care, to increase patients' knowledge about foot care, to promote frequent foot care practice, to deliver proper wound care, to decrease amputation rates, and to reduce treatment cost as well as to reduce family burden, especially financial burden. As a result, evidence is useful for prevention of foot ulcers among patients with type 2 diabetes. The aim of this study was to summarize current evidence-based guidelines on foot care among patients with type 2 diabetes to increase knowledge and practice of foot care.

The author searched different databases and websites through the electronic Mahidol library system to select best available guidelines based on the PICO framework. Cumulative Index to Nursing and Allied Health (CINAHL), PubMed, and ScienceDirect Databases and www.guideline.gov website were used to search and select guidelines in this study. The keywords used in the search included "patients with type 2 diabetes," "type 2 diabetes," "type 2 diabetes mellitus," "diabetes mellitus type 2," "type 2 diabetic patients," "foot care," "foot care program," "foot examination," "foot screening," "foot care course," "foot care education," "foot ulcer

management,” “foot ulcer prevention program,” “foot ulcer prevention education,” “preventable ulcers,” and “no further complications.” The author used the Boolean operator in the search. For each of the PICO elements, the author selected synonyms by connecting the terms with “OR,” then located citations that were relevant to all the PICO elements by linking them with “AND.” After searching, the author found 33 relevant guidelines before reading the whole full texts of the guidelines retrieved. Finally, 12 pieces of guidelines that were relevant to the objective of the study were selected, while the other 18 guidelines were excluded.

Of the 12 selected guidelines, four were international guidelines, seven were national guidelines, and one was a consensus statement. The studies that were analyzed and synthesized in this study were published in the English language between 2004 and 2014. The results from the guideline synthesis have revealed that the main activities for foot care were the following: 1) assessment of feet including inspection and examination of the feet, 2) assessment of risks and classification of risks into different categories, 3) providing patients and family members with information about foot care, 4) selection and use of appropriate footwear, 5) nail care, 6) provision of advice to patients about blood glucose control, and 7) referring patients to the multidisciplinary healthcare team if there is any risk for peripheral arterial disease (PAD). These are essence of all twelve guidelines implemented in this study which have been approved by the experts. With sufficient foot care knowledge and practice, foot complications especially foot ulcers will be reduced and ulcers will be healed, and this can decrease lower limb amputations. To identify and classify the risks of ulcers, the University of Texas classification system was used.

It is recommended that the main activities of the foot care program should be developed on the basis of foot care for patients with type 2 diabetes. The author would like to implement the recommendations from the reviewed guidelines in the author’s clinical setting in Bangladesh. The following strategies should be considered when implementing this guideline. Distribution of the knowledge gained from this study is also suggested.

4.2 Suggestions

Based on the study findings, it is recommended that diabetic patients need to receive foot care. The implementation of foot care should be applied in the following criteria.

4.2.1 Implications for practice:

4.2.1.1 The guidelines on diabetic foot care should be developed using the recommendations derived from the aforementioned 12 guidelines.

4.2.1.2 The guidelines should be applied according to the context of clinical settings in Bangladesh. The resources used for providing foot care to the patients as well as the method to arrange the education should be modified to suit the clinical practice contexts.

4.2.1.3 The guidelines should be made simple and easy for nurses to practice it in a real situation.

4.2.1.4 The feasibility and effectiveness of the guidelines should be tested and confirmed by means of a pilot study.

4.2.1.5 Regular communication with all stakeholders should be conducted with monthly meetings and establishment of rapport with them.

4.2.1.6 A training program should be organized for nurses to equip them with necessary knowledge and skills on diabetic foot management as well as to raise their awareness of effective diabetic foot prevention.

4.2.1.7 The guidelines should be disseminated to personnel in all health care levels including Upazila health complex, District sador hospital, and medical college hospital.

4.2.1.8 The guidelines should be implemented into clinical practice for patients with diabetes type 2 in the author's clinical setting. All patients with diabetes type 2 should receive the care as follows: a) Foot examination in a year, b) Identification and classification of risks, c) Footwear, d) foot care education, e) Control of glucose level, f) Referring of at-risk patients to the multidisciplinary foot care team, g) Daily foot inspection, h) Immediate report, if any change occurs, i) Nail care, j) Self-monitoring and inspection, k) A special foot care program for patients with disabilities, and l) Management of wounds by means of the following: i) relief

pressure, ii) restoration of skin perfusion, iii) classification of infection, iv) treatment of infection, v) use of antibiotics, vi) metabolic control and treatment of co-morbidity, vii) local wound care, viii) education for patients and relatives, ix) assessment of osteomyelitis, x) treatment of vascular insufficiency and neuropathy, and xi) identification of causes and prevention of recurrences.

4.2.2 Implications for research

4.2.2.1 A pilot study should be conducted prior to application of the recommendations of foot care to prevent foot ulcers among patients with type 2 diabetes to ensure the feasibility, appropriateness, and effectiveness of the suggestions for the foot care program.

4.2.2.2 Research should be undertaken to assess the prevalence rates of foot ulcers after attaining the education program.

4.2.2.5 Research should be carried out to evaluate the change of knowledge on foot care and foot care practice after attaining a foot care program about foot care practice and regular visit to a foot care clinic.

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