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Nursing Interventions for the prevention of foot ulcers in adult diabetic inpatients

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Nursing Interventions for the prevention of foot ulcers in adult diabetic inpatients.

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Degree Programme in Nursing
Bachelor's Thesis
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Nursing Interventions for the prevention of foot ulcers in adult diabetic inpatients

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The purpose of this thesis is to describe the nursing interventions needed for the prevention of foot ulcers in adult diabetic inpatients. The research question was: 'What kind of nursing interventions are needed for the prevention of foot ulcers in adult diabetic inpatients?'

This thesis aimed to review what kind of nursing interventions are needed to prevent diabetic foot ulcers in adult inpatients. The importance of this study was to get accurate data, updated facts and a better understanding of previous and existing studies since there were little awareness and knowledge about diabetic foot ulcers and its preventions among adult inpatients. Therefore, it was significant to know the risk factors associated with diabetic foot ulcers, how it can be prevented and the clinical or non-clinical nursing interventions available.

A systematic literature review was used in this study, focusing on qualitative research methodology for the analysis of data. The data were collated from the Laurea academic electronic database. Three databases were used in this study, and these include CINAHL, SAGE and Science Direct. A literature search was conducted with these databases followed by the selection of data relevant to this study; selected articles were critically analyzed, and a total of 8 articles have been chosen.

The findings highlighted various nursing interventions needed for the prevention of diabetic foot ulcer amongst adult inpatients. These processes include routine foot examination, adequate wound dressing, glycemic control, effective antibiotic regimens, insulin medication, appropriate footwear and patient education such as self-care. Summarily, for the proper care of diabetic patients, nurses help in the delivery of holistic and adequate patient education with the intention to prevent the incidence, associated-infections, and recurrence of diabetic foot ulcer in adult inpatients.

Keywords: Nursing Interventions, Diabetes Inpatients, Diabetic foot ulcer, Prevention.

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1 Introduction

As with other forms of diabetes, people with diabetes mellitus (DM) are prone to developing various types of physiological and neurological complications resulting from their constant hyperglycemia, with foot injuries being the major and most common cause of hospitalization. The presence of infections, ulcerations, and destruction of soft tissues associated with neurological disorders or peripheral artery disease in the lower limbs define a pathophysiological condition called diabetic foot (American Diabetes Association, 2015; Sinwar, 2015).

According to the International Diabetes Federation IDF (2016), there are about 285 million adults with diabetes in 2010 worldwide, and this number is estimated to rise in the future. The number of people who are being diagnosed with type 1 or type 2 diabetes is increasing rapidly, with current estimates suggesting that 220 million people worldwide have diabetes (Ali et al. 2012). Fujiwara, Y et al. (2011) already predicted that if the current trend as at that time continued, at least 366 million people worldwide would have been diagnosed with diabetes by the year 2030. In the UK alone, three million people are known to have diabetes (Diabetes UK 2013), but there may be around one million people who have the condition but are yet to receive a formal diagnosis (NHS Choices 2012). The prevalence of diabetes is set to rise globally from 2.8% in 2000 to 4.4% in 2030, which means that 366 million people will be affected (Fujiwara, Y et al. 2011).

This thesis aims to review what kind of nursing interventions are needed to prevent foot ulcers in adult inpatients, it enumerates nursing interventions related to the topic and consequently serves as a useful resource for nursing students, nurses, and front-line health professionals about evidence-based nursing interventions needed in the prevention of diabetic foot ulcers in adult diabetic inpatients. To achieve the above aim, it was important to underscore the risk factors for diabetic foot ulcers, how it can be prevented and the nursing interventions needed. The findings of this work may assist in acquiring more knowledge and proffering various solutions in managing and preventing diabetic foot ulcers.

2 Diabetes

According to Deshpande, Harris-Hayes, & Schootman (2008), Diabetes mellitus is a metabolic condition that causes elevated blood glucose levels that result from an inability to produce insulin and resistance to insulin absorption). In 2011, the CDC (Centres for Disease Control and Prevention) stated diabetes as a leading contributor to premature mortality in the United States amongst other noncommunicable diseases. Diabetes affects major organ systems through its effects on the micro and macro vascular structures. The most common organ-specific complications cause retinopathy, neuropathy, and nephropathy. Diabetes mellitus is a chronic disorder characterized by high blood glucose level (pre-and post meals) and either

insufficient or ineffective insulin. When diabetes is not well treated or managed, it results in different serious complications such as cardiovascular disease, Nerve damage (neuropathy), kidney damage (nephropathy), eye damage (retinopathy), foot ulcer and damage to skin integrity, hearing impairment and Alzheimer's disease (CDC 2011).

2.1 Risk factors for diabetes

The risk factors for diabetes include obesity, dietary changes, smoking, genetic influences, physical inactivity, sedentary lifestyle, family history with diabetes mellitus, elevated blood pressure ($\geq 140/90$ mmHg) or being treated for hypertension, polycystic ovary syndrome, and history of diabetes mellitus during pregnancy. Central obesity and sedentary lifestyles are the biggest risk factors for type 2 diabetes; obese individuals are five times more likely to develop the condition (Public Health England, PHE. No date). There is concern that dietary habits are changing and the globalization of fast foods, high-fat and high-sugar processed foods are eroding traditional dietary habits and therefore reducing the benefits the Mediterranean diet can confer (Salas-Salvadó et al. 2011).

Smoking is a risk factor for type 2 diabetes; it has been shown to impair insulin secretion in men who did not have diabetes (Morimoto et al. 2013). It had been suggested that there is a 40% risk of children developing type 2 diabetes as adults if one parent has the condition. This risk increases to 70% if both parents have it (Majithia & Florez 2009).

2.2 Types of diabetes

There are three most common Types of diabetes, which are type 1 diabetes (T1D), type 2 diabetes (T2D) and gestational diabetes mellitus (GDM). Type 1 diabetes is the most common and severe metabolic disorder in childhood, and the incidence increases with age until puberty (Craig et al. 2009). Autoimmune destruction of the beta cells, leading to absolute insulin deficiency, is a characteristic of type 1 diabetes. Type 1 diabetes is an autoimmune condition mediated by genetic, immunologic and environmental factors. In type 1 diabetes, hyperglycemia occurs as a result of lymphocytic infiltration of pancreatic cells in the Islet of Langerhans causing the beta (β) cells to be destroyed, resulting in people affected being dependent on exogenous insulin for survival (Gan et al. 2012; Forbes and Cooper, 2013).

According to American Diabetes Association (2006), Abnormalities resulting in resistance to insulin action and subsequent beta cell insufficiency, mainly caused by obesity and a sedentary lifestyle, are the main causes of type 2 diabetes. Type 2 diabetes, is a disease that is characterized by an inability to produce or efficiently use insulin. Abbatecola & Paolisso (2009), argued that almost half number of people that are over 65 years old are diagnosed with diabetes type 2. Type 2 diabetes, accounting for 90% of the cases of diabetes, is a chronic disease with significant personal and social implications. Also, type 2 diabetes is associated with significant early mortality and an increasingly high level of morbidity, especially in in-

dustrialized countries where risk factors such as obesity, a sedentary lifestyle and unhealthy eating habits are more common (WHO 2006).

Gestational diabetes mellitus is the most common medical disorder affecting pregnancy in the UK, with approximately 2-5% of women having diabetes while pregnant. The majority of pregnancies complications are due to gestational diabetes mellitus (NICE 2008). Gestational diabetes mellitus is defined as a type of diabetes that occurs or diagnosed during pregnancy. Gestational diabetes mellitus occurs when the body is unable to make or utilize all the insulin it needs during pregnancy, it is characterized by glucose intolerance. Gestational diabetes mellitus increases the risk of poor maternal and can cause serious complication during pregnancy.

3 Diabetic foot ulcer

The prevalence of diabetic foot is variable and directly related to the resources available for the treatment of DM in each country, so it is more common in developing countries. It is estimated that 15% of individuals diagnosed with DM will develop ulcers during their lifetime (Leone et al. 2012). The American Diabetes Association (2014), described diabetic foot ulcer as the most common and serious complications of diabetes mellitus. It is a major health concern in the world and if not properly taken care of it mostly leads to lower extremity amputation. Diabetic foot ulcers become frequently infected with potential progression to cellulitis, if not treated promptly and appropriately, diabetic foot infections can lead to sepsis and gangrene, which sometimes require amputation of the lower extremity (William et al. 2004). Diabetic ulcers are susceptible to infection once wound is present, ulceration, infection, and gangrene is the leading cause of hospitalization in patients with diabetes mellitus though more serious problem like tissue death also known as gangrene can occur which mostly lead to amputation. Foot ulceration causes eighty-five percent of diabetes-related amputations. Research has demonstrated that development of foot ulcer can be prevented. (American podiatric medical association, no date).

Neuropathic (nerve) and vascular (blood vessel) problems are some complications that causes diabetic foot ulcer. Patients with diabetes are at an increased risk for developing foot ulcers (Clayton and Elasy, 2009).The most feared consequence of a foot ulcer is limb amputation which is common in diabetic persons. Eight out of ten non-traumatic lower limb amputations are performed in cases of diabetes, and 85% of them follow a foot ulcer (Singh et al. 2005).

Diabetes foot ulcer can be identified as an open sore or wound that is located on the bottom of the foot, and the underlying tissues are exposed, usually skin heals quickly if it is cut but in a diabetes patients, skins are prone to poor healing which leads to ulcer as a result of poor circulation, lack of feelings in the foot, foot deformity and irritation. Diabetic foot ulcers may

develop as a result of neuropathy, ischemia or both and when infection complicates a foot ulcer, the combination can become limb and life threatening (Khanokar et al. 2008).

3.1 Risk factor for foot ulcers

There are many factors that increase the risk of developing foot ulcers which are smoking, high cholesterol level, overweight, high blood pressure, other complications of diabetes are the kidney problem, heart disease, and eye related problem e.tc. Almost adult with diabetes have the risk for foot ulcer, and 12% of adult have the history of foot ulcer (Nelda C. Martinez & Toni Tripp-Reimer. 2005). It is widely recognized that three distinct pathologies have the greatest effect on the diabetic foot: ischemia, infection, and neuropathy (Wukich et al. 2013).

Therefore, It is significant to identify patients who pose the high risk of having diabetic foot ulcer to prevent more serious complication that can lead to foot amputation. Foot complications happen when the blood that flow to the legs and feet is reduced, The neuropathy (nerve damage) also the high blood glucose levels can reduce the feeling sensation both in the legs and feet. Previous amputation, past foot ulcer history, peripheral neuropathy, foot deformity, peripheral vascular disease, visual impairment, diabetic nephropathy (especially patients on dialysis), poor glycemic control and cigarette smoking are the main risk factors for foot ulcers (Boulton et al. 2005).

3.2 Types of diabetic ulcers

There are two main types of ulcers; neuropathic and ischemic. In an adult with diabetes, pure ischemic ulcers are less common, and the clear majority of ulcers are either pure neuropathic or mixed neuro-ischemic.

Neuropathic diabetic foot ulcer causes nerve damage in a diabetic patient due to low blood circulation to the nerves as a result of an increase in blood glucose rate. This condition leads to loss of sensation in the ulcerated wound. Pataky, Z.(2012), states that ischemic diabetic foot ulcer arises when a high level of blood glucose causes low blood flow in specific areas of the body, and this hinders fast ulcerated wound healing.

3.3 Stages of diabetic foot ulcers

Diabetic foot ulcers can be divided into five stages which help in better understanding of the natural history and can aid fast diagnosis and interventions (Edmonds, M 2009). Wagner Ulcer Grade Classification System classifies ulcers based on wound depth and the presence of infections. This grading system is mostly associated with diabetic foot ulcers that arise from neuropathic, ischemic, and arterial etiology (Kumar Amir C Jain, 2012).

The 1st stage of diabetic foot ulcer is the normal foot for all diabetic patients that do not have neuropathic, ischemia, the deformity is not at risk of having ulceration, and these can be achieved by annual screening to detect risk for foot or leg ulcer. It is important to educate the patients to wear suitable footwear and maintain a healthy foot care. Diabetic patients are in stage 2 if one or two risk factors like neuropathy, deformity or ischemia are present during the annual check-up and it needs urgent medical attention, especially in the neuropathic foot. In the 3rd stage, the foot is ulcerated, and it can be divided into two, the neuropathic foot which develops at the plantar of the foot and toes while neuro-ischemic foot ulcer commonly seen at the back of the heel, aspices of the toes and it is caused due to the wearing of unsuitable footwears. It requires relief control, wound control and vascular control. The foot is infected in the 4th stage, and infections are caused by organisms from the skin areas, infected ulcerated foot signs are the unpleasant smell, purulent discharge, sinuses and may expose the bones or tendon. It requires urgent assessments, microbiological control in treating the severe infection by giving antibiotics to reduce the infection. If not treated well, it can progress to necrosis while the last stage is necrotic foot which is classified as either wet or dry necrosis, dry necrosis can develop to neuro-ischaemic foot, wet necrosis develops to neuropathic foot due to septic arthritis in a soft tissue infection. The urgent and aggressive intervention of diabetic foot ulcers will reduce the number of major amputations in an adult diabetic inpatients.

As shown in Figure 1 below, Kumar Amir C J. illustrates the Wagner classification of diabetic foot ulcers.



Figure 1 : The Wagner classification of diabetic foot ulcers . (Kumar Amir C Jain, 2012).

4 Nursing intervention

Nursing intervention is a process by which nurses implement nursing care plan which involves assessments, planning of the holistic care of patients. This process involves a general knowledge of all that needs to be done to improve the health of the patient. i.e., patient guidance, medication administration, hygiene, symptoms control, supporting patients and their family members. A nursing intervention should also involve educating the patients and giving instructions about his or her care and how to manage their health conditions to prevent re-occurrence or deterioration. Diabetic self-education are provided by nurses, dieticians, and other health care professionals. The nursing interventions required for treatment of diabetic foot ulcer is essential because it helps to prevent further complications that may lead to amputation or foot infections. Patient education on foot self-care plays a significant role in preventing foot complications in patients with diabetes (Singh, Armstrong, & Lipsky, 2005).

Nursing intervention for diabetic foot ulcer in adult inpatients includes assessing patient's history, performing physical examinations, i.e., skin and wound assessments, patient's education about self-care, glycemic control, wound care, infection control, medications, documentation. For proper management of diabetic foot ulcer, the health professionals such as nurses, doctors, podiatrist, dietician, the orthopedic specialist need to work as a team to achieve the set goal objectives in treating diabetes and its complications.

5 Prevention of diabetic foot ulcer

Diabetic foot related problem is preventable through the combination of quality foot care, inter-professional diabetes care team, diabetes patients education (Bakker, K. et al. 2005). Prevention is an action designed to stop something before it occurs, it is the measure used to oppose disease treatment. The most important ways of preventing diabetic foot ulcers in adults are education of patients or clients, families, and health care team providers is an essential component of an effective, inter professional team approach, effective systems and structures for screening shoes so as to ensure that they are fit properly , diabetic socks are also available for support (Bakker, K. et al. 2005).

The actions for preventing diabetic foot involve education for DM control, early diagnosis, and care of the lower limbs (American Diabetes Association & Sinwar 2015). According to Broersma (2004) " Diabetes may result in a deficiency in the sensation of the lower extremities, and this can cause ulceration, and if the ulcer is not treated properly, it may lead to amputation." More than 80% of amputations are preceded by untreated ulcers (Cornell & Steinberg, 2009). Important prevention strategy involves proper wound care technique which can lessen amputation rates (Masoompour et al., 2008; Morris et al. 1998).

Disease prevention can be categorized as primary, secondary and tertiary prevention. Primary prevention aimed at reducing the incidence of diseases by addressing disease risk factors. Secondary prevention includes methods that detect and treat preclinical pathological changes and control disease progression which leads to an early intervention that is more cost effective. Tertiary prevention is the key goal is to enhance the quality of life by reducing population prevalence. An adult with diabetes must pay full attention to their foot, inspection of the foot as often as possible is advised as it is the foundation of diabetic foot ulcer prevention. Also, ensure minor foot injuries like cuts, blisters and scrapes should not be left unattended to prevent been worsened and infected (iraj, B. et al. 2013).

6 Adult diabetic inpatients

Adult diabetic inpatients are diabetes patient between the age 18 above admitted to the hospital. According to National diabetes inpatient audit 2012, the report stated that 66% of hospitalized patients in the UK are admitted for treatment other than diabetes while 9% of the patient admitted for treatment of their diabetes.

The goals of nurses for adult hospitalized diabetes patients is to prevent hypoglycemia, hyperglycemia adverse effect, infections, this is achieved with the help of multi-professional health team interventions such as insulin therapy, blood glucose monitoring, diagnostic and therapeutic procedures and diet monitoring till glycemic level is stable. Often, when an adult diabetes patient is hospitalized health care team assumes the responsibility of managing and controlling the diseases while self-management is sometimes encouraged (Cohen, L. et al. 2007).

7 Purpose statement and research question

The purpose of this thesis is to describe the nursing interventions needed for the prevention of foot ulcers in adult diabetic inpatients.

Research Question: What kind of nursing interventions are needed for the prevention of foot ulcers in adult diabetic inpatients?

8 Methodology

The methodology adopted for this thesis work is the systematic literature review. A systematic review can be defined as a way of using systematic and reproducible methods to identify, critically evaluate and gather relevant, high-quality individual studies addressing one or more research question to arrive at a conclusion or findings (Baumeister, R. F. 2013). A systematic review can either be qualitative or quantitative. A qualitative systematic review is a research study that includes observations, interviews or verbal interactions which focus on the interpretation of the people that participate in the research which aimed at minimizing bias by using systematic review method (Higgins and Green 2008).

A systematic literature review can combine findings from different studies; it permits researchers to answer and find solutions to various questions which help in addressing and interpreting the questions. Hence, it is too risky to draw a firm conclusion based on one study, in contrast, literature review combines various data from hundreds of researchers to arrive at a conclusion (Baumeister R.F& Leary M.R 2005).

This thesis work focuses on the nursing interventions needed in the prevention of foot ulcer in adult diabetic inpatients. Five steps of a systematic review include; a literature search using predefined databases, assessing the quality of the studies, data extraction from Laurea UAS databases, data analysis and presentations of our findings.

8.1 Literature search

A comprehensive literature search was conducted which help to ensure and identify the key literature/text on our chosen topic and could find relevant articles. Several relevant searches were developed which are related to our topic and logical, using inclusion and exclusion criteria to search for literature through all the relevant databases. This process gives us the widest chance of identifying and choosing the right amount of literature needed for the research. (Aveyard 2010).

In this study, the data search strategy was developed by consulting the school`s (Laurea UAS) librarians and the use of systematic literature guideline by Aveyard 2010 was adopted. Laurea university of applied sciences databases (FINNA) is a credible, affordable and available resource, this database was useful when searching for relevant literature. Three steps of data search processes were done which are planning, searching for articles related to our topic and data assessment. The research question was broken down into four main concepts in order to assist in the literature search, these concepts are diabetes inpatients, nursing interventions and prevention and foot ulcers. The search performed was restricted to "ALL" available resources in all language and in the nursing and social services database. Some of the available online journals and electronic resources include EBSCO (CINAHL, Academic search Elite), Med-

line, Pub-Med, ProQuest, Biomed central journal, SAGE, and science direct. The databases eventually used was SAGE Premier 2012, EBSCO(CINAHL) and Science direct. These databases were selected because of its reliability and it contains quality articles that were beneficial to achieving the objectives for this thesis.

The initial search was done using LAUREA Finna database, The first search was done without the use of any criteria and a total of 24,183 articles were retrieved from all the 3 chosen databases. The criteria used in filtering the articles were articles published between 2007 to 2016, text written in English, full-text articles, articles that are related to this topic, articles with an abstract and articles that answer the research question, after using the inclusion criteria a total of 1,280 articles were retrieved. 74 articles were kept for assessment and reviewed and 8 articles were chosen. Table 1 shows how the main concept and the keywords are combined during the search for relevant articles, it illustrates the primary data search process used in this study and the concept term were combined together i.e “Nursing intervention + Diabetes inpatients”, “Nursing intervention + Diabetics foot ulcer”, “Prevention + Diabetics foot ulcer”. The operators OR and AND were used during the search.

Table 1 : Illustration of Literature databases search process.

Databases	Nursing interventions + Diabetes inpatients	Nursing interventions + Diabetics foot ulcer	Prevention + Diabetics foot ulcer	Total No. Of articles retrieved without criteria	No of articles reviewed	No of articles used
Ebsco (CINAHL)	68	39	599	706	37	4
Science Direct	11,884	1583	4360	17827	14	0
SAGE Premium 2012	2776	769	2105	5650	23	4
Total	14728	2391	7064	24183	74	8

8.2 Inclusion and exclusion criteria

This part helps us to create a baseline set of standards that guide us when conducting our study, it serves to maintain transparent protocol that should be followed during data retrieval process, laid down criteria for inclusion and exclusion was used and it helps to obtain quality literature which will be important in our thesis work. These criteria also help to streamline individual searches and avoid unnecessary use of articles which are not relevant to our work. The criteria supports and drives us closer to getting the best results in our search for quality articles, It also saves quality time and makes our work more precise. Any factor that doesn't meet the criteria were disqualified.

The keywords used in our search were also outlined. The criteria used include; only electronic publications from 2007 to 2016, articles that have full text, articles written only in English language, articles that have full access to Pdf format, free of charge articles, articles that relate to our topic, with abstract and scientific articles that answer our research questions. Below shows the inclusion and exclusion criteria in table form.

Table 2 : Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> • Articles published between the time periods 2007-2016. • Articles available with full text and Pdf format. • Articles that are written only in English language. • Articles that are relevant to the research purpose/topic. • Articles with free access. • Articles with an abstract. • Scientific articles. • Subject topic included "Nursing", Diabetic foot. 	<ul style="list-style-type: none"> • Articles published before 2007. • Articles that the full text and Pdf format are not available. • Articles that are written in other languages than English. • Articles that are not relevant to the research purpose/topic. • Articles that include charges. • Articles without an abstract. • Nonscientific articles.

8.3 Data appraisal

Rahul Mhaskar & Patricia Emmanuel (2009), defines critical appraisal as the process of systematically examining research evidence to judge its trustworthiness, its value, and relevance in a particular context . “Critical appraisal examines the process followed in order to evaluate whether the chosen articles were free of bias, and it helps to determine the strength and weakness of the study”.

The data appraisal is vital for systematic review of articles because it validates that the data and evidence of the review are accurate and trustworthy. It provides adherence to reporting standards and increases the reliability of the study. Johns Hopkins Nursing Evidence-Based Practice Model was adopted for the data appraisal process. This model was used because it is easy to understand and it evaluates the evidence derived in the study. Johns Hopkins Nursing Evidence-Based Practice Model consists of three evidence levels, level I is the strongest evidence level while level III is the weakest evidence level. Level I comprises of “experimental studies, randomized controlled trials (RCT), a systematic review of RCTs, with or without meta-analysis”. Level II comprises of “quasi-experimental studies, systematic reviews of a combination of RCTs and quasi-experimental, or quasi-experimental studies only, with or without meta-analysis”. Level III comprises of “nonexperimental studies, systematic reviews of a combination of RCTs, quasi-experimental and non-experimental studies, or nonexperimental studies only, with or without meta-analysis, qualitative study or systematic review with or without meta-synthesis” (Johns Hopkins University Hospital 2016).

Johns Hopkins Nursing Evidence-Based Practice Model also makes use of quality guides which can be used to evaluate the quality of each article. The quality guides include articles on scale A, B, and C. Scale A is high-quality articles which include consistent, generalizable results, sufficient sample size for the study design; adequate control; definitive conclusions, consistent recommendations based on a comprehensive literature review that includes thorough reference to scientific evidence”). Scale B is good quality articles which include “reasonably consistent results; sufficient sample size for the study design; some control; fairly definitive conclusions, reasonably consistent recommendations based on a fairly comprehensive literature review that includes some reference to scientific evidence”. Scale C is Low quality or major flaws articles which include “little evidence with inconsistent results; insufficient sample size for the study design; and conclusions cannot be drawn” (Johns Hopkins University Hospital 2016). Table 3 illustrates the evidence levels and quality guides of final articles in this study.

Table 3 : Johns Hopkins Nursing Evidence-Based Practice Model.

Level of evidence	Number of Articles	Quality A (high quality)	Quality B (good quality)	Quality C (low quality)
Level I	2	1	1	0
Level II	1	1	0	0
Level III	5	2	2	1
Total	8	4	3	1

8.4 Data extraction

The purpose of data extraction is to retrieve data from different sources for data processing and to get evidence based facts that can be eventually presented in the findings of the study, these extracted information form integral part of the thesis work. The primary search generated a total of 24,183 articles. After using the criteria, 1280 articles were retrieved and then screened to begin the extraction process. There are 2 selection phases in this data extraction section.

Firstly, articles were screened based on their titles and abstract, after this screening the articles that were relevant and related to our topic were selected for further review assessment. This first phases generated a total of 74 articles. Secondly, the articles selected after the end of the first phase were assessed critically and reviewed thoroughly based on their relevance to providing appropriate answers to our research question. In this second selection phase, the authors of this thesis paid more attention by evaluating the quality and validity of the articles and it generated 8 articles as the final selected articles for this study. Articles that were duplicated, irrelevant and didn't meet up to the setup criteria for this study were discarded.

Thirdly, it was ensured that the final articles selected were read several times for better understanding, the selected articles were reliable, authentic and useful for further data analysis because it emphasizes and provides an explanation to our topic and research question. i.e. focuses on nursing interventions that are needed to be done to prevent diabetic foot ulcer in adult inpatients.

Figure 2 below, illustrates the information about database search, database extraction process and how the selected articles used in this study emerged.

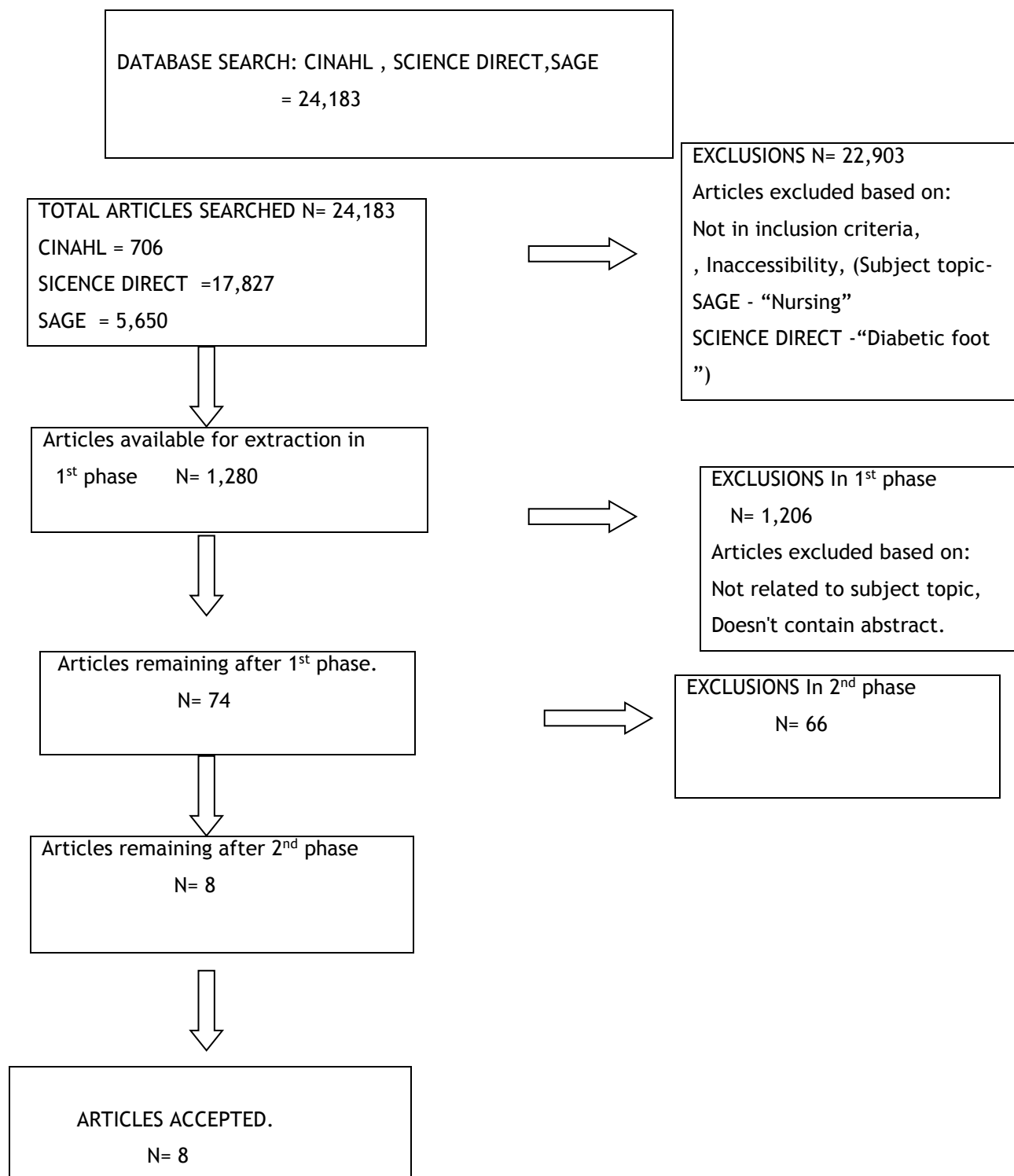


Figure 2 : Data Extraction Process.

8.5 Data analysis

Data analysis is the collection and analyzation of the data from a primary study using either qualitative or quantitative method. It can also be defined as the form of turning unstructured and raw data into organized data and the aim of data analysis is to organized, structured and get meaningful data from the research (Ward, J.D. Ferber, C. et.al. 2013).

Qualitative research explains “how and why” an occurrence operates in a context. It is non-numerical, images, videos text and people’s spoken or written words which can be gathered through interviews, it is complex which produces large amount data and analyzing the data is time-consuming (Noble, H. & Smith, J. 2013). The qualitative research approach was done by selecting articles that are related to our study, reading and analyzing them thoroughly to avoid wrong interpretation by both writers, the data was organized carefully by removing superfluous data in order to give accurate and reliable information. Inductive analysis refers to a systematic procedure for analyzing qualitative data in which the analysis is guided by evaluating the objectives. It uses the detailed reading of raw materials to derive concept themes through interpretation from raw data by researchers. The inductive approach includes open coding, creating categories and abstraction phase.(Thomas, D.R. 2006).

In this study, the eight selected articles were analyzed through inductive content analysis method by the collection of data to identify patterns and interpretation of the raw data for better understanding. The raw data was collected from different scientific articles and these articles were thoroughly screened by critically reading the raw data, then the raw data were organized into themes that answered the research question and the theme was labeled as the sub categories. The sub categories were further classified based on similarities of concept and this was termed as the main categories. Seven sub categories and four main categories were identified by the writers. Figure 3 below further explains how the raw data was grouped which resulted in the main categories in data analysis. The raw data was labelled in blue color, the sub-categories in yellow color and the main categories in light Red color.

Raw DataSub-CategoriesMain Categories

Assessing the patient risk factor for diabetic foot.
Visual inspection of the foot for foot deformity, redness, blisters etc.
Documenting the size, depth, and position of the ulcer.
Checking for the sensory and motor responses in the foot.
Regular review of the foot and follow up.
Referrals for high risk patients.

Risk assessment

Foot Assessment

Educating the patient about wearing comfortable and fitting foot wear.
Offloading and weight bearing of the foot to pre-

Use of appropriate foot wear

Controlling and managing the level of blood glucose.
Regulating lipid level.
Eating a diet low in saturated fat and cholesterol.
Doing regular exercise.

Glycemic and lipid control

Glycemic and lipid control



Figure 3 : Illustration of the inductive content analysis process.

9 Findings

In the data analysis process, The data were critically analyzed thereby making sure that the results of our findings answer the research question and purpose statement of this thesis. Four main categories were derived from the data analysis process and they include foot assessment, glycemic and lipid control, pharmacological intervention and patient education.

9.1 Foot assessment

Foot assessment is the act of assessing, evaluating and gathering information about patient foot i.e. It involves general inspection of the foot. The aim of the foot assessment is for early detection of any risk factor for diabetic foot complications such as neuropathy and ischemia that can result in amputation. Visual inspection of the foot should consist of daily examination for foot deformities, areas of redness, blisters, calluses, fissures, dry skin, and toenail appearance i.e thickness, ingrown toenails (Sibbald et al. 2012). A nurse should assess the foot of diabetic patients, document the size, depth, and position of the ulcer. Diabetic foot inspection and assessment should include the identification of sensory neuropathy (loss of the ability to feel a monofilament, vibration or sharp touch) and/or the abnormal build-up of callus, a reduction in the arterial supply to the foot (NICE 2012). For all patients with diabetes who are at risk of neuropathic ulcer formation, foot assessment is critical for prevention and early detection of conditions that can contribute to ulceration (Jarrett 2003). All patients with diabetes require an annual comprehensive foot examination to identify risk factors that are predictive of ulcers and amputations (American Diabetes Association, 2014b).

The Foot assessment for diabetic foot inpatients includes Neurological assessment, Dermatological assessment, Vascular assessment, Musculoskeletal assessment. Neurological assessment is the assessment of sensory and motor responses of the foot i.e. reflexes. It also includes physical examination which examines the functionality of the nerve in the foot, sensation to vibration over and around the major nerve in the foot, assessment for pain sensation around the foot. Neurological assessment can be done using 10g monofilament screening, vibration can be assessed using 128Hz tuning fork or testing vibration sensation with a biothesiometer. The dermatological assessment is the assessment of the skin condition of the foot, this assessment involves visual examination and screening of skin status such as color, thickness, dryness, cracking, assessing skin integrity, ulceration, hemorrhage of the skin, increase in skin foot temperature etc. Dermatological assessment can also help to know whether a patient needs a referral for foot care treatment. Vascular assessment is the assessment that involves viewing the feet and palpitation of foot pulses to know about blood flow, pulse evaluation i.e. peripheral pulses, sensation testing, It helps to assess vascular ulceration risk and degree of loss of sensation in the feet, checking the skin color of the foot.

Musculoskeletal assessment is the assessment for deformity i.e. claw toes, prominent metatarsal heads, Charcot joint, muscle wasting etc. This type of assessment also helps to evaluate muscle strength, load distribution, the range of motion, common forefoot deformities that are known to increase plantar pressures and are associated with skin breakdown. Assessment of wound, and proper wound dressing which involves wound debridement is also important for the prevention of diabetic foot ulcer. The clinical assessment of the wound should be taken into account when choosing an appropriate wound dressing. Exudate levels, site of the wound, the presence of infection, pain levels and size of the wound must all be considered before choosing the most appropriate wound care product (NICE, 2004; Weir, 2012). In foot assessment, the nurse should also investigate if there is a presence of infection in the foot of diabetic patient because infection such as wound or bone infection in the foot can worsen the condition and lead to amputation. Tissue specimens and/or wound swabs should be sent to the laboratory for wound culture and a plain x-ray of the foot can help to identify the presence of foreign bodies, gas in the tissues or evidence of osteomyelitis (Cavanagh et al. 2005).

9.1.1 Risk Assessment

The risk assessment is very important nursing intervention in the prevention of diabetic foot ulcer in diabetes inpatients. Nurses should make sure they assess various risk factor such as neuropathy, limb ischemia, ulceration, callus, infection, inflammation, deformity, gangrene, Charcot arthropathic. Once a patient has been identified as high-risk, the patients should be offered a 'package' of care, which includes regular review, foot-health education at each visit and assessment of footwear and insoles (NICE 2004). When patients have been thoroughly assessed, they should be assigned to a foot risk category. These categories are designed to direct referral and subsequent management or follow-up. An increased risk category is associated with an increased risk of ulceration, hospitalization, and amputation (Diabetes UK & NHS Diabetes, 2011). Patient's level risk can be categorized as low risk, moderate risk or high risk. A patient is categorized as low risk if there is no risk factor, moderate risk if a patient has one risk factor and as high risk if there is more than one risk factor or patients has the previous history of ulceration or amputation. Annual Foot reassessment is necessary for low-risk patients, for moderate risk patient reassessment should be carried out within three to six months but the for the high-risk patients it is more frequent i.e. every one to two months. Table 4 shows kinds of risk categories, assessment and how risk can be managed.

Table 4 : Risk categories and management. (NICE 2004).

RISK	ASSESSMENT	MANAGEMENT
Ulcerated	Red, hot, swollen foot New or previous ulcer.	Refer urgently to multidisciplinary diabetic foot team. If the ulcer is infected, swab wound and consider antibiotics.
High risk	Reduction in neuropathy/vascular status + deformity or skin changes or previous ulcers.	Arrange frequent review (every 1-3 months)• Review education/footwear/vascular status • Ensure special arrangements for people with immobility or disabilities at each review, evaluate provision of • Intensified foot care education • Specialist foot care and insoles • Frequent skin/nail care if needed.
Increased risk	Neuropathy or absent pulses or other risk factors.(e.g. Deformity).	Enhanced foot education, inspect feet every six months, consider footwear, advanced vascular assessment, referral for nails or callus if needed.
Low risk	Normal sensation and palpable pulses.	Foot care education and annual review.

9.1.2 Appropriate footwear

Nurses should educate patients about the need to wear appropriate footwear because It allows the toes to move freely and makes it comfortable. Appropriate footwear helps to reduce the risk of new ulcer or skin irritation of the foot. Wearing inappropriate footwear exposes the patient to increased friction, irritation, and decreased foot protection (Rizzo et al., 2012). Foot offloading is the process that helps to relieve or reduce plantar pressure or strain in the foot and this improves healing, recurrence or prevention of diabetic foot ulcer. Offloading involves weight bearing and with the use of footwear. Offloading footwear consists of therapeutic shoes such as half-shoes, soft cast, removable cast walker, wedged sandals etc.

The picture below in Figure 4 shows what an offloading footwear looks like. It helps to relieve the foot from intense pressure that may cause ulceration.



Figure 4 : Offloading footwear (Health management publication, Inc 2004).

9.2 Glycemic control

Glycemic control is the process of controlling and managing the levels of blood sugar (glucose) in a diabetic patient. Glycemic control appears to be the most important intervention for preventing neuropathic ulcers (ADA 2015). Nurses should monitor glycemic control such as controlling blood glucose level in a diabetic patient. Glycemic control also improves microvascular outcomes thereby preventing vascular complication such as diabetic nephropathy, neuropathy, and retinopathy. If blood glucose level is controlled, it hinders wound healing in the diabetic foot. Lipid control is also essential in preventing the risk of cardiovascular disease in diabetic patients. Lipids include cholesterol, triglycerides, high-density lipoprotein (HDL), and low-density lipoprotein (LDL).

Nurses should make sure they regulate lipid level of a diabetic patient by raising HDL level, lowering triglyceride level and LDL level and this can be done by keeping blood glucose level as close to normal. Nurses should also educate diabetic patients about the benefits of maintaining a diet low in saturated fat and cholesterol, exercising regularly and consuming more soluble fiber i.e. beans, oats etc. Statins medication helps to lower lipid level in the blood.

9.3 Pharmacological Intervention

Clinical interventions of diabetic foot ulcer in adult inpatients are to delay or prevent infection and underlying factors of the disease condition from progressing to lower extremity am-

putation. Antibiotics medication are used in combination with other treatment such as wound dressing, checking of vital signs, healthy diet.

The pharmacological intervention used by nurses to prevent diabetic foot ulcer in adult inpatients are outlined below. Antiseptics such as hydrogen peroxide, acetic acid, povidone iodine and sodium are used for wound dressing to prevent and treat the infection. The use of antiseptics helps in reducing the bacterial loads of the foot ulcer. Nurses use antiseptics solution prescribed by the doctors to clean the wound sites and can use antiseptic gel on the wound before dressing. (Christy L. Scimeca et al. 2010).

9.3.1 Antibiotics

Not all patients with DM Foot require hospitalization and the use of antibiotics medications. Patients that have inflammations wound drainages, necrosis on the ulcer require immediate hospitalization and the need of antibiotics are required to prevent and treat the infection. Hospitalized DM foot ulcer infection patients have gram-positive organism such as staphylococcus, effective antimicrobial therapy is needed. There are different kind of antibiotics that can be used for DMF patient and there are 3 routes of administration such as oral, topical and I.V route (Christy L. Scimeca et al. 2010).

Oral antibiotics such as Keflex, cefuroxime, cefadroxil are mostly recommended, it targets the staphylococcus and the skins infection sites. Topical antibiotics such as ampicillin, amoxicillin, amoxicillin, Augmentin, sulbactam ointment can be put on the wound after cleaning. It inhibits protein and cell wall synthesis. It is effective against most gram-negative organisms. Intravenous antibiotics such as cephalosporins (ceftriaxone, cefuroxime, cefazolin, cefepime), carbapenems are often used for life-threatening diabetic foot ulcer conditions (Imipenem, ertapenem) fluoroquinolone's (ciprofloxacin, moxifloxacin, levofloxacin) are often used for gram-negative osteomyelitis and pseudomonas. (Christy L. Scimeca et al.2010).

Nurses' intervention is routine giving of antibiotics prescribed to patients, usually, antibiotics are given every 12 hours, nurses should make sure that the antibiotics are available, know the route of administration, check for indications and side effect and educate the patient on important of the antibiotics. According to a research, 90% of the patient that uses carbapenems for diabetics foot ulcers were improved and it was reported that clinical intervention help to prevent lower extremity in adult diabetic foot ulcers. (Curtis L. smith. 2004).

9.3.2 Insulin therapy

Insulin therapy is one of the important treatments of diabetic patients and the route of administration is through subcutaneous route. The insulin therapy helps to alleviate symptom and minimize the risk of complication. Diabetic foot ulcer patients are educated on glucose

self-monitoring, self-injection of insulin, the number of international units (IU) to be given at a time.

A Study has shown that injection of insulin on the wound could reduce blood glucose level, inflammation and increase collagen deposition which improves wound healing in a diabetic patient. The local use of insulin for wound healing has been proving to be effective, however, the safe dose is yet to be ascertained. (Zhaoxin, Z. & Lei, L.V. 2016).

9.4 Patient Education

Patients education is important nursing intervention in preventing the reoccurrence of foot ulcers, many patients lack the education needed to properly manage and care for their feet. Providing patient education about prevention of foot ulceration and amputation in patients with diabetes is a common clinical practice (Dorresteijn et al., 2012). Diabetic foot ulcer patients need to be educated so has to reduce foot ulcers and amputations. Patients with diabetic foot ulcers always have loss of quality life and can also result in disability. (Bakker, K. 2005).

Patient education is an important nursing responsibility, and it should include assessment of the effectiveness of patient teaching regarding common practices such as diabetic foot care (Dorresteijn J. et al., 2012). It is important that nurses can evaluate patient's self-care ability, educating patients on how to take care of their feet, healthy lifestyle i.e. cessation of smoking, healthy diet and exercise. (Dorresteijn J. et.al. 2010). Patients education can be done by giving lectures, hand book, telephone follow-up, group exercise.

9.4.1 Self-care

Diabetic foot ulcer patients need to continue self-care and management of their foot ulcers to minimize or prevent infection, reoccurrence, and amputation by monitoring their diets, weight, glucose level, foot extermination, compliant with medications, proper footwear, physically active and proper wound dressing. Nurses need to educate DMF patients during their hospital stay on the importance of self-care monitoring and total adherence to all these will reduce further complication and improve quality of life. Researches has indicated patients with diabetes often fail to engage in consistent self-care of the feet (Chin & Huang, 2013). Nurses teach diabetic foot patients how to clean, dress their wound, examine their foot and determine what to wear.

9.4.2 Healthy lifestyle

Educating the patient about a healthy lifestyle is very important in the prevention of diabetic foot ulcer. This healthy lifestyle includes a healthy diet, exercise, avoiding smoking etc. Patients with diabetic foot ulcer are educated on a healthy diet, hyperglycemia can cause tissue damage which may lead to ischemia which may result in impaired wound healing. Nutrition

therapy help to promote wound healing, patients should be encouraged to eat a balanced diet meal and certain supplement recommended by a physician can also be used in order to meet the body requirement (Lynn Grieger 2009). Patients body weight should be controlled, it helps in good quality of life and can be achieved by healthy eating and exercise. Educating about exercise is also vital to improving the health of a diabetic patient. Diabetic foot ulcer patients are educated on the importance of regular physical exercise, it helps patients to lose weight and glycemic control. (Physical Activity Guidelines Advisory Committee 2008). Smoking has an adverse effect on wound healing, cigarette smoke contains the toxins that is associated with impaired wound healing. Smoking reduces blood flow, harmful to tissues, nervous system, lung, the risk of infection, slow healing. Diabetic foot ulcer patients should be educated on the importance of cessation of smoking, what are the things that cause a relapse, learn how to quit, and on where they can get the assistance needed in quitting smoking. Nurses should also follow-up on patients who are willing to quit smoking and give them resources needed to cope with wound healing to quit smoking.

10 Discussion

Diabetes is a serious life-long health condition with some harmful complication including nerve damage, cardiovascular disease, amputation, diabetic ulcer etc. Diabetes mellitus is a metabolic disorder in which the body has a deficiency of and/or a resistance to insulin (Jerreat 2003). According to Cornell & Steinberg (2009), there has been a low success rate in the treatment of foot ulcers and more than 80% of amputations are caused by untreated ulcers. Diabetes is more common in adults and they are more likely to experience various complications due to age factor i.e. foot ulcer takes more time to heal in older people. Type 2 diabetes is growing and is most commonly associated with adults over the age of 40 (Shilling 2003). It is likely that the older population will have been living with diabetes for many years. Over time, complications such as peripheral sensory neuropathy (nerve degeneration and loss of function) and peripheral arterial disease that affect the lower limb progress to the extent that they start to cause ulceration and damage to the foot (Foster and Edmonds 2011).

(NICE 2004) emphasized that the need for preventive measures, such as regular foot screening and health education should be extended to patients and their family members. Since diabetic foot ulcer is one of the most common complications of diabetes and it poses more risk of amputation, it is important that these complications are prevented to its bearest minimum. So, It was necessary for the authors to work on this subject as a thesis topic. With the help of good academic sources, a lot of studying and brainstorming was done to discover about evidence-based facts, and this can support the purpose of our thesis which is to describe the nursing interventions needed for the prevention of foot ulcers in adult diabetic inpatients. For the objective of our thesis to be achieved, a well-defined research question was utilized and this question was always considered throughout every section of this thesis work.

There are various nursing interventions needed for the prevention of foot ulcers in adult diabetic inpatients and the nursing interventions will be discussed and reflected on, according to the result of the findings in this study. The analysis of this study produced four main categories and the main categories were presented as the findings which are Foot assessment, Glycemic and lipid control, Pharmacological intervention, Patient education. Foot assessment is one of the nursing intervention needed when preventing diabetic foot ulcer and it consists of risk assessment and use of appropriate foot wear. Assessment of the foot involves assessing the vascular and nerve function of the feet. The foot assessment can be done to determine its vascular function by palpating for the dorsalis pedis and posterior tibial pulses in the foot while nerve function can be assessed by using a 10g monofilament, this helps to know if the patient feels any sensation in the foot. Foot risk assessment helps to detect for any risk factor such as diabetic foot ulcer, infection, deformity, nerve damage, vascular problems etc. When a person with diabetes has a foot ulcer and is also feeling systemically unwell, they are likely to have a severe infection (Foster and Edmonds 2011).

Early and regular foot assessment can help to prevent foot ulcer risk in adult diabetic inpatients. i.e. physical foot inspection, foot examination or screening, pressure offloading etc. All patients should undergo foot screening to assess any risk of developing diabetic foot ulcers. The use of appropriate foot wear is vital and must be checked because it can prevent worsening of foot ulcer, inappropriate footwear can also contribute to ulceration in a diabetic patient, mostly in people with sensory neuropathy. Nurses should ensure that adult diabetic patients wear a comfortable and well-fitted shoe to prevent ulceration. Proper glycemic and lipid control is also a key preventive nursing intervention of diabetic foot ulcers in adult diabetic inpatient, there should be regular monitoring of blood glucose in adult diabetic patients because high blood glucose may affect the body's immune mechanism and this can result in slow healing of the wound, infection and also cause worsening of diabetic foot ulcers. Poor control of blood glucose in an individual with diabetes leads to many complications. Over time the sustained blood glucose readings rise above the normal range of 4-7mmol/l and it increases the risk of heart disease, vascular disease, kidney disease, neuropathy and retinopathy which is also known as disease of the retina (Drury & Gatling 2005).

Fasting blood sugar test are done in the morning before breakfast while random blood sugar can be done in the afternoon, night or as requested by the doctor. Nurses ensure all these glycemic test are done and documented accordingly. Pharmacological interventions are the effective preventive method and it plays a vital role in preventing diabetic foot ulcer. It involves the use of medication and other pharmacological measures such as antibiotics, insulin etc. Insulin also helps to maintain the blood glucose level from getting too high or too low. Antiseptics also helps to sterilize the wound area and it helps to prevent infection. Proper wound management such as wound dressing, wound debridement are a good intervention for preventing diabetic foot ulcer.

Nurses ensure diabetic foot ulcer is dressed at least once a day depending on how bad the ulcer is. Nurses can use antiseptics to sterilize the wound, Normal saline 0.9% can also be used to clean the wound area, then wound debridement can be done to remove dead tissues, cotton gauze and regenerative bandage can be used on the wound. All these are done in an aseptic procedure such as wearing gloves, nursing face mask and gown to prevent infections. Patient education plays a vital role in management and prevention of diabetic foot ulcer. Nurses should orientate the patients on the need to maintain good hygiene, self-care, and healthy lifestyle etc. Educational support is essential, Nurses should be well informed about treatment and management of diabetic foot ulcer and they should advise the diabetic patients about their general care. i.e. what type of food to eat, the benefit of exercise, how to clean and dress the wound, how to prevent infection etc. Nurses should educate their patients on cessation of smoking, where they can get help, support group and how they to deal with relapse. Nurses also need to educate more on exercise because weight loss has a lot to do with diabetes patients, an exercise that will not put too much pressure on the foot ulcers should be recommended, healthy diet plan should be introduced and patients should be referred to Nutritionist if necessary. Nurses should also educate the patients self-care practices i.e. how to examine their foot, how to check their blood sugar, how to give insulin, how to clean their wound in aseptic manner. It is essential to evaluate whether the patient has understood the messages, is motivated to act and has sufficient self-care skills (Wounds International 2013).

In some cases, it is also significant that nurses educate or instructs the family members of the patient about the patient's care i.e. If the patient is not mentally active or is unable to do things by themselves. It is sometimes possible that diabetic foot ulcer patients may not be aware that they have ulcer because it can be painless, so there is need for nurses and healthcare professionals to assess and monitor diabetic patients carefully and individually because the earlier the foot ulcer is detected, the more quickly it can be treated thereby preventing the worsening of these complications.

The collaboration of health multidisciplinary team cannot be over emphasized in the management of diabetic foot ulcer. The nurses should work with other health care professionals such as the doctor, podiatrist, nutritionist, physiotherapist, pharmacist etc. The nurses can also make referrals if necessary so that patient can receive special treatment or help that is beneficial to their general health. The diabetic foot multidisciplinary team consists of diabetes physicians, vascular and orthopedic surgeons, podiatrists, diabetes nurses, tissue viability nurses or vascular nurse specialists. They have the collective expertise to manage these challenging wounds effectively (NICE 2011). It is well-recognized that a multidisciplinary team approach greatly improves the outcomes for diabetic foot ulcers (Krishnan, et.al. 2008).

According to the reviews and results presented in the findings, the listed nursing intervention is important in preventing diabetic foot ulcers in adult diabetic inpatients. The government should provide financial resources for health institution so that more evidence based research can be done to improve the outcome of diabetic foot ulcer management and its prevention. More education awareness program should be organized to inform and educate the health professionals on new research, new interventions for the prevention of diabetic foot ulcers. The public also needs to be educated about the importance of treatment of diabetes and its complications, the need for early detection and prevention which can reduce amputation, morbidity and mortality rate in the populace.

10.1 Trustworthiness

Trustworthiness can be defined as the validity of data collection, sampling strategy, selection process, and data analysis and findings in a research (Elo, S. et al. 2014). Trustworthiness of a qualitative research has been described to be credible, dependable, transferable and confirmable. (Gunawan 2015). The study concepts must have credibility, reproductive, non-bias, and dependability.

The thesis contract and plan of this thesis was prepared by the authors and accepted by our supervisor. The methodology was critically studied, researched by the writers and was accepted by the supervisor. The data search process used in this study was in compliance with Laurea thesis guidelines and the school librarian was consulted for directive about some databases. The data search used in this study was a systematic literature review, articles were accessed from Laurea electronic database (Finna). The databases used in this study were EBSCO CINAHL, SAGE AND SCIENCE DIRECT. The data collected was reproductive because it was explained in details, articles used were articles only in English language and articles published from 2007 to 2016. The theoretical background, data collection and selection process, data analysis process findings were reported to show the trustworthiness of this thesis. All the references used in this thesis was clearly mentioned and documented to show the credibility of this thesis. The aim of the validity and reliability of this study was to avoid any kind of misinterpretation and bias. The writers ensured the findings answers the research question and purpose statement of this study. In conclusion, the writers made sure trustworthiness was achieved in this research, the findings answered the research question and are linked with the purpose statement.

10.2 Ethical consideration

Ethical consideration is very important in a nursing research, both legal and ethical issues were evaluated to ensure honesty, integrity, objective, confidentiality, avoid misinterpretation and error in this thesis study. The materials used in this thesis were extracted from Laurea databases and academic sources, which show the articles were of high integrity.

Plagiarism can be defined as using other people words as if it yours (Bull, J. 2010). Writers ensured that plagiarism was avoided in this thesis writing process by following the Laurea university of applied science guideline for reference. Ethical considerations involves getting informed consent from those you are interviewing, giving questionnaire or those you are getting information or material from according to (Bull 2010). This thesis work does not involve any funding by a third party (companies or organizations), no funding obtained from any organization. The writers ensured that this study was simplified and self explanatory for easy interpretation of data. The task in this study was fairly shared with the writers, writers work jointly, there was a common interest in this subject which enabled us to be fully committed to this thesis.

The methodology used in this study was a systematic literature review and the guidelines were strictly followed, the inclusion and exclusion criteria of the articles were full text, English language and publishing year. Furthermore, we would like to confirm that there was no conflict of interest involved in the findings.

10.3 Limitations and recommendations

This thesis has some limitations even though the aim and purpose were reached, a systematic review has been used in this study. The articles selected were mainly articles in English, full text and publishing date was between 2007-2016, therefore some articles that are important and relevant might be missing in our search. Access to some articles was also a limitation to this study, some articles were not full text, needs to be purchased. Moreover, there are not enough articles that discuss the nursing intervention of diabetic ulcer adult inpatients, due to this the writers might have missed out some relevant data.

For future study, the writers recommend more researches to be done on nursing interventions in the prevention of diabetic foot ulcers in adult inpatient. Though there are a lot of researches done on prevention of diabetes, diabetes complications, diabetic leg ulcer, neuropathy, and wound care etc. There were few studies found on diabetic foot ulcer inpatients and more studies is recommend to be done on this topic.

We recommend that nurses should be educated more on the nursing intervention needed for the prevention of diabetic foot ulcer in adult diabetic inpatients and healthcare institution should provide variety of seminars and training about diabetes and diabetic foot ulcer focusing on self-care, assessment, examination, glycemic control and wound care to prevent recurrence or amputation of the lower extremity.

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List of abbreviation

(B) cell	Beta Cell
CDC	Centres for Disease Control and Prevention
DM	Diabetes mellitus
DMF	Diabetes mellitus Foot
GDM	Gestational diabetes mellitus
HDL	High-density lipoprotein
LDL	Low-density lipoprotein
PHE	Public Health England
T1D	Type 1 diabetes
T2D	Type 1 diabetes