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NURSING INTERVENTIONS FOR THE PREVENTION OF FOOT ULCERS IN ELDERLY DIABETIC PATIENTS

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**NURSING INTERVENTIONS FOR THE PREVENTION OF FOOT
ULCERS IN ELDERLY DIABETIC PATIENTS**

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NURSING INTERVENTIONS FOR THE PREVENTION OF FOOT ULCERS IN ELDERLY DIABETIC PATIENTS

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Diabetic foot ulcer (DFU) is one of the severe consequences of diabetes. Diabetic foot lesions frequently result from a patient simultaneously having two or more risk factors, with diabetic peripheral neuropathy playing a central role. In elderly diabetic patients, foot ulcer is a major cause of hospitalization.

The purpose of this thesis is to describe the nursing interventions used in the prevention of foot ulcer in elderly diabetic patients. The research question was what the nursing interventions are used in the prevention of foot ulcers in elderly diabetic patients. The search for data was conducted in January 2018. An inductive qualitative analysis was chosen to acquire updated facts and accurate data leading to a better understanding of previous and existing studies.

3 academic databases were searched. These are Cumulative index of Nursing CINHAL(EBSCO), PubMed, Science direct. A total number of 6 articles produced in the years 2012-2017 were selected. The method used in this thesis is a literature review with an inductive qualitative analysis.

Five main categories in the prevention of foot ulcer in diabetic elderly patients were derived from the data analyzed. These include; glycemic control, insulin therapy, patient education, appropriate footwear, identification of diabetic foot. In a nutshell, nurses' role in prevention of DFU can never be over emphasized. Elderly patients tend to need more education and guidance on prevention measures. Prevention methods are effective with this age group when the nurses work with the patients by corresponding to their individual needs.

Since only few academic databases were used in data collection, a future study could be conducted to study the impact of age on the presentation of DFU. Future studies could attempt to discuss diabetic foot disease with an emphasis on the specificities of the disease in elderly patients.

Keywords: Nursing intervention, foot ulcer, Diabetes, Prevention, Elderly

Table of Contents

1	Introduction	5
2	Key concept definition.....	6
2.1	Diabetes	6
2.2	Diabetic foot ulcer.....	7
2.3	Elderly patients	9
2.4	Prevention	11
2.5	Nursing Interventions.....	12
3	The purpose statement and research question	14
4	Methodology	14
4.1	Principles of literature review	14
4.2	Data Search and screening	14
4.3	Inclusion and exclusion criteria.....	16
4.4	Data appraisal	16
4.5	Data Analysis.....	18
5	Literature review findings.....	22
5.1	Identification of the diabetic foot	22
5.2	Appropriate footwear	22
5.3	Patient education	24
5.4	Glycemic control	24
5.5	Insulin therapy.....	25
6	Discussion	27
7	Reliability and validity.....	29
7.1	Ethical considerations.....	30
7.2	Limitations and recommendation	31
8	References	32
9	Figures.....	35
10	Tables	35

1 Introduction

Diabetes can be defined as a metabolic syndrome with a hyperglycemic state. The occurrence can be due to a lower insulin secretion or an incomplete insulin activity. Today, 382 million people, or up to 8.9% of the total world population fall victim to diabetes mellitus (Noor, Zubair & Ahmad 2015). According to World health organization (WHO 2017), the number of people with diabetes had risen from 108 million in 1980 to 422 million in 2014. Luximon, Ganesan and Younus (2015), goes on to quote that the prevalence rate is higher in older people who are above 65 years of age (20%) than young people (2%) younger than 35 years old.

Diabetes is a non-communicable disease with multi-faceted complexities. Noor et al. says that complexities of diabetes mellitus include retinopathy, neuropathy, atherosclerosis, nephropathy and foot ulcers. Also, they mention that these are all the result of a compromised vascular system causing inappropriate circulation which uncovers the foot at higher risk among all the complications in diabetes.

American diabetes association (ADA 2015), documents that older adults with diabetes have the highest rates of major lower-extremity amputation and peripheral neuropathy of any age-group. Furthermore, those aged ≥ 75 years have higher rates than those aged 65-74 years for most complications.

World health organization records that compared to the general population, the elderly population has a higher incidence of chronic wounds: diabetic foot ulcers, pressure ulcers, and venous stasis ulcers. The narrative written by Chand, Mishra, Kumar & Agarwal (2017) goes on to agree that the actual risk of amputation and the burden of foot injury in the elderly are most certainly underestimated by current epidemiological data. The prevalence of neuropathy, foot deformities and foot ulcer as well as the risk of amputation, all increase with age in both diabetic and non-diabetic elderly population.

The dramatically increasing number of diabetics can be prevented by optimizing patient management and education. The intensity and severity of the condition such as non-traumatic lower extremity amputation is preventable (Turns 2015). The study conducted by Maximillian (2014) have concluded that over 50% of people with diabetes mellitus are unaware of their disease. This plays a part in the societal economy which includes treatment cost, loss of lives, inefficient productivity. The increasing number of diabetic conditions is not only a matter of concern in youth but also in the elderly population. Studies on preventive methods for diabetes and diabetic foot ulcers are in need.

Prevention of the occurrence of foot ulcer in the elderly patients demands a well-coordinated and extensive approach. The health care system and the health care workers dealing with elderly patients at the risk of acquiring foot ulcer can impact a positive outcome. To prevent the foot ulcer from occurring, a patient-centered care plan needs to be built by the healthcare system and workers.

The purpose of this thesis is to describe the nursing interventions used in the prevention of foot ulcer in elderly diabetic patients. The information imparted in this thesis can prove useful to the nursing professionals working with elderly patients suffering from diabetes.

2 Key concept definition

2.1 Diabetes

World health organization (WHO 2017), defines diabetes as a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. The Cambridge Dictionary, 2018 describes Insulin as a hormone in the body that controls the amount of sugar in the blood. Hyperglycemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels.

Types of diabetes include Type 1 diabetes that occurs when the insulin producing pancreatic beta cells are destroyed by the body's immune system. This is also known as Insulin-dependent diabetes. Children and young adults are usually the ones who suffer from this form of diabetes. Risk factor for type 1 diabetes include autoimmune, genetics, environmental factors. Insulin is always needed for this kind of diabetes. Type 2 Diabetes or adult diabetes: In this form of diabetes the cells are incapable of using the insulin accurately, as insulin resistance. (American diabetes Association, 2015.)

The pancreas ability to produce insulin gradually ceases. This is more of also known as non-insulin dependent diabetes. Type 2 diabetes occurs primarily as a result of obesity and lack of exercise. This kind of diabetes is associated with older age, family history, obesity, physical immobility, impaired glucose metabolism, history of gestational diabetes (WHO 2017).

Although increasing numbers of individuals with type 1 diabetes are living into old age, this thesis concerns type 2 diabetes—overwhelmingly the most common incident and prevalent type in older age-groups. According to Gwen (2006), Type 2 diabetes is the most common type of diabetes and accounts for 90-95% of all people with diabetes. Older adults are at high risk for the development of type 2 diabetes due to the combined effects of increasing insulin resistance and impaired pancreatic islet function with aging (ADA 2015).

2.2 Diabetic foot ulcer

Diabetic foot ulcer in elderly patients is an issue that must be taken seriously. Diabetic foot problems account for more hospital admissions than any other long-term complications of diabetes and also result in increasing morbidity and mortality (Turns 2015). A steady increase of predominant diabetes and following diabetic foot ulcers can be witnessed everywhere (WHO 2016). The World Health Organization, 2016 has also estimated the prevalence of diabetes related complexities for all age-groups worldwide to be 2.8% in 2000, which corresponds to a total number of 171 million of patients. This number will more than double and will reach 366 million in 2030. The data adds that this increase is as much related to the aging of the population.

Uncontrolled diabetes has extreme consequences for health and well-being. The complications include stroke, kidney failure, damage can result in reduced blood flow, which combined with nerve damage (neuropathy) in the feet - increases the chance of foot ulcers, infection and the eventual need for limb amputation (Turns 2015). Noor et al. dictate that Around 90,000 amputations are done yearly as a result of non-traumatic diabetic foot complications.

Diabetic foot ulcers frequently result from a patient simultaneously having two or more risk factors, with diabetic peripheral neuropathy playing a central role. They can be classified into two types: neuropathic ulcers (diabetic neuropathic foot) and neuroischemic ulcers (diabetic neuroischemic foot). Loss of protective sensations, such as those towards pain and heat, as well as of vibration, tactile and deep pressure sensations are the main symptoms of diabetic sensory neuropathy, which is the primary factor for foot ulceration (Luximon, Ganesan & Younus, 2015). Around 15% of diabetic patients will face foot ulceration during the period that they have diabetes (Chand et al. 2012; American Diabetes Association 2015). The following diagram helps to describe the phases of formation of diabetic foot ulcer.

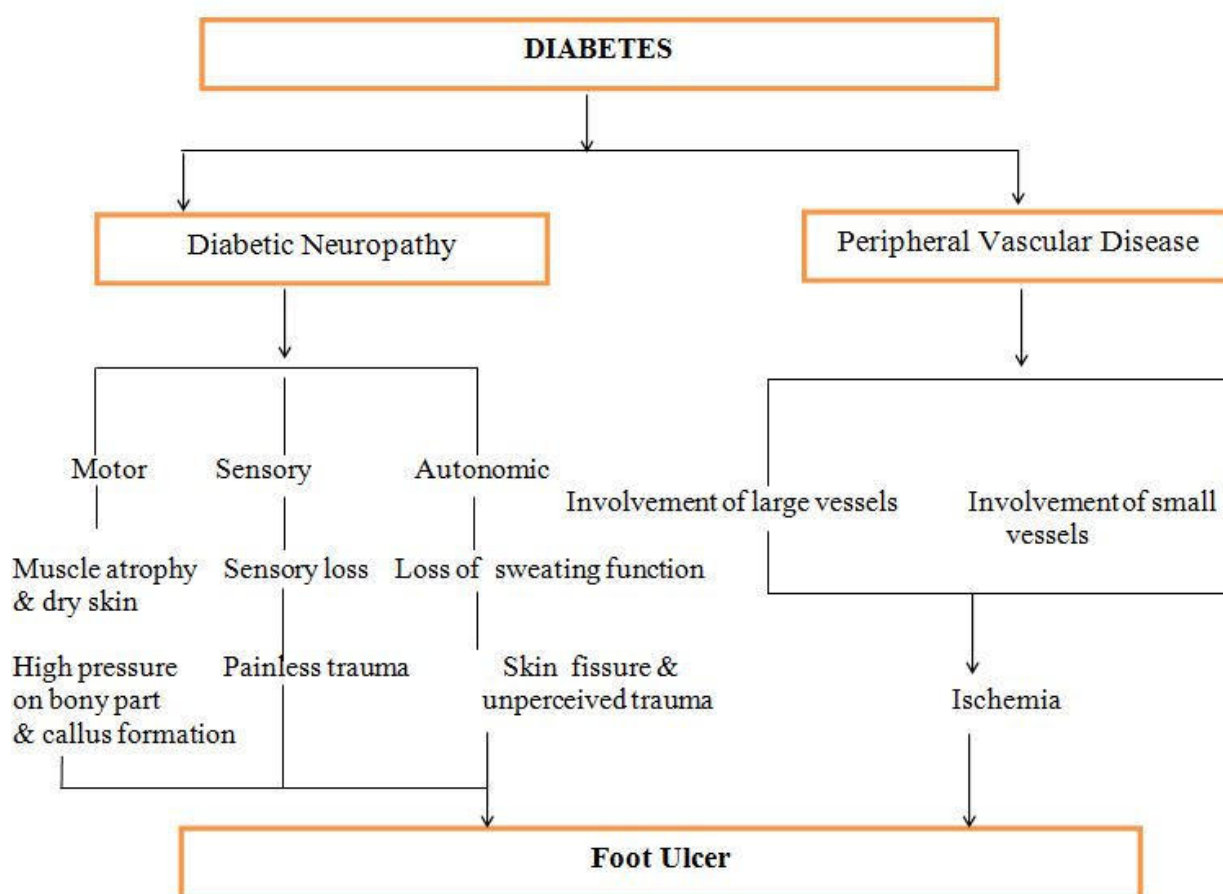


Figure. 1. Diabetic foot ulcer etiology (Luximon, Ganesan & Younus 2015)

This neuropathy leads to an insensitive and sometimes deformed foot, often causing an abnormal walking pattern. In people with neuropathy, minor trauma (e.g., from ill-fitting shoes, walking barefoot or an acute injury) can precipitate ulceration of the foot (Schaper, Van Netten, Apelqvist, Lipsky & Bakker 2015). Treatment of diabetic foot ulcers is challenging because of their multifactorial etiology, and it places a high burden on especially elderly patients, healthcare systems and society. Diabetes shows to drastically increase the risk of lower extremity amputation because of the non-healing infected foot ulcers (Bus, Jubiz, Lavery, Monteiro-Soares, Price, Rasmussen, Van Netten 2015).

Category	Risk factor	Ulcer incidence	Amputation incidence	Prevention and treatment
0	No sensory neuropathy	2-6%	0	Reevaluation once a year
1	Sensory neuropathy	6-9%	0	Podiatry/chiropractic every 6 months; over the counter shoes and insoles
2	Sensory neuropathy & foot deformity or peripheral vascular disease	8-17%	1-3%	Podiatry/chiropractic every 2-3 months; therapeutic shoes and insoles; patient education
3	Previous ulcer or amputation	26-78%	10-18%	Podiatry/chiropractic every 1-2 months; therapeutic shoes and insoles; patient education

Table 1. Diabetic foot risk categorization tool by Alavi et al. (2014)

Rates of amputation in populations with diagnosed diabetes are typically 10 to 20 times more than those of non-diabetic population, and over the past decade have ranged from 1.5 to 3.5 events per 1000 persons per year in populations with diagnosed diabetes (WHO 2016). Similarly, the data reveals that the relative risk of amputation was at least five times higher in old (>80 years) than in younger (40-59 years) subjects. About two-thirds of amputations are performed in patients aged over 60 years. Table 1 shows how the foot in risk of ulcer formation can be categorized in prevent amputation.

2.3 Elderly patients

Elderly patients or geriatric patients are people of higher age (>65 years and >75 years). They go through involuntary and morbid changes that significantly influence their functional state, adaptability, ability of regulation and stress tolerance. (Pavel 2010.) Elderly patients require often active observation of health and monitoring their functional state. According to Statistics Finland (2018), over 20,9 % of the Finnish population are above 65 years old. There is no escaping the fact that people get old all the time and the need to take care of the ageing population also increases.

Changes in the biomechanics, structure and function of the body come with the ageing process. The basic composition and homeostatic changes that ageing brings upon are important determinants of the physiological functions and therapeutical interventions in elderly patients. Similarly, the glucose metabolism also goes through changes as ageing progresses. In elderly patients with multi-morbidity the glucose tolerance decreases with increase in age. (Pavel 2010.)

In the same way, the functionality of the feet weakens with age, as the body also loses lean muscle mass in relation to the proportional increase of body fat. Thus, these factors can themselves contribute to the progression of glucose intolerance leading to acquiring diabetes which further leads to foot problems and diabetic foot ulcer and in some cases as aforementioned lower extremities amputation. (Rodrigues-Sanz, Tovaruela-Carrion, Lopez, Paloma, Romero, Navarro & Calvolobo 2017.)

American Diabetes Association (ADA 2015), shows that after the age of 60 there is continuous increase of the cardiovascular disease, stroke, hypertension. Similarly, with the age prevalence of diabetes rises as well. World health organization (WHO 2017), explains that in elderly patients (>65 years) the prevalence of diagnosed diabetes is approximately 6-10%. An additional 10% have undiagnosed diabetes. An increasing proportion of the elderly population is therefore at risk of microvascular complications. Microvascular complications are renal disease and eye diseases, including diabetic foot ulcer. While macrovascular complications include coronary heart disease, stroke and peripheral vascular diseases (Gwen 2006).

Sensorimotor neuropathy is one of the most common long-term condition of diabetes mellitus. Authors DUBY, Campbell, Setter, White & Rasmussen 2004, define sensorimotor neuropathy as a disease that affects large and small afferent nerve fibers to varying degree, resulting in mixed symptoms and sensory loss. Patients with this disease are posed at a high risk for falling which comes with life-threatening consequences. Furthermore, the narrative DUBY et al. 2004, explains that the loss of innervation can lead to atrophy of essential pedal muscles, resulting in deformities that predispose the patient to calluses and to ulceration. Quite a number of these cases end up in amputation. Foot care in gerontological care is nowadays seen of paramount in the healthcare sectors around the world (Ghanavati, Shaterzade, Goharpey & Arastoo 2011).

The literatures used for this thesis considers the idea that the diseases and the morbidity in old age are marked by many extraordinary, meaning the diseases have the tendency to cumulate and potentiate each other. Thus, multidimensionality is exemplary in geriatric medicine. An elderly patient who is sick must be comprehended as a bio-psycho-social unit in more holistic way than younger patients. The main prevention method to modify this disease is by addressing the underlying diabetes with focal control of the patients individualistic nursing care plan. (Pavel 2010.)

2.4 Prevention

Disease prevention, understood as specific population-based and individual-based interventions for primary and secondary (early detection) prevention, aiming to minimize the burden of diseases and associated risk factors (WHO EMRO 2017). Prevention measures cover the occurrence of disease or conditions secondary to a disease. Disease prevention is considered to be an action which usually emanates from the health sector, dealing with individuals and populations identified as exhibiting identifiable risk factors, often associated with different risk behaviors (WHO Geneva 1989).

Type 2 diabetes is preventable, and so are the complications attached to it. To do so, more focus must be put into eradicating the diabetes risk factor such as overweight, obesity, physical inactivity, unhealthy diet. Physical activity interventions have shown to be more effective in avoiding the occurrence of diabetes than diet change. (Luximon et al. 2015.)

Diabetic neuropathy and peripheral arterial disease put people with diabetes at greater risk of foot problems and it is estimated that one in ten will have a foot ulcer due to diabetes during their lives. Diabetes is also the most common cause of limb amputation not associated with trauma, and 80% of these amputations will be preceded by foot ulceration. (Chapman 2017.)

Early recognition of the high-risk foot is imperative to decrease the rates of mortality and morbidity. The foundation to prevent such ulcerative foot problems are identification of the at-risk foot, regular inspection and examination of the at-risk foot, education of patient, family and healthcare providers, routine wearing of appropriate footwear and treatment of pre-ulcerative signs (Shapiro 2016). Furthermore, some signs of foot ulcer can be asymptomatic or slow progressing. Thus, it is critical for diabetic patients to be screened of any signs of ulcers irrespective of being symptomatic. (Alavi et al.)

Prevention of neuropathy in diabetic elderly patients is a process that requires good knowledge and understanding of the geriatric patients. Patients group who live comparatively poor-quality life, suffer from balance impairment, difficulty in putting shoes, risk of falls and restrictive mobility and performance of daily activities need more guidance in prevention of diabetic foot ulcers. (Pavel 2010.)

The role of physician, nurses and other healthcare professionals is important, frequent assessment, examination and evaluation of foot problem is very important. Health care professionals should work together to discuss any clinical presentation and clinical based diagnostic evaluation. With the goal to prevent medical conditions and deformities that may affect the feet and alter foot conditions in elderly diabetic patients (Rodriguez-Sanz et al. 2017).

Foot ulcer prevention is very important to help reduce the burden on both the patient and health resources. Foot ulcers count amongst one of the major complications with occurring morbidity, mortality and resource consumption. Treatment of such foot ulcers can prove to be challenging due to their multifactorial etiology. Therefore, prevention of foot ulcers is of great importance and has long been recognized as a priority by the International Working Group on the Diabetic Foot.

The best approach in dealing with diabetic foot is prevention of ulcer through the identification of individuals at risk, patient education and follow-up. It is possible through routine foot exam, including previous history of the patient, the overall look, neurologic assessment. The first step to prevention is always the recognition of the at-risk individuals. Screening efforts must include all diabetic patients. In all patient care environment, it is important that the healthcare professional knows what to look for and how to correctly carry out a risk-based assessment. (McMahon 2016.)

Factors such as mobility, dietary habits, and patient knowledge about foot ulcers are just to name a few elements during the assessment. Recommendation per clinical guidelines (WHO EMRO 2017) say that all patients with diabetes must be examined every year to construct the risk of foot ulceration. Neuropathy (biothesiometry, monofilaments and absent ankle reflexes), and those that detect excessive plantar pressure (peak plantar pressure and joint deformity) were all significantly associated with future diabetic foot ulceration. (Alavi et al 2014)

Many experts agree that unfortunately, the feet are often neglected during a physical assessment. Furthermore, the severity of an oncoming foot ulcer is failed to be recognized. Alongside with assessment of the family medical history, healthcare professionals involved in the care of diabetes patients should have the skills necessary to discuss with the patient their individual level of risk and agree plans for future surveillance and supported self-management. (NICE 2016.)

2.5 Nursing Interventions

According to the center for Nursing Classification & clinical effectiveness (2017), nursing intervention is defined as any treatment, based upon clinical judgement and knowledge that a nurse performs to enhance patient outcomes. Nursing interventions form a base for any patient care plan, ranging from acute care, intensive units to home care. These interventions involve patient assessment, therapeutic involvement, patient-empowerment and educating the family. A patient supportive and educative approach encourages the patient to believe in

himself and promotes self-management (CNC 2017). This statement can be supported by Tartaglione, Cavacece, Cassia & Russo 2018, where the authors dictate that educating patients to have control over their treatment helps them feel less dependent on the healthcare professionals and healthcare services. It gives them a sense of independence and control in their disease management. As a result, patients feel awareness and increase in their quality of life. (Tartaglione et al. 2018)

Nursing Interventions can be understood as action plans put in place to get a problem fixed or regulate a health condition. Nursing interventions are categorized as: nursing diagnoses, goals and outcome criteria, nursing orders and evaluation. Carrying out medical orders and interventions might not always be curative but are meant to comfort and assist the patients as much as possible. It is right to say that some nursing interventions can play a therapeutic role as it helps alleviate symptoms, decrease pain, and incorporate holistic care. (Campbell 2017.)

McMahon (2016), briefly describes that there are four stages to nursing interventions. The first is the assessment, in which the nurse determines what the problem is. After the assessment, the nurse formulates an appropriate intervention plan. After planning, the nurse implements the treatment he or she has formulated, and then evaluates the patient to determine the outcome of the interventions, and to decide if additional interventions need to be undertaken.

For nursing interventions to prove effective, exploring patient's perspectives and their personal goals for wellness must be understood. Campbell 2017 believes nurses must be active listeners and observers. Recognizing the patients' health motives helps in constructing a treatment that minimizes waste in resources and promotes patient dignity. A care plan provides guidance for individualized care of the patient. A care plan flows from each patient unique list of diagnoses and must be organized by individual's specific demands. (CNC 2017.)

Diabetes being a life-attenuated disease, nursing intervention comes in use with not just diabetic individuals but also for family integrity and career education. This eventually leads to the promotion of community awareness. Thus, a good nursing intervention at the right time can prove to be an effective tool towards prevention of conditions like foot ulcer in diabetic elderly patients. (Rodriguez-Sanz et al. 2017.)

3 The purpose statement and research question

The purpose of this thesis is to describe the nursing interventions used in the prevention of foot ulcer in elderly diabetic patients.

Research question: What are the nursing interventions used in the prevention of foot ulcer in elderly diabetic patients?

4 Methodology

4.1 Principles of literature review

The method chosen to execute this thesis is a literature review. A literature review is the comprehensive study and interpretation of literature that relates to a specific topic. This method seeks to summarize the literature that is available on any one topic. A literature review is done by systematically searching and analyzing relevant literature which seeks to answer the research question. (Aveyard 2010.)

Aveyard (2010), emphasizes the ever-increasing importance of literature reviews in the health and social care sector. In a literature review, all the available evidence on any given topic is retrieved and reviewed so that an overall picture of what is known about the topic is achieved. Thus, the importance of a literature review is such that it provides an up-to-date understanding of the subject and its significance to practice. Furthermore, it identifies the methods used in previous research on the topic. This way it is easy to find the answer to the research question. This type of review provides comparisons for one's own research finding (Holloway & Wheeler 2013). Considering the aforementioned attributes, a literature review was the best fit for this thesis work.

4.2 Data Search and screening

Three databases were initially identified: Cumulative index of Nursing CINHAL(EBSCO), PubMed, Science direct. PubMed comprises of more than 28 million citations for biomedical and lifescience literature. CINAHL(Ebsco) is an index of English-language and selected other-language journal articles about nursing, allied health, biomedicine and healthcare. ScienceDirect is a large database of scientific and medical research.

These databases were accessed through electronic portal NELLI. The search was conducted in January 2018. The search words used were *nursing, nursing interventions, diabetes, foot ulcer, foot problems, elderly*. Data search was conducted in all three databases using the same search words and same combinations. Table 1 shows the number of hits and the selection process. The literature search identified 1370 references. Totally 12 articles were selected and finally 6 articles met all selection criteria and were included in this review.

Table 1. Data search and screening table

Database	Key terms	No. of hits	Selection based on first criteria	Selection based on second criteria	Selection based on third and final criteria
CINHAL (EBSCO)	Prevention AND Diabetes AND foot ulcer AND Nursing intervention	150	50	9	3
PubMed	Prevention AND Diabetes AND foot ulcer AND Nursing intervention	374	29	7	1
Science direct	Prevention AND Diabetes AND foot ulcer AND Nursing intervention	846	30	10	2

4.3 Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
First: <ul style="list-style-type: none"> - Studies conducted in English - Full text-language literature 	<ul style="list-style-type: none"> -Studies conducted in other languages than English - Partial-text language literature
Second: <ul style="list-style-type: none"> - Studies conducted in duration 2012-2017 	<ul style="list-style-type: none"> - Studies that were conducted before 2012 and after 2017; a 5 years period span
Third/final: <ul style="list-style-type: none"> - Applicability and compatibility of the studies' abstract to that of the research question 	<ul style="list-style-type: none"> -Studies with abstracts that did not correspond to the research question.

Table 2. Inclusion and exclusion criteria

An inclusion and exclusion criteria for the studies to be included was established. This way a research protocol had been set beforehand. The inclusion and exclusion criteria has been presented in table 2. The applicability of the title and the implication of the abstract defined the basis of the initial phase of data selection. Of all the search results a panel of studies were selected firstly, based on the fact that the study was written in English and the studies that were a full-text language literature. This deducted the array of search results as follows: CINHALL (EBSCO)-50, Pubmed-29, Science direct-30. The second selection criteria were selection of studies completed in duration 2012-2017 (5 years). This helped to furthermore constrict the result as follows: CINHALL (EBSCO)-9, PubMed- 7, Science direct- 10. The final selection criteria, which was the applicability and the compatibility of the studies' abstracts to the research questions, aided in finalizing the literature that were going to be used for the research; which were as follows: CINHALL (EBSCO)-3, PubMed- 1, Science direct- 2.

4.4 Data appraisal

Critical appraisal must be understood as understanding the strengths and limitations of a piece of research. While writing a literature review, critical appraisal comes handy since it allows the authors to measure the weight and the impact a particular research work should put on the work. Being a critique for relevance and exposing the limitations of the used materials before using it as a reference only adds to the reliability of the thesis. (Aveyard 2010.)

The appraisal process began by first identifying and classifying the literature (Aveyard 2010). In total three articles reported qualitative studies, one practice literature, one theoretical literature, and one policy literature. Since no one ideal appraisal tool was found, with the help of the book authorized by Aveyard (2010), a generic content of assessment questions was drawn up as follows:

- Is the evidence relevant to your research question?
- does the study attempt to answer the same clinical question as that of this work?
- Is the evidence from a known reputable source?
- Was the context clearly described?

Study	Notes	Critical appraisal based on questions formed
Schaper, N. C., Van Netten, J. J., Apelqvist, J., Lipsky, B. A., Bakker, K. 2015. Prevention and management of foot problems in diabetes: A summary Guidance for daily practice 2015. Www. Elsevier.com.	Qualitative Study	This study showed the most relevance to the research question of this work. Furthermore, the content of this piece of work is quite elaborate and matches the purpose of this research. The source belongs to the scientific database, Science Direct
Alavi, A., Sibbald, G. R., Mayer, D., Goodman, L., Botros, M., Armstrong, D. G., Woo, K., Boeni, T., Ayello, A. E., Kirsner, R. S. 2014. Diabetic foot ulcers- Part I. Pathophysiology and prevention.	Qualitative Study	The evidence is relevant to the research question. The context of this work was clearly described. There were some exemplary discussions and evident pictures for more elaborate understanding. The study does answer if not in detail but in light the same clinical question as that of this thesis. The source belongs to the scientific database, Science Direct
Shapiro, J. 2016. Preventing Preventable Diabetes Foot Disease. Www.podiatrym.com	Practice literature	This study is compatible with the research question. The context is shorter in description than other studies in this review. This study answers only part of the research question of this thesis. The source belongs to the Nursing database, CINHAL(EBSCO)

Chapman, S. 2017. Foot care for people with diabetes: prevention of complications and treatment. British journal of community Nursing. Vol 22, No 5	Theoretical literature	The content of this study is very relevant to the research question. It discusses most in detail about prevention of diabetic foot ulcer than any other works in this review. Which is also to say that it shows a good attempt in answering the same clinical questions as this thesis work. The source belongs to the Nursing database, CINHAL(EBSCO)
Annersten G. M., Pilhammar, E., Alm Roijer, C. 2012. Prevention of foot ulcers in patients with diabetes in home nursing: a qualitative interview study	Qualitative study	The content of this study is vast. It shows its relevance to the research question by its inclusion of nursing actions and care plan. It succeeds in answering the same research question as that of this thesis as it discussed about prevention and prophylaxis. The source belongs to the Nursing database, CINHAL(EBSCO)
National institute for health and care excellence. 2016. Diabetic foot problem: prevention and management. NICE clinical guideline 19	Policy literature	The context of this work is very broad, and every aspect is described widely. It corresponds well to the research question of this work. It contains discussion on nursing interventions as well as facts on prevention and management of diabetic foot problems. It is a little excessive and holds the tendency to lead the reader astray and get lost in its vastness of contexts. The source belongs to the database, PubMed

Table 3. Data Appraisal of the article used in the thesis.

4.5 Data Analysis

The framework approach toward this review was an inductive qualitative data analysis. The approach of qualitative data analysis was developed in the 1980s by social policy researchers at the national center for social research as a method to manage and analyze qualitative data in applied policy research. Management of data is done by following structured topic guides where aims and objectives are the main focal point. (Smith and Firth 2011.)

The qualitative data analysis is gaining popularity in recent times as it is able to provide a foundation for systematic analysis and manage qualitative data. in a situation whereby, there is need to form a general concept from a number of specific relevant data, inductive analysis

can be adopted. Therefore, this process of inductive qualitative data analysis enhances the analytical process and the credibility of the findings. (Smith and Firth 2011.)

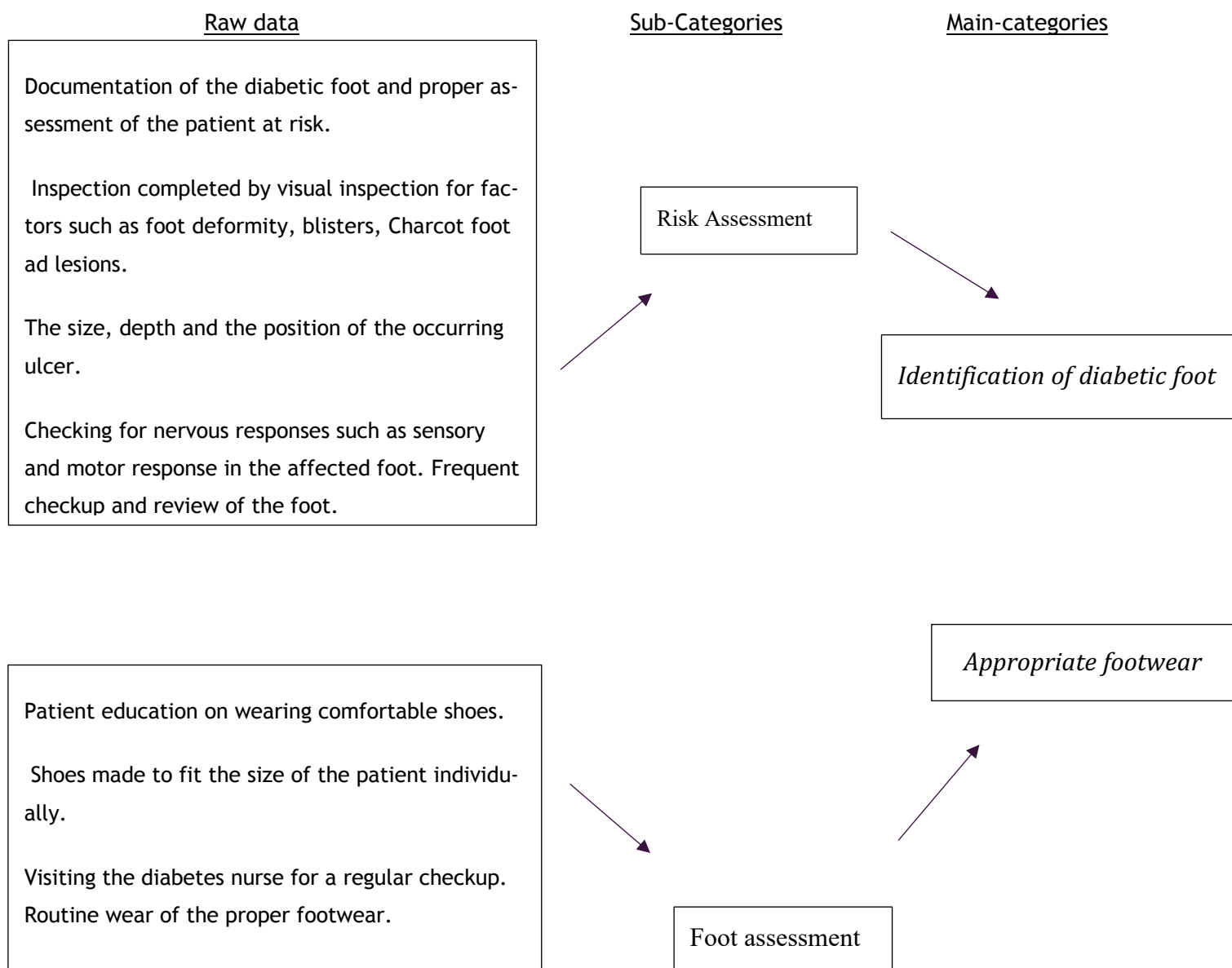
Chenail (2012), goes on to explain that qualitative data analysis as a form of knowledge management is a matter of managing analytical process to transform data into information and information into knowledge and knowledge into wisdom. Bryman and Burgess (1994) state that, the qualitative researcher has to provide some coherence and structure the cumbersome data set while retaining a hold of the original accounts and observations from which it is derived. All of this has implications for the method of analysis which are developed. The authors add, qualitative analysis is about detection, and the tasks of defining, categorizing, theorizing, explaining, exploring and mapping are fundamental to the analyst's role. The methods used for qualitative analysis therefore need to facilitate such detection, and to be a form which allows certain functions to be performed.

To understand the essence of an inductive qualitative data analysis, Wang and Park (2015) say, 'the goal of qualitative data analysis is to focus on the potential meanings of your data which eventually allows you to systematically summarize scattered and episodic stories and images into patterns of themes'. While that being mentioned the analysts must not be led astray of the complexity of the data but recognize and illustrate meaningful patterns in the data. This type of inductive data analysis can be plainly understood as, to have no pre-conceived ideas and to approach the data as it presents. Classification of the emerging themes into concepts that eventually leads to a theoretical story. (Wang and Park 2015.)

Figure. 2 shows the data analysis process. Initially, the literature reviewed were read and coded by the authors. This was done by both the authors reading through the chosen literatures rigorously. The authors then noted down relevant and important data in relevance to the research question individually. The notes were further discussed amongst the authors to form sets of Sub categories such that statements and notes addressing one diabetic foot ulcer issue would be grouped together. Likewise, the main categories were formed in the attempt of grouping similar types of interventions portrayed in the sub-categories. This procedure of categorization is the best-known method of carrying out an inductive qualitative data analysis (Finfgeld 2003).

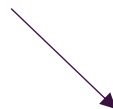
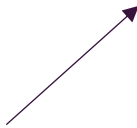
The authors considered this thesis work as an exploration of ideas and an open-ended study; thus an inductive approach allowed the writers to extract a wider range of theoretical idea from the data. In the beginning of the analysis process, the text data had been read several times by both the authors to familiarize with the overall themes of the narratives. Next, the texts had been read thoroughly line by line during the analyzing phase. The identified themes were merged into broader groups. This way the authors extracted the panel of findings. The findings were then re-examined to the narrative data to understand connection of the themes.

Fig 2. Illustration of the Data analysis process



Avoid smoking and consumption of alcohol.
 BMI index, regular exercises and controlling the weight.
 Eating healthy and good sleeping pattern

Healthy Lifestyle



Encourage the patient to learn to take care of oneself.
 Teach proper foot care like lesion dressing, assessment of one's sensitivity and pain.
 Help to create a timetable of medications and regular exercises.
 Help to teach how to eat healthy food and teach about nutrients needed in treatment of a diabetic foot.

Patient education

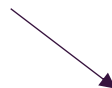


Self-care



Blood sugar level management. Regulating the saturated and unsaturated blood lipid level
 Habituating to eat a diet low in saturated fat combined with daily exercises.
 Staying active and positive minded. Controlling stress

Lipid and metabolic control



Glycaemic control

Patient education on the usage and the importance of the various types of medicine and pharmacological measure available.
 Educate the patient on types of insulin. Routes of administration, method of administration. Insulin injection practice.

Insulin therapy



Pharmacological intervention



5 Literature review findings

5.1 Identification of the diabetic foot

According to Annersten, Pilhammer & Alm 2012, Vascular foot changes and neuropathy are accelerated due to various biochemical abnormalities. This includes hyperglycemia, ischemia or both. Many contributory factors can have associated as risk factors can be associated with diabetic foot ulcers (DFU).

There are many explanations on the classification of an ulcer; such as depth, size, appearance and location. These aspects all provide mapping of progress during treatment (Schaper et al. 2015). To identify the foot at risk of ulceration, the feet should have examined annually to seek evidence of signs or symptoms of peripheral artery disease.

Simplified screening tests can be used in identification of the high-risk diabetic foot, and subsequent foot ulcers may have prevented. Referrals to a foot specialist may also prevent ulceration in elderly clients which aids in decrease risk of lower extremity amputations. Alavi et al. (2014), suggests that amputation could reduce any prevention of occurring foot ulcers which can reduce by 40% to 80% through the detection of high-risk patients and a subsequent inter professional approach that focuses on preventive measures. Figure 1. below shows an example of a simplified screening test for identification of the foot at risk.

Regular screening and follow-ups must be held frequently for patients found to have a risk factor. It is imperative to understand that an asymptomatic person with diabetes does not eliminate foot disorders. Asymptomatic neuropathy, peripheral artery disease, pre-ulcerative signs or even a festering ulcer should be inspected closely. (Schaper et al. 2015.)

Inspection and examination should include: History: Previous ulcer/amputation, end stage renal disease, previous foot education, social isolation, poor access to healthcare, bare-foot walking. Vascular status: History of claudication, rest pain, palpation of pedal pulses. Skin: Callus, color, temperature, edema. bone/joint: Deformities (e.g., Claw toes, hammer toes) or bony prominences, limited joint mobility. Footwear socks (worn when at home and when outside): Assessment of both their inside and outside. (Shapiro 2016.)

5.2 Appropriate footwear

Early signs of a diabetic foot problem include losing sense of touch and lose of reflex in the feet muscle. Walking barefoot with an insensitive foot can very likely cause ulceration. To add, usage of inappropriate footwear is another contributing factor. It is also reported that

inappropriate footwear is one of the primary reasons for developing foot ulceration, and 21-76% of foot ulcers or amputations occur due to ill fitted footwear (Annersten et al. 2012). If a patient suffers from loss of protective sensation, they must have access to appropriate footwear.

Prevention of diabetic footwear ulcers and the importance of footwear have been described in the literatures used for this thesis. Elderly patients suffering from or even just as risk-carriers must be encouraged to wear appropriate footwear at all times. All footwear must be prepared to accommodate to altered biomechanics and deformities of the affecting patient's foot. Elderly diabetic patients with no signs of ulcerative symptoms must in all case wear comfortable shoes that has a good fit as prophylaxis. An appropriate footwear is imperative for patients with neuropathy or holds a history of amputation or ulcer. (Alavi et al. 2014.)

Schaper et al. (2015), explains that the shoe should not be either too tight or too loose (see figure 3). The inside of the shoe should be 1-2cm longer than the foot. The internal width should equal the width of the foot at the metatarsal phalangeal joints (widest part of the foot), and the height should allow enough room for all the toes. The fit of the footwear must be evaluated in the standing position. Shapiro (2016), weighs on the fact that prescription shoes are a great prophylaxis to foot ulcers only when they are used by the patients during their most ambulatory period of the day. Footwear cannot be effective if it is not worn. If there are deformities and abnormal loading of foot caused due to hyperemia, callus, ulceration, the patient must be referred to a foot specialist. The foot specialist can consult the patient into construction of a custom footwear including insoles or orthoses. In-shoe plantar pressure measurements can be used to measure and sketch the footwear. This can guide modifications in an effective manner to improvise pressure relief in individual patients. (Schaper et al. 2015.)



Figure 3. Internal width of the shoe (Schaper et al. 2015).

5.3 Patient education

In the context of foot ulcer self-management is important, as foot ulcer usually develops outside a clinical setting. This aims at improving daily foot care habits. Monitoring the foot temperature at home provides immediate feedback on the risk of ulceration (NICE 2017). An imperative component that can contribute to a positive clinical outcome is patients' adherence to the daily measurement of foot temperature (Chapman 2017).

Patient education can be carried out in various forms such as in individual sessions or group sessions. Healthcare professional with multi dimension reach such as nurses, podiatrists, physiotherapist, doctors can hold information seminars and practical lessons. Brochures and hand outs are always a good idea to reach clients. They are easy to read and follow the instructions from the printed pictures as guidance. (Chapman 2017.) Instructing not just the clients but their relatives and the next of kin and the care takers can prove to be helpful in the long run. Helping to recognize the signs of early ulcer and reporting them on time can show to be very effective in preventing foot ulcer; signs such as onset of fever, changes in local wound conditions, worsening hyperglycemia. (Shapiro 2016.)

Educating the elderly patients on the mode of insulin delivery is a crucial part of patient education. Unlike younger patients, elderly patients might struggle with accurately administering insulin. Patients of the elderly group are exerted with poor eyesight or impaired manual dexterity. Such patients benefit from a comprehensive guidance from diabetes specialist nurses on the selection of the insulin pen. Short, fine needles have the advantage of being less painful and are best suited for thin skin (NICE 2017).

5.4 Glycemic control

An essential component of the overall management of type 1 and type 2 diabetes is dietary regulation. In the management of diabetes, the type and amount of food consumed holds an integral importance. The role of health care professionals is to assist patients to achieve and maintain ideal metabolic and glycaemic control. Nutritional goals should be determined in partnership with the elderly patients, taking into consideration individual needs and helping the patient accept and maintain a healthy lifestyle.

Chronic hyperglycemia appears to be one of the most important factors in the development and healing of diabetic foot ulcers. In attempt to prevent the many complications of diabetes including foot ulcer, the most common treatment is controlling of blood sugar levels.

Interventions that enhances glycemic control might include more frequent subcutaneous insulin administration, continuous insulin infusions, oral antibiotics, lifestyle modification (Chapman 2017). Prescribed topical antibiotics such as ampicillin, amoxicillin, sulbactam ointment can be used while cleaning a foot ulcer wound. These show the utmost effect against any gram-negative bacteria. Other oral medication like Keflex, cefuroxime is prescribed to target the staphylococcus and also the skin infection sites (Alavi et al. 2014).

Nurses can facilitate the prevention of foot ulcer by administering medications and insulin on time. In addition, educating the patient about the different types of available antibiotics and their usage. Furthermore, nurses can help elderly patients to remind and follow a daily pattern of insulin and medication chart. (Annersten et al 2012.) Chapman (2017) says, it is also important for nurses to recognize that the enhanced glucose control might increase the risk of severe hypoglycemia episodes, which needs to be considered while calculating the risk and benefit ratio.

5.5 Insulin therapy

Insulin is a hormone that is produced by the pancreas. With each meal, the beta cells of the pancreas release insulin to help the body use or store the blood glucose attained from the food. It aids in breaking down of macromolecules like carbohydrate into glucose. Glucose is then used as fuel by the body. In case of diabetes 1, the body is incapable of producing insulin while in Type 2 diabetes, the absorption of insulin is very poor. (Shapiro 2016.)

Insulins can be of different types, depending on how quickly they work, when they peak and how long they last. Insulin proves futile if taken orally since it gets digested as does protein in the food. It is thus injected into the subcutaneous layer under the skin where it gets absorbed into the blood. The most common injection sites are the thighs, hips, buttocks.

Types of insulin

Rapid acting insulin begins work about 15 minutes after injection, peak hour in 1 hour, work continues for 2-4 hours.

Regular or shot-acting insulin in absorbed into the bloodstream in 30 minutes after injection, peak hour from 2-3 hours after injection, remains effective for 3-6 hours after injection.

Intermediate acting insulin usually reaches the bloodstream in 2-4 hours after injection, peaks 4 to 12 hours, remains effective for 12- 18 hours.

Long-acting insulin reaches the bloodstream several hours after the injection, it works by lowering the blood glucose levels evenly over a 24-hour period

The approach towards elderly patients on starting insulin therapy should be taken carefully. Considering greater comorbidity as a result of conditions such as cognitive function or age-related changes in functional ability and senses affecting the ability to administer insulin, supervise the blood glucose level and manage hypoglycaemia.

Starting an elderly client on insulin require a proper assessment of the patient. The advantages and the disadvantages of using insulin must be understood well by the patients and the carer. To add, a structured management plan must be built based on comprehensive assessment. The patient's cognitive skills must be assessed in detail with the Folstein Mini-Mental State examination. In addition, mood should be assessed with the geriatric depression scale. This group of tools are used to determine whether a patient is capable to inject insulin independently and to recognise and deal with hypoglycaemia. (NICE 2016.)

For elderly type 2 diabetic patients the targeted glycated haemoglobin (HBA1c) should be < 7% given that the patient leads a good quality lifestyle (NICE 2016).

For elderly type 2 patients suffering from poor glycaemic control with normal weight, addition of a bedtime injection of intermediate-acting insulin to existing oral hypoglycaemic therapy can lessen hyperglycaemia without extra weight gain. This option is best used by elderly patients who do not want to use two insulin injections as their insulin therapy. While an example of a different regimen could be the usage of the long-acting insulin in conjunction with a rapid-acting insulin before meal. An insulin regimen may differ from patient to patient corresponding to the individual lifestyle and requirements. (Alavi et al. 2014.)

Foot ulcers can be well prevented if Diabetes Mellitus is kept in check. Diabetes and its complexities can prove to be demanding of an elderly patient. Control of insulin administration, blood glucose level should be a part of holistic and patient-centred approach. Therefore, elderly patients require open discussion which involve them and education in order to develop good concordance with insulin therapy regimens.

6 Discussion

The purpose of this thesis was to describe the nursing interventions used in the prevention of foot ulcer in elderly diabetic patients. With this thesis the authors have tried to answer the research question with the best of their capability. The literatures reviewed were searched in the previously mentioned academic databases and the findings were achieved with an inductive qualitative analysis. The findings have been interpreted according to the two authors understanding and capability.

Elderly clients with diabetic neuropathic foot have increased risks of developing ulcerations and other further serious complications, such as the Charcot foot and other foot deformities, and may face lower extremity amputation. In this thesis, the causes of the diabetic foot, risk factors for foot ulceration, the etiology of ulcers, various types of diabetic foot have been presented.

The authors of this thesis have tried to describe the nursing interventions in prevention of diabetic foot ulcer in elderly patients. The authors intended to do so by reviewing previous researches specializing in the same area of interest. The authors fix an aim with an intention that nurses and nursing student can adopt and learn about prevention of diabetic foot ulcers in elderly patients and potentially apply it in their working life.

As said in the famous proverb, prevention is better than cure, prevention of diabetic foot ulcer in elderly patients starts by recognizing the signs of developing foot ulcer. To rephrase it as, identification of the at-risk foot. The results from the reviewed literature explains that vascular foot changes and neuropathy are accelerated due to various biochemical abnormalities. This includes hyperglycemia, ischemia or sometime both. All patients require annual comprehensive foot examination to identify risk factors that are indicative of ulcers and amputations. Early recognition of the high-risk foot is imperative to decrease the rates of mortality and morbidity. The foundation to prevent such ulcerative foot problems are identification of the at-risk foot, regular inspection and examination of the at-risk foot.

Amongst other findings the literature reviews also suggest that in management and prevention of diabetic foot ulcer interventions such as offloading, control of infection, control of ischemia, wound debridement should be offered as standard care.

This thesis has tried to emphasize the importance of therapeutic footwear. Offloading has shown to be an integral part of prevention of diabetic foot ulcers. Use of appropriate or custom-made therapeutic footwear for different types of diabetic foot, and diabetic care education and prevention of foot ulcers in elderly patients. Older patients with diabetes and their care takers need to pay attention early on to prevent ulcers by choosing appropriate footwear and proper diet plan. The diabetic foot with the absence of protective footwear will increase

mechanical stress on the surface of the foot. Therefore, appropriate and custom-made therapeutic footwear with insoles (custom made or prefabricated therapeutic) has a dominant role in reducing plantar pressure on the diabetic foot and preventing the risk of foot ulceration.

During the thesis the authors stumbled upon not only the findings but also ideas on how a nurse's role could prove to be effective in prevention of foot ulcer in the elderly patients. Such as, nurses impart information and knowledge to their patients as they work in caring for them. A role of the nurse is also to facilitate communication between the patient and the doctor. The thesis also provided an insight on the care of elderly population. While one of the findings of this thesis came to be providing patient education and information on preventing signs of foot ulcer, the authors have come to learn that a multi-professional input as a preventive method can be effective in the prevention of foot ulcer.

The results that arose from the selected articles also prove how vital role patient education plays in prevention of foot ulcer in elderly patients. Nursing is a profession that naturally teaches while providing care and promoting health. Patient care and education goes hand in hand. Patient education can be carried out in various forms such as in individual sessions or group sessions. Healthcare professional with multi dimension reach such as nurses, podiatrists, physiotherapist, doctors can hold information seminars and practical lessons in a way that is understandable by senior patients. Elderly patients can feel themselves to be in a vulnerable situation when dealing with painful medical condition such as diabetic foot ulcer. Hence, the results also showed that the role nurses play at supporting elderly patients through educating and consulting can put a major positive impact and help them accept and overcome their feeling of vulnerability.

While reading the research material, the authors figured that one of the best ways to prevent diabetic foot ulcer was to start a glycemic control regime. This was then added and explained also as one of the main findings. Achieving euglycemia, or a state of normal blood glucose level can delay or totally prevent the formation of diabetic foot ulcer. Glycemic control includes use of insulin-sensitizing medications, use of insulin and adjustment of lifestyle and foot habits. All the literature used in this research constituted glycemic control to be one of the important preventive components.

Although the findings of the thesis fulfil the research question and the authors have come to explain the nursing intervention in prevention of diabetic foot ulcer, the authors feel that there are more factors and component that the authors could not fully analyze. The limiting factor of the literature review was the lack of specific research that pertained to this topic. For example, the amount of available literature review for elderly patient as target group was much less than for youth of adult age population.

Further study suggestion on this topic should be done specifically keeping elderly population as target group. Also, there needs to be more information to learn the impact of age in the presentation of foot ulcer in elderly patients with diabetes.

7 Reliability and validity

Reliability of data is connected to consistency, accuracy, precision, stability, equivalence and homogeneity. A reliable item or instrument is required to be consistent. Validity of content refers to the universality of content. It also evaluates whether the items of content are representative of the content domain that is looked for. A valid item or instrument measures something that is supposed to measure (Lo- Biondo Wood & Haber 2010).

The reliability of this thesis is highly considered. The two authors of the thesis have deliberated and reflected on several aspects. The literature gathering process was conducted such that the authors only selected research articles based upon empirical studies. To ensure consent with these criteria, only professional, scientific databases and peer reviewed scientific journals were used. Among the databases used were CINHAI(Ebsco), PubMed, ScienceDirect. Successful attempts were written down and documented. A few studies overviewed prevention of foot problems diabetic patients but could not be included in this review due to the incongruency of the age group to the thesis.

Studies conducted in English language was an inclusion criterion in the selection of the data as English being the lingua franca for and amongst the two authors and as both the authors have sufficient knowledge regarding the language. Studies conducted within the timespan of 2012-2017 were selected for reviewing. Studies with only full-text language literature was included so that the data could be well reviewed.

Under the methodology, the authors have described how they used inductive content analysis approach. To add, the method of interpreting and classifying data has been explained. The authors have given an example in a diagram form how the data was put together interpreted. The authors also believe that the data is appropriate since they were acquired from academic articles that were less than 5 years old, peer-reviewed and the content reflected the topic and the research question of the thesis. The authors used 6 articles to analyze the data and enough sources to validate the data.

The authors equally participated in the extraction of raw data, classifying the information, highlighting emerging themes and arranging the data by categories based on similarities they exhibit.

7.1 Ethical considerations

The importance of ethical considerations in any scientific writing cannot be over emphasized. Ethics are the norms or standards for conduct that distinguish between right and wrong. They help to determine the difference between acceptable and unacceptable behaviors on the part of the researcher. Holloway & wheeler (2013), mentions that the integrity, reliability and validity of the research finding rely heavily on adherence to ethical principles. They further emphasized the need for every scientific article to be devoid of plagiarism or any form of duplication of another person's work without due reference or acknowledgement of the person. The readers and public must be assured that researchers have followed the appropriate guidelines for issues such as human rights, animal welfare, conflicts of interest, safety, health standards and so on.

The authors having understood the vitality of ethical consideration and have tried to comply with all ethical standards set for writing thesis work. This study has been completed by two authors who declare hereby that they have no conflicting interests.

Laurea university of applied science "Laurea's thesis guidelines," was followed in the course of this thesis. In the beginning, the authors sort for and got the approval for the thesis topic from the responsible teacher/supervisor at Laurea. A thesis agreement and a thesis plan were written and accepted by the supervisor at the beginning of this study.

The literature that was reviewed was gathered from reliable sources and official academic databases which the authors were authorized to access through school's electronic portal NELLI. All the articles used were free access and prohibited articles were not used in this thesis work. References were used for any adapted citations or captured statements. No unauthorized personal data of the authors was revealed in this thesis. In addition, plagiarism was averted by giving appropriate references where needed, according to Laurea Guidelines for Referencing (King 2013).

For data appraisal, the authors adopted the critical appraisal parameters by Aveyard (2010). The process of data appraisal is shown as table 3. Data from the articles were systematically grouped to form the main categories, that were then used in discussing the findings from the study. The findings presented in this thesis is obtained from that of reviewing the 6 articles that were chosen. The authors invested genuine effort in presenting the work in their own language and thoughts. However, the findings reflect the authors own interpretation of the data discovered by the literature review process.

The credibility of the findings can be verified by the fact that more than one literature amongst the 6 literatures granted raw data to mature into the findings. The data analysis process in section 5.4 gives a detailed description of how the authors arrived at the findings. This

ascertains the dependability of the thesis and claims how reliable the findings of this thesis are as the review and analysis of the literature and data was carried out by two authors. This study hopefully can be of value to the multidisciplinary array of healthcare workers involved in treatment decisions for the group of elderly patients suffering with diabetics.

7.2 Limitations and recommendation

Although the purpose of the thesis were obtained, there remains some unpreventable limitations. Faults are unpreventable as novice writers of thesis work. The selection process of the literature was carried out carefully but only by the two authors. The literature search was confined to some restriction such as, full-text literature and literature written in the English language and literature published not older than five years. Vital data may have been missed out in literature and studies done in other languages. Likewise, literatures older than five years could have held important information that might have proved essential. Relevant data might have been lost as well in purchasable articles as only free access articles were used in this thesis.

The academic databases searched for data collection were those which were accessible by Laurea UAS electronic portal NELLI. Compatible data could have been missed out due to the inaccessibility of many other scientific databases. While the majority of the literature reviewed in this thesis were of high quality, all research is inherently flawed, and thus the limitations of those articles also affect this study.

Acknowledging one's limitations is important while carrying out a study such as this. The authors of this study are in no way professionals and there are chances that some data or piece of information go unnoticed which could affect the quality of this study.

The literature review recommends that more studies should be done specifically to learn the impact of age in the presentation of foot ulcer in elderly patients with diabetes. Prevention of foot ulcers in elderly patients has not been given attention since most of the prevalent studies have been done on the treatment and management of the disease. Likewise, the elderly patients have been the least concerned for group in context of prevention of diabetic foot ulcer. Nursing education should be emphasized which helps in the cause for prevention of diabetic foot ulcer in elderly patients. Nurses play a big role in spreading awareness and educating patients and thus more nursing researches should focus on studying the prevention of diabetic foot ulcer in elderly patients.

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9 Figures

[Fig. 1. Diabetic foot ulcer etiology \(Luximon, Ganesan & Younus 2015\)](#)

[Fig 2. Illustration of the Data analysis process](#)

[Figure 3. Internal width of the shoe \(Schaper et al. 2015\).](#)

10 Tables

[Table 2. Data search and screening table](#)

[Table 3. Inclusion and exclusion criteria](#)

[Table 4. Data Appraisal of the article used in the thesis](#)

