The role of nurses as educators in the prevention and management of type 2 diabetes: A systematic Literature review
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Degree Thesis for Undergraduate Studies (Bachelor of Health)

Degree Programme in Nursing

BACHELOR'S THESIS

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Degree Programme: Nursing

Specialization: General Nursing

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Title: The roles of nurses as educators in preventing and management of type 2 diabetes: A systematic Literature review.

Date: February, 2019    Number of pages: 56    Appendices: 3
Abstract

Globally about 200 million people suffer from type 2 diabetes mellitus (T2DM). In Finland, a country with a population of about 5.5 million people, there are about 300,000 people living with T2DM. Nurses have the obligation to guide a patient on suitable prevention and management strategies towards T2DM. Therefore, this study aims at investigating the roles of nurses as educators in the prevention and management of T2DM. This study chooses a systematic literature review methodology. This was achieved by reviewing and analysing previous literature based on the fifteen studies that were identified. These studies focused on the role of nurses in acting as educators in the prevention and management of T2DM.

Based on the reviewed literature, the analysis was based on three main key themes identified; the role of nurses in the prevention of T2DM, the role of nurses in the management of T2DM and the role and responsibilities of nurses as educators. Further, the three themes were described into eleven sub-categories that presented more specific findings. Based on these sub-categories, it was noted that nurses play a major role in the prevention of diabetes where they act both as advocates and teachers to educate patients on ways of reducing their risk of developing T2DM, the need to consume a well-balanced diet, the need to limit alcohol consumption and stop smoking and the importance of regular physical exercises. Additionally, the nurse’s role in the management of T2DM helps to evaluate the patient’s individual needs and in the understanding of diabetes-related complications and associated problems. Nurses have a role and responsibility as educators in the promotion of self-care among diabetic patients, provisions of nutritional education, early screening and detection of T2DM among high-risk patients, monitoring of blood glucose levels and provision of education on the administration of oral and injectable therapies. Nurses are able to play these roles since they have the opportunity to engage patients seeking healthcare services. In conclusion, as described the nurse plays a vital role in the prevention and management of T2DM.

Language: English
Key words: Diabetic type 2, Prevention, Elderly, Nurse Educator Role and Support, Management and Nursing
1 Introduction

Diabetes mellitus can be defined as a metabolic disorder which is characterized by the presence of a high blood sugar level due to the production of a limited amount of insulin or lack of insulin sensitivity in blood and this usually happens over an extended period of time (Borus, & Laffel, 2010; Biessels, Strachan, Visseren, Kappelle, & Whitmer, 2014). Diabetes mellitus can be categorized into three and include; Gestational diabetes mellitus, diabetes mellitus type 1 (T1DM) which is also called juvenile diabetes and type 2 diabetes Mellitus T2DM which is also known as adult-onset diabetes (Haas, Maryniuk, Beck, Cox, Duker, Edwards, ... & McLaughlin, 2012). WHO (2016), ranked diabetes mellitus fourth among non-communicable diseases.

According to WHO (2015a), T2DM was originally known as non-insulin dependent or adult onset, diabetes and is as a result of inefficient insulin utilization. T2DM is characterised by multiple metabolic abnormalities, and insulin resistance is one of the most common factors (Paulweber, Valensi, Lindström, Lalic, Greaves, McKee,... & Sheppard, 2010). In addition, it can also occur when there is an accompanying defect in insulin secretion which is also related affects the degree of insulin resistance (Ismail-Beigi, 2012; Peyrot, Rubin, & Khunti, 2010). Prolonged type 2 diabetes results in a functional defect in the pancreatic beta cell resulting from a decrease in beta cell mass. The beta cell defects lead to decreased production of endogenous insulin, decreased unresponsiveness to glucose and aggravate hyperglycaemia. This deficiency in most cases requires the patient to be supplemented with exogenous insulin. T2DM, a common non-communicable disease, has become a major public health concern. This condition is difficult to treat and very expensive to manage. Globally, type 2 diabetes appears to be majorly as a result of increased body weight as well as inadequate physical activity (WHO, 2016).
Worldwide, there are an estimated 200 million people suffering from diabetes and global projections indicate that this figure is likely to double in the next 25 years (Dabelea, Mayer-Davis, Saydah, Imperatore, Linder, Divers,... & Liese, 2014). In Finland, a country with a population of about 5.5 million people, there are about 300,000 people living with type 2 diabetes and those undiagnosed with type 2 diabetes estimated to be about, 160,000 (Finnish Diabetes Association, 2018). One of the most serious concern is the fact that at least a third of the people in Finland are genetically predisposed to having type 2 diabetes. In addition, about 10-20 per cent of people have impaired glucose tolerance (James, Oparil, Carter, Cushman, Dennison-Himmelfarb, Handler, ... & Smith, 2014). Among those suffering from the condition, the highest prevalence has been shown to be among the working age group and the figures reaching a peak among the 55-59 years old. In addition, the numbers of people aged 60-74 years have also been shown to be quite high. This indicates that type 2 diabetes rates among the old are growing rapidly. Finnish Diabetes Association (2003), indicates that rapid rise in type 2 diabetes is an indication of a serious challenge for Finland public health care sector.

Nurses possess diverse roles and responsibilities in helping patients. Throughout the years, nurses’ roles have continued to evolve in relation to the patient’s needs (Jansink, Braspennin, van der Weijden, Elwyn, & Grol, 2010). The nurse takes care of the patients’ needs to promote healthy living. Although most people do not trust the nurses in early detection and prevention of diabetes, they play a major role in the prevention of diabetes where they act both as advocates and teachers (Ley, Hamdy, Mohan, & Hu, 2014; Pan, Schernhammer, Sun, & Hu, 2011). Since the nurses have the opportunity to engage patients seeing healthcare services, they have the opportunity to educate them on risk factors for T2DM (Munshi, Florez, Huang, Kalyani, Mupanomunda, Pandya, ... & Haas, 2016). No, the matter the type of risk that one is exposed to, nurses have the ability to guide
a patient on suitable prevention and management ways towards to type 2 diabetes (Launer, Miller, Williamson, Lazar, Gerstein, Murray, & Lovato, 2011; Nam, Chesla, Stotts, Kroon, & Janson, 2011). The aim of this study is to investigate nurses as educators’ roles in the prevention and management of type 2 diabetes. The main focus is on the care of people suffering from type 2 diabetes, and additionally study nurse’s role care provision. This will be achieved by analysing current research concerning type 2 diabetes prevention and management.

2 Research aim and Problem Identification

This study aims to gain new knowledge and a greater understanding of the role of nurses as educators in the prevention and management of T2DM. The study will focus on how education provided by nurses may impact on patient wellbeing. To achieve the study, aim, it is paramount to first establish the risk factors related to T2DM and how they can be avoided or overcome and the role of nurses in the prevention and interventions.

2.1 Research Questions

1. What roles do the nurses play in the prevention and management of T2DM?
2. What is the education role of nurses in the prevention and management of T2DM?

3 Background

Diabetes Mellitus is a disorder denoted by high levels of blood sugar since the body produces limited amounts of insulin. It results due to a deficiency or absence of insulin or even an impairment of insulin and these results in a varying degree of disruption of metabolism (Launer, Miller, Williamson, Lazar, Gerstein, Murray, & Lovato, 2011; Nam, Chesla, Stotts, Kroon, & Janson, 2011). Diabetes is a common chronic disease whose prevalence rates have continued to
grow globally. In this condition, the patient’s body is not able to produce enough insulin (Naylor, Aiken, Kurtzman, Olds, & Hirschman, 2011). Many rare forms of diabetes mellitus are known, however, there are to main types which include type 1 diabetes mellitus which was formerly known as insulin-dependent diabetes mellitus juvenile-onset diabetes mellitus (Ley, Hamdy, Mohan, & Hu, 2014). This form of diabetes develops due to the annihilation of the pancreatic beta cells by the immune system and these are important cells which produce insulin in the body and this insulin functions to regulate blood glucose levels. Usually, people suffering from this form of diabetes survive by insulin injections (Jansink, Braspennings, van der Weijden, Elwyn, & Grol, 2010). This form is most common in young adults as well as in children although it is known to occur at any given age.

Type 2 diabetes was previously known as non-insulin dependent diabetes mellitus or adult-onset diabetes. This form of diabetes usually represents between 90-95% of all reported diabetes conditions and begins as a resistance towards insulin which occurs when the body cells lack to properly use the available insulin (Ngandu, Lehtisalo, Solomon, Levälahti, Ahtiluoto, Antikainen, & Lindström, 2015). Due to the body’s need for more insulin, the pancreas gradually loses its function. This form of diabetes is most common at old age. There is the opportunity to improve the health of an individual suffering from type 2 diabetes through the adoption of a healthy lifestyle and this requires healthy eating, physical activity that is done on a daily basis and ensuring that the patient maintains a healthy weight (Borus, & Laffel, 2010; Biessels, Strachan, Visseren, Kappelle, & Whitmer, 2014). The main interest in type 2 diabetes in this study is the fact that it has been shown to affect the elderly with figures indicating that up to 50% of people older than 60 years are affected.
3.1 Risk factors for diabetes

The main risk factors for type 1 diabetes mellitus are genetic, environmental and autoimmune while for type 2 diabetes are poor nutrition, smoking, the history of the family of type 2 diabetes mellitus, age mainly older adults, history of diabetes during pregnancy, hypertension, alcohol, obesity, lack of physical activity and genetic factors. These factors expose one to a sedentary way of living and it has been shown to be most common especially those struggling with weight problems (Ngandu, Lehtisalo, Solomon, Levälähti, Ahtiluoto, Antikainen, & Lindström, 2015). Type 2 diabetes is related to the body’s resistance to insulin, and this is a major risk factor. Type 2 diabetes can also develop among the young people and there is also a risk of children developing it.

3.2 Management of Age-related type 2 Diabetes

Ageing is a normal process that occurs in every human and can have an impact on the physical well-being, mental health, and psychosocial function and these can even lead to death. In addition, ageing increases the possibilities of exposure to multiple chronic conditions that can affect life quality (Peters, Laffel, & American Diabetes Association Transitions Working Group, 2011). Diabetes mellitus prevalence among the elderly has increased because after the elderly have retired, they tend to succumb to a sedentary lifestyle especially for those who are usually taken to retirement homes. This coupled with poor nutrition, inadequate knowledge on diabetes prevention and management, alcohol, smoking among other factors leads to heightened chances of having type 2 diabetes in later years of life (Peyrot, Burns, Davies, Forbes, Hermanns, Holt,... & Willaing, 2013). Increase in the occurrence rates of type 2 diabetes to persons with the age of 65 years and above has been identified as the most important demographic change. Type 2 diabetes usually
presents with different diabetes signs and symptoms. Therefore, it’s very critical that nurses and caregivers comprehend the signs and symptoms of the patients in order to know how to help them (Punthakee, Miller, Launer, Williamson, Lazar, Cukierman-Yaffee, & Bergenstal, 2012). One example is that the elderly experience age-related physiological changes hence they may not necessarily present with the classical symptoms of excessive blood sugar. Some of the common symptoms include confusion, frequent urination, dehydration, dry eyes and mouth among other symptoms (Sinclair, Morley, Rodriguez-Mañas, Paolisso, Bayer, Zeyfang, & Dunning, 2012).

3.3 Diabetes Complications in type 2 diabetic patients

T2DM morbidity is very high in Finland especially with the elderly. When a patient has a long history of having diabetes, they are highly likely to suffer from diabetes complications (Langa, Vijan, Hayward, Chernew, Blaum, Kabeto, ... & Fendrick, 2002). This is most likely to occur in the population. Diabetes complications can result in lowered life quality, disability and even death can occur. Complications from diabetes may affect different body parts and can manifest in different ways depending on the individual (Gregg, Engelgau, & Narayan, 2002). The complications are categorised into two; the first category is chronic complications which can either be macrovascular such as stroke, coronary artery disease or peripheral arterial disease or microvascular with examples including nephropathy, neuropathy and diabetic retinopathy (Ishizawa, Babazono, Horiba, Nakajima, Takasaki, Miura, ... & Uchigata, 2016). The second category is that of acute complications such as coma and hypoglycaemia which can result from the hyperosmolar hyperglycemic nonketotic syndrome or diabetic ketoacidosis (Wallander, Axelsson, Nilsson, Lundh, & Lorentzon, 2017).
One of the most serious microvascular complications is eye complications that mainly leads to blindness. However, the severity of these complications is dependent on the severity of the high blood sugar levels as well as the duration. Another potential complication among diabetics is the risk to develop cardiovascular diseases. There is a 2 to 6 higher likelihood of diabetics developing to ischemic heart disease. The immune system is normally altered in diabetic patients and this predisposes them to risks of infections (Gao, Xiao, Miao, Zhao, Cui, Huang, & Fei, 2016). These infections occur in these patients with increased severity and also increase the risk of developing other complications. These are studies that support that improving glycemic control also improve the immune system function (Gray, Picone, Sloan, & Yashkin, 2015). Some of the most common infections among diabetics include community-acquired pneumonia and fungal cystitis. Another common complication is foot infections which if not vigorously treated can lead to osteomyelitis, cellulitis among other and these can ultimately end in amputation (Atif, Saleem, sghar, Malik, & Ahmad, 2019).

3.4 Prevention practices of T2DM

To prevent T2DM, minor changes in one’s lifestyle can greatly influence the chances of getting the disease. Therefore, there is a need for action to be taken with regard to the modifiable factors influencing the development of this condition which include lifestyle and dietary habits (Ericson, Hellstrand, Brunkwall, Schulz, Sonestedt, Wallström,... & Orho-Melander, 2015).

3.4.1 Dietary habits

Maintaining a suitably balanced diet has been connected with the reduction in the risk of getting type-2 diabetes (Nam, Chesla, Stotts, Kroon, & Janson, 2011). There is the increased emphasis of the consumption of foods rich in whole grains, unsaturated fatty acids, vegetables and fruits, dairy
products that are low in fat, fish, poultry and reduced consumption of red meat (Gray, Picone, Sloan, & Yashkin, 2015). This diet is not only suitable for the management of diabetes but also acts against the development of type 2 diabetes. This diet has plentiful mono-unsaturated fatty acids while the fruits and vegetables are rich sources of antioxidants and polyphenols. In addition, this type of diet prevents weight gain and show marked improvement in glucose tolerance (Gray, Picone, Sloan, & Yashkin, 2015).

3.4.2 Physical Activity

A significant relationship exists between diabetes, obesity and lack of physical activity. Urban regions have been associated with reduced physical activity hence explaining the high prevalence rates of obesity (Borus et al. 2014). In rural areas, people use walking as a mode of transport which is a form of physical activity. Physical activity provides multiple benefits that include; weight maintenance, cardiovascular benefits, psychological wellbeing, improved depression, glycemic control, increased sensitivity towards insulin and improved blood pressure among many other benefits (Colberg, Sigal, Yardley, Riddell, Dunstan, Dempsey... & Tate, 2016). The degree of the benefits is dependent on the patient’s characteristics as well as the training is undertaken. The effectiveness of the training is more if it involves aerobic exercises that target the muscle strength. Physical activity also helps in controlling cardiovascular risks factors such as high blood pressure, weight maintenance, cardiorespiratory fitness and reduced mortality (Smith, Crippa, Woodcock, & Brage, 2016).

There are two major types of exercises that are advocated for people with diabetes. These include; aerobic and resistance exercises whose benefits in diabetic patients have been highlighted such as decreased insulin resistance and enhanced glucose uptake. Studies indicate that aerobic exercises are more effective and efficient than resistance exercises (Aune, Norat, Leitzmann, Tonstad, &
Vatten, 2015). However, in diabetic patients, both forms of exercise are recommended as the effects of the combination are much more than when each one of them is applied separately.

Patients suffering from type 2 diabetes have been recommended this training over the years. The recommended frequency is usually at least 3 days every week which can be increased to 5 days (Smith, Crippa, Woodcock, & Brage, 2016). However, there should be no more than 2 consecutive days of exercise because increased sensitivity and glucose tolerance are only maintained for a period of 12-24 h. The exercises should be done at a maximum of 40-60% aerobic capacity which matches to 55-69% maximum heart rate which is based on the age of a patient (Borus et al. 2014).

Other recommended forms of physical activity are the unstructured forms such as climbing stairs, walking among others. Overall, physical activity among elderly diabetic patients should be individually prescribed while taking into consideration each patients characteristic (Smith, Crippa, Woodcock, & Brage, 2016). In all patients, the exercises should start with reduced volumes of workout and slow progression while considering the diabetes type and nature of treatment the patient is currently using as well as the nature of any related complications the patient may be experiencing (Ismail-Beigi, 2012). Prior to engaging in the exercises, it is crucial for a patient to also undergo pre-clinical evaluation while paying attention to any complications that may constrain the exercises. In addition, it is important to decrease the dosage of insulin to prevent the appearance if hypoglycemia during the exercises (Launer, Miller, Williamson, Lazar, Gerstein, Murray, ... & Lovato, 2011).

3.5 Care and Management practices of T2DM

Diabetes mellitus is defined as the ability of an individual to learn how to live with a chronic disease or condition and is therefore self-managed (Mahalakshmi, Bhavadharini, Kumar Maheswari, Jebarani, Ninov, Kayal,... & Unnikrishnan, 2016). To deal with the medical,
behavioural, and emotional management of the condition, an individual requires the confidence to undertake some tasks. (Gray, Picone, Sloan, & Yashkin, 2015). The progression of diabetes and related complications is influenced by lack of awareness and suitable practices yet they are highly preventable (Tewahido, & Berhane, 2017). Some of the management strategies are to have a regular check of the blood sugar levels, blood pressure and weight (Atif, Saleem, sghar, Malik, & Ahmad, 2019). Access to quality health care, trust and communication between the doctors and the patient are important factors. In addition, the patients require knowledge and education from the nurses to understand how to control diabetes on a daily basis (Tewahido, & Berhane, 2017). Self-care is one of the most critical contributors to positive outcomes in patients with diabetes.

3.5.1 Glycaemic control

Glycated haemoglobin (HbA1c) is used in the verification of the effectiveness of the care and management in a diabetic person with regard to their medical status, physical activity and nutrition (Hayward, Reaven, Wiitala, Bahn, Reda, Ge,... & Emanuele, 2015). It serves as a glycemic control where a target between 6% and 7% of the HbA1c is considered to be normal. However, there is a need for medical interventions when the fasting glucose levels are higher than 7 mmol/L or higher than 10 mmol/L immediately after taking meals (Hayward, Reaven, Wiitala, Bahn, Reda, Ge,... & Emanuele, 2015). Since the elderly are at high risk for hypoglycemia then healthcare providers must provide individualized approaches that are sensible in the management of diabetes.

3.5.2 Dietary patterns

T2DM is the most predominant type of diabetes especially among those in their mid-50’s (DeFronzo, Ferrannini, Groop, Henry, Herman, Holst,... & Simonson, 2015). One of the main factors which are linked to a variety of diseases that include diabetes is diet. Food quantity and
quality that one consumes is a major factor of a person’s overall health. Therefore, in diabetes management, diet is a crucial factor which may involve only diet or a mix of insulin hypoglycemic and drugs (Nam, Chesla, Stotts, Kroon, & Janson, 2011). Depending on several factors such as age, health condition, gender and occupation, diet is usually individualized. Dietary guidelines are defined as sets of statements that offer advice on how to manage diabetes in order to promote the overall nutritional wellbeing of a person suffering from diabetes. This includes the prevention of complications and control of glycemic. Managing type 2 diabetes using diet plays major roles that include; to help achieve the optimal blood lipid concentrations, glucose concentrations, provision of appropriate energy that is required for normal growth and development especially in pregnant and lactating women, improving the overall health through a balanced diet and to avoid or slow the start of complications arising from diabetes (Mahalakshmi, 2016).

If a diabetic patient is not careful, complying with dietary restrictions can result in overindulgence or monotonous consumption of a certain food. This can further be enhanced by lack of knowledge, poverty or even cultural misconceptions on certain food types on their role in diabetes management (Gray, Picone, Sloan, & Yashkin, 2015). Non-obese diabetics have a recommended daily energy intake of 1500 to 2500 calories per day with an average of 2000 calories. For overweight diabetics, the energy requirement is between 800 to 1500 k per day whereas for underweight diabetics the recommended energy intake should not be below 2500 k.

### 3.5.3 Oral medication in type 2 diabetes

Elderly patients suffering from type 2 diabetes have a high risk of contracting diabetic related complications which include both microvascular and macrovascular complications (Inzucchi, Bergenstal, Buse, Diamant, Ferrannini, Nauck,... & Matthews, D. R. (2015). Additionally, these patients experience increased rates of amputation of lower limbs and related complications beyond
other age groups suffering from diabetes. Elderly people aged 75 years and above have even a higher rate of experiencing most of the diabetes-related complications and have a significant increase in death by hypoglycemia (Ismail-Beigi, 2012). They also visit emergency rooms more frequently due to hypoglycemia in comparison to other diabetic patients in the general population. Therefore, their treatments are characterized by several factors such as nutrition-related problems, the clinical presentation of the disease, cognitive and functioning impairments, high co-morbidities, hearing and visual impairments among other factors. Based on these and other factors, diabetes treatment should focus on preventing disability, ensure the best quality of life for the patients, avoid any possible side effects among others (Ley, Hamdy, Mohan, & Hu, 2014). Initial treatment strategies for the elderly are similar to those of the old and include lifestyle changes, reduction in weight and drug treatment which in most cases is taken throughout their lives (Ley, Hamdy, Mohan, & Hu, 2014). These strategies have previously been discussed later in the chapter.

3.5.4 Insulin replacement therapy

Good metabolic control of type 2 diabetes requires a combination of pharmacological treatments as well as lifestyle changes (Peyrot, Rubin, & Khunti, 2010). Insulin has over the years been used to treat all forms of diabetes (Perry, Petersen, & Shulman, 2016). Initially, human insulin preparations did not imitate the endogenous insulin secretion. This led to the development of insulin analogues such as lispro, glulisine, degludec, aspart and U-300. These analogues are rapid acting and hence have increased the flexibility towards the management of diabetes (Dave, Vanikar, Trivedi, Thakkar, Gopal, & Chandra, 2015). The analogues that are fast acting have a duration of action that is quicker and shorter than normal insulin and a suitable before meals while the long-acting ones have a duration of action that is longer hence suitable for a once-daily dose as illustrated in Appendix 1. Examples of rapid-acting insulins include as part and lispro while
long-acting insulin is detemir, glargine and ultra-long-lasting insulin include degludec (DeFronzo, Ferrannini, Groop, Henry, Herman, Holst, ... & Simonson, 2015).

3.5.5 Footcare management

Among people suffering from diabetes, foot care is one of the most important management therapies as foot-related complications are highly common among the diabetics. Foot complications of the foot include charcoal foot that is foot deformation, ulcers which are open wounds on the foot and amputation (American Diabetes Association, 2016). Foot ulcers refer to a patch of broken skin which can occur either on the lower or upper side of the foot. Foot ulcers occur in 1 out of every 10 diabetic patients and if not well taken care of, they develop into blisters and small wounds which can lead to amputation (Bonner, Foster, & Spears-Lanoix, 2016). Even the smallest of blisters can present a potential risk to a diabetes patient. Furthermore, these blisters and ulcers usually require extremely rigorous care and treatment to ensure that they are completely cured. In addition, foot ulcers can easily develop into lower body infections leading to the possibilities of amputations at advanced stages (American Diabetes Association, 2016). High blood sugar levels result in poor healing of the skin, due to improper repair which is caused by nerve damage.

Additionally, foot care is very important as prolonged high levels of blood glucose leads to diabetes mellitus and can result to loss of circulation to the body extremities as well as damage to the nerves which is referred to as diabetic neuropathy (American Diabetes Association, 2016). When the nerves in the feet become damaged, they lose sensation and can become numb. Unfortunately, most diabetics do not realize that they have a feet problem until the problem reaches an advanced stage. It is, therefore, important to have regular examinations of the feet for diabetic patients.
Feet ulcers can be caused by the poor blood circulation to the feet, diabetes that is not carefully managed, wearing shoes that are not well fitting, walking barefoot and neuropathy. Other potential risks for foot ulcers among diabetics are; smoking, overweight, physical inactivity, high cholesterol levels and high blood pressure among other factors (Ouyang, Dwyer, Jacques, Chuang, L. M., Haas, & Weinger, 2015). Apart from the worst risk of amputation, if foot ulcers are not prevented or carefully managed, they can take a very prolonged time to heal and the patient is very uncomfortable due to the chronic pain associated with the ulcers (American Diabetes Association, 2016). The role of nurses is to educate diabetic patients on how to take care of their feet and how to check on any potential damages on their feet. In addition, the patients should be able to identify any bruises, swelling, changes in skin colour, hard skin or any ulceration on their feet. The best prevention strategy for the diabetic foot is control of the blood sugar levels through the diet and physical activity to maintain good health (Peimani, Tabatabaei-Malazy, & Pajouhi, 2010).

3.6 Nurses’ roles as educators in the management of type 2 diabetes

Majority of diabetic patients do not understand how destructive diabetes can be especially with internal organs. In addition, they do not know how to easily assess their bodies especially the feet for ulcers, lacerations or wounds as having diabetes can affect the healing process (Peyrot, Burns, Davies, Forbes, Hermanns, Holt,... & Willaing, 2013). Therefore, diabetes education is very important for diabetic patients and it is usually delivered by diabetes nurse educators. Diabetes education can be delivered to individual patients or can among a group of patients (Punthakee, Miller, Launer, Williamson, Lazar, Cukierman-Yaffee,.. & Bergenstal, 2012). Diabetes nurse educators are mandated to provide diabetes patients with education on care and management of diabetes. This focuses on teaching patients on the causes, signs, symptoms, pathophysiology as
well as control of blood sugar levels them (Punthakee, Miller, Launer, Williamson, Lazar, Cukierman-Yaffee,... & Bergenstal, 2012). For effective care and management, nurses as educators require to make the patients understand the above concepts in relation to diabetes for them to remain compliant with their treatment strategies and follow up (Punthakee, Miller, Launer, Williamson, Lazar, Cukierman-Yaffee,.. & Bergenstal, 2012)

Nurses possess diverse roles and responsibilities in helping patients. Throughout the years, nurses’ roles have continued to evolve in relation to the patient’s needs. The nurse takes care of the patients’ needs to promote healthy living (Peimani, Tabatabaei-Malazy, & Pajouhi, 2010). Although most people do not trust the nurses in early detection and prevention of diabetes, nurses have a major responsibility in the prevention of diabetes by being both as an advocate and a teacher. Further, nurses have a significant role in educating patients and families of the elderly in order to achieve a better learning outcome. Nurses are involved in holistic planning with diabetic patients’ families in order to organize for their needs. The main role of nurses as educators is to assess, promote and guide on self-care among patients and families. Education, therefore, provides patient care that is self-centred and meets the patients physical, social, spiritual and psychological needs (Peimani, Tabatabaei-Malazy, & Pajouhi, 2010). Provision of education by nurses is a crucial aspect of nursing practice is to help patients to promote their self-care through the nurses’ comfort, knowledge and support (Stellefson, Dipnarine, & Stopka, 2013). The treatment outcome can be enhanced by the provision of information concerning their illness and treatment.
4 Theoretical Framework

Dorothea Orem’s theory has been utilised for the purposes of this study. This theory’s approach is based on the notion that optimal health and wellness maintenance can be attained by self-care. In this case, self-care is described as a person’s ability to take care of themselves as well as the provision of care to those requiring it. Based on this theory nurses have been given the role of educators, providers, support and advocates of therapeutic and safe environments to the patients. The major role of care is to provide guidance to people on how to take care of their own and others. According to Parse, there are three conceptual categories form the theory of Orem (Hartweg, 1991). These include self-care, nursing system and self-care deficit. This study will be guided by two of the conceptual categories which include self-care and nursing systems.

4.1 Orem’s Self-Care Theory

Patients suffering from diabetes demand self-care support in order for them to maintain a healthy lifestyle and improve the quality of their lives. Adequate support reduces the likelihood of the patients being regularly hospitalized as well as reduces the possibilities of diabetes-related complications. The increased demand for self-care support by diabetic patients has led to the development of technology-enabled systems by healthcare works to combine the responses from the professionals and those form the users in a timely manner (Santos, Ramos, & Fonseca, 2017). Orem pioneered the theory of self-care whose role was to put emphasis on individuals’ abilities to engage in self-care. Orem’s description of self-care is “autonomous and self-directed continuous actions performed by adults that cater to the regulatory needs of their functioning and development”. Through the self-care theory, there is the knowledge that is acquired and it is represented as an individual care system and an interaction between the actors (Santos, Ramos, &
The knowledge obtained plays a major role in empathizing the need for healthcare providers to strengthen their capabilities in supporting patients in the control of their chronic diseases like type 2 diabetes. Thus, control is provided through a nursing agent who helps the patients to increase their independence and autonomy.

Self-care theory has received significant attention both academically and clinically as it serves as a practical guide for care support among individuals suffering from chronic sicknesses. By utilizing the theory of self-care, this study design is based on a theoretical foundation of nurses led care in patients. The Orem theory adds structural views that help to explain the way patients are able to undertake their daily care routines (Abotalebidariasari, Memarian, Vanaki, Kazemnejad, & Naderi, 2016). Seven essential self-care strategies in diabetic people are known and are; physically active, close monitoring of blood sugar levels, eating healthy meals, compliance with medication, risk reduction skills, healthy coping skills, problem-solving skills (Santos, Ramos, & Fonseca, 2017). These measures are useful for both the nurses and the patient in the treatment and management of diabetes. Nurses have referred to self-care as a practical and cost-effective approach for the patient’s self-care assessment. Diabetes self-care requires that a patient is keen on making the many dietary and lifestyle modifications required and supplement them with the support of the nurses to sustain a high self-confidence level in order to improve on their quality of life by having successful behaviour change (Santos, Ramos, & Fonseca, 2017).

4.2 Theory of Self-Care Deficit

This theory categorically explains how patients allow healthcare providers to take care of them whenever they are unable to do so by themselves. It basically depicts the possibility of adults taking deliberate measures to control their survival, their wellbeing and their quality of life (Santos, Ramos, & Fonseca, 2017). Based on Orem’s views nurses have a major responsibility in meeting
patients’ self-care needs. They do so by teaching as well as knowledge sharing, provision of physical or psychological support, provision of guidance and corrections, doing or working for another and provision of a sustainable environment to support the patient’s development.

4.3 Theory of nursing systems

The nursing system theory focuses on the patient who receives therapeutic self-care from an agency providing self-care. Based on this form of self-care, three forms can be deduced; fully compensatory which is providing total care to a person, partially compensatory where the patient, nurse and supportive developmental implement the interventions and the nurse only offers supplemental health care to the patients able to independently perform the self-care activities required (Zhao, Suhonen, Koskinen, & Leino-Kilpi, 2017). Therefore, nurses, herein referred to as the agency produce the action by attending to the patients and providing required therapeutic self-care that meets their needs.

5 Methodology

This thesis has chosen the systematic literature review methodology, which is characterized as a way of utilizing organized and duplicable strategies to distinguish, analyse critically and assemble pertinent, top quality individual studies that look into one or several research questions to establish a finding or conclusion (Baumeister, 2013). This Literature review allows for updating with present knowledge on the subject and gives a foundation for future research. A systematic review can either focus on qualitative or quantitative studies or both. The main purpose of this review is to synthesise the results of other studies and this follows a certain process which includes; research problems’ assessment, research questions’ formulation, reviewing of studies through a database
search and retrieving critical data that is relevant for the study. The last part of the process is an analysis of the results and findings from the studies.

5.1 Systematic Literature Review

As noted above, the method of research selected for this study is a systematic literature review. It requires no recruitment of study participants; however, it requires a deep understanding of the research topic to understand why the method was most suitable. The most important aspect of the current study method is to critically review what other researchers have investigated, develop alternative research ideas and use the data to update current research on the study topic. With the advancing of evidence-based nursing practices, critical review of literature helps in synthesising existing knowledge or evidence related to the study topic (Rew, 2011).

Therefore, the literature review that is systematic provides a detailed discussion and summation of ideas, problems and findings from studies previously published on this study topic. A good research plan required to be developed in order to establish knowledge that is convincing and related to the research questions (Kiteley & Stogdon 2014). Therefore, since the literature review proceeds from planning through reporting it becomes easy to summarise critically any present knowledge identified in relation to the current study. In addition, this makes it possible to identify any strengths and weaknesses of previous studies hence focusing on the strengths and eliminating the weaknesses. A perfect review of literature places the current study in the right context hence avoiding repetition and redundancy. Systematic literature review for the current study will proceed by first formulating the desired research questions, selection of suitable databases and undertaking the actual searches, finally analysing of applicable literature and writing up of the review is done.
5.2 Data collection

To conduct a thorough and comprehensive literature review for the current study, the study was undertaken through by using FINNA which is a search engine providing unlimited access to both electronic and library sources from the Novia University of Applied Science, Tritonia Library. The following electronic databases were used: Cinalh, Ebsco, PubMed, Emerald, Med-line, ProQuest, Google Scholar, and Sage. Peer-reviewed journals containing resources related to the role of nurses in the healthcare systems as well as how to prevent and manage type 2 diabetes will be chosen (Creswell et al, 2003). In addition, information available from published books and articles as well as from published journals contributed to the knowledge in the systematic literature review. PICOS was used to establish the keywords, search terms and the inclusion criteria. PICOS is an abbreviation that defines the study population (P), the interesting phenomenon (I), the study context or location in relation to the study objectives (CO), and the study design, date and language used in publishing the work (S) (Cooper, Booth, Varley-Campbell, Britten, & Garside, 2018). The present study aims to undertake a systematic review of the role of nurses as educators in preventing and managing type 2 diabetes. The study population was type 2 diabetic patients, the phenomenon of interest was the nurses’ role in preventing and managing type 2 diabetes, the study context included research from various parts of the globe and was not limited to any geographical location, while the study design was based on peer-reviewed articles in high impact journals as well as published books, the publications must have been published in English and limited to the years 2003 to 2019. All the data searches were conducted in December 2018 and the best keyword searches and phrases identified for use in the actual data search. Numerous terms and keywords were used such as; type 2 diabetes, nurses, elderly, prevention of type 2 diabetes, risk factors among others. Further, a different
combination of the keywords was used to form search words. The search words were” Diabetic Type 2” AND” Prevention” AND “elderly”, “Nurse” “Educators” Role “AND “Support” AND” Management”, ” Diabetic” AND” Nursing Prevention”. The search was limited to the years 2003 to 2019. Each of the search words was used on each of the selected databases and all the searches were conducted in English. The selected keywords and search terms used in different databases are presented in table 1 below.
Table 1. Database search process

<table>
<thead>
<tr>
<th>Database</th>
<th>Keywords/Search items</th>
<th>Hits</th>
<th>Title</th>
<th>Abstract</th>
<th>Relevance to the current study</th>
<th>Articles considered for the study</th>
</tr>
</thead>
<tbody>
<tr>
<td>CINEHL</td>
<td>Type 2 diabetes</td>
<td>78</td>
<td>17</td>
<td>12</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>EBSCO</td>
<td>The role of nurses in diabetes prevention</td>
<td>125</td>
<td>24</td>
<td>14</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>PubMed</td>
<td>Nurses as educators in diabetes prevention and management</td>
<td>65</td>
<td>18</td>
<td>13</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Emerald</td>
<td>Type 2 diabetes prevention and management</td>
<td>48</td>
<td>32</td>
<td>10</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Med-line</td>
<td>The role of nurses in diabetes prevention</td>
<td>34</td>
<td>23</td>
<td>17</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>ProQuest</td>
<td>Type 2 diabetes and the elderly</td>
<td>24</td>
<td>13</td>
<td>9</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Google Scholar</td>
<td>Prevention and management of type 2 diabetes</td>
<td>102</td>
<td>32</td>
<td>18</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Sage</td>
<td>Type 2 diabetes prevention and management</td>
<td>21</td>
<td>15</td>
<td>12</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>497</td>
<td>174</td>
<td>105</td>
<td>63</td>
<td>15</td>
</tr>
</tbody>
</table>

This process was continually repeated by substituting the keywords with synonyms, adjectives, nouns until a time when sources in relation to the study topic were found and retrieved. Initially by using the keywords and search terms a number of 497 hits were found. Out of the 497 articles, the researcher identified sixty-three articles that were most closely related to this study. The search was further limited to articles with full text available and a total of 15 were identified. The articles were published in Cinalh (2), Ebsco (1), PubMed (2), Emerald (2), Med-line (2), ProQuest (1), Google Scholar (4), and Sage (1). Further, the publication years for the articles were as follows; 2019 (1), 2016 (4), 2015 (2), 2014 (1), 2012 (2), 2010 (2), 2004 (1), 2003 (1), and 2001 (1). In
addition, the studies were conducted in different global locations which included; U.S. (5), Pakistan (1), China (1), India (1), Taiwan (1), Finland (1) and three articles were not based on any location but were metanalysis study covering the study topic in general. Majority of the study articles chosen were qualitatively based. The search results were retrieved and saved for future reference since they contained all the information required to carry out this study successfully. Only high-quality studies were selected in addition to studies referred to by the authors.

5.2.1 Selection Criteria

The inclusion criteria used for this study during the search for relevant articles were as follows. The first important point to consider when selecting the articles was the relevancy of the articles and this ensured that the search articles were important to this study and that the full article text was accessible. In addition, the articles focused on type 2 diabetes, the articles had to be published in English and not Finnish and the studies display the current clinical practice in nursing. The exclusion criteria were used to do away with irrelevant articles hence more priority given to articles that were relevant for this study. This was important as the search resulted in numerous articles hence the need to exclude some of the articles to be left with only the relevant ones. This was achieved by limiting the articles to those with full texts available and must have been published in high-quality journals. The exclusion criteria used was any articles published before the year 2000 as well as articles that were not very closely related to the topic under study. In addition, articles published in low-quality journals based on the journal's Impact factor were also excluded.
### Table 2. Inclusion criteria

<table>
<thead>
<tr>
<th>Criteria for Inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Published articles in English</td>
</tr>
<tr>
<td>Published articles in the years 2003-2018</td>
</tr>
<tr>
<td>Articles whose content was inclined to answering the research questions</td>
</tr>
<tr>
<td>Articles published in high impact journals</td>
</tr>
<tr>
<td>Published books</td>
</tr>
<tr>
<td>Accessibility of the full texts for the articles</td>
</tr>
</tbody>
</table>

#### 5.3 Data Analysis

This section elaborates the concise analysis of the literature which elaborates how the research questions were answered. According to Kiteley and Stogdom, (2014), literature review analysis describes the process by which data and findings from previous studies are drawn together to address specifically formulated research questions. This analysis entailed qualitative content analysis which has been defined as a method which entails the subjective interpretation of content derived from data and this can be achieved through methodical categorization, coding and distinguishing of themes and patterns. Analysis of content can be categorized into two; inductive and deductive. The role of content analysis is to present the interesting phenomenon intensively through which the salient features are grouped into smaller groups. The findings from the analysis of content are then presented as categories or mind gap. Inductive content analysis was chosen for data analysis because it is constantly used in nursing research, to analyse content from published books, articles and more literature material systematically. Inductive content analysis can further be categorised into three stages; the preparation, organisation and reporting stage (Kylmä and
Juvakka, 2007). In the initial step, data is split into smaller sections while in the second step data is clustered where it is separated into specific categories or groups and finally subcategories with similar content are connected and general categories derived from them. Since the inductive content analysis, also referred to as bottom-up approach, was utilized for this study, this helped in moving data from the particular to the common to combine specific instances established into more general statements. Fifteen articles met the inclusion criteria and were reviewed. The articles were from existing literature and they were analysed closely since the researcher was familiar with the content of the articles. The selected articles were scrutinized severally with the major ideas being extracted, coded and then sorted into groups with similar themes which were named and interpreted. During the application phase, any relevant phrases relating to the research questions were highlighted and extracted. Further, in the reduction phase, single words or combinations were used and the reduced expressions gathered, clustered and subcategories which were similar in content connected into main categories.

After the categorising the data and checking for the reliability of the process, the last and most critical step was drawing conclusions from the data. This was done to make sense of the categories and derive meanings and relationships. These findings were then reported based on the description and interpretation of the data.

5.4 Ethical consideration

This has a critical role in research as they guarantee honesty, integrity, objective, confidentiality, and help to keep away from misinterpretation and mistakes during the course of a study. Ethics helps in the avoidance of violating any rules that are associated with the research process. The material used in this thesis were extracted from high-quality databases and academic sources, and
this illustrates that the articles were of high quality and integrity. The researcher was very careful to avoid any kind of infringement which could lead to the study being disapproved. In addition, the researcher avoided unethical behaviours such as plagiarism, fabrication of data and falsification which could negatively influence the researcher reputation. The researcher will follow the university guidelines with regard to ethical practices as outlined in the thesis guidelines. The articles used for the study were obtained from the databases listed since the researcher had access to them is a registered member of Novia. The data was presented in its original form with no fabrication to ensure trustworthiness in the study.

6 Findings

The study findings are presented in relation to the main study objective based on the key themes identified in the literature reviewed. This qualitative content analysis was utilized to analyse the contents of the studies selectively. This was based on the fifteen studies that were identified. Details of these articles are provided in the appendices in 1. This finding will describe the categories and sub-categories illustrated in figure 2 below.
6.1 The need for prevention and management of type 2 diabetes

Based on reviewed articles, there is an indication that type 2 diabetes has been highly prevalent among the ageing population. In fact, Abdelhafiz, & Sinclair, (2013) noted that,

“There is an epidemiologic shift from diabetes being a disease of middle age to being a disease of older people due to increased life expectancy’. (Abdelhafiz, & Sinclair, 2013)

Diabetes in adults has been associated with high comorbidity, increased vascular complications as well high prevalence of geriatric syndromes. Adults with diabetes are heterogenous hence preventive and management practices should be individualized while taking into account their desires and ensuring that their quality of life drives their needed care (Haas, Maryniuk, Beck, Cox, Duker, Edwards, & McLaughlin, 2012). Apart from the increase in age another factor that contributes to the high prevalence of diabetes population is lifestyle changes. Diabetes
management should, therefore, take note of their complex needs, relevant targets and their heterogeneous nature. Upon diagnosis of diabetes, adults should undergo a detailed geriatric analysis since geriatric syndromes like physical dysfunction and cognitive dysfunction are examples of problems that arise as one age as well as other vascular challenges (Abdelhafiz, & Sinclair, 2013). This assessment as noted from the articles reviewed should comprise checking for cardiovascular risk factors, geriatric syndromes and micro and macrovascular issues.

“Retinopathy Screening for diabetic retinopathy as well as other ocular diseases common in older people, such as cataract, glaucoma, and macular degeneration. Nephropathy Chronic kidney disease is common in older people. Neuropathy Regular feet inspection and access to diabetic foot care are essential in older people with diabetes as many may not be able to care for their feet due to physical disability”. (Abdelhafiz, & Sinclair, 2013).

As further noted by Gao, Xiao, Miao, Zhao, Cui, Huang, & Fei, (2016), cardiovascular diseases are the most common mortality causes among diabetic patients, however, this is regardless of the patient's age. To prevent and manage these conditions, the patients are required to modify their lifestyle such as through regular physical exercise, weight reduction, stop smoking, adopt healthy eating habits. These modifications help in controlling the blood pressure and blood sugar levels. In addition, the use of dyslipidaemia treatments as well as antiplatelet treatments is recommended as secondary preventive strategies (Aune, Norat, Leitzmann, Tonstad, & Vatten, 2015). Upon diabetes diagnosis and assessment, lifestyle modification and drug therapy are beneficial to both the young and old patients. However, special care and considerations should be noted when considering appropriate therapies for adults with diabetes.
According to Jansink, Braspennning, van der Weijden, Elwyn, & Grol, (2010), due to the heterogeneous nature of adults with diabetes, there is a need for individualized care and a holistic plan of action for care to look into the challenging patients’ needs. This is where the role of the nurses come in, where they provide a plan of action devised to take into consideration the preferences, wishes, functional status, life quality and expectancy. In addition, nurses should provide nutritional guidelines that are tailored to reflect personal preferences. Lastly, the nurses should ensure that the treatment strategies are adjusted accordingly for each patient.

6.1 The role of nurses in the prevention of type 2 diabetes

Nurses roles in the prevention of type 2 diabetes among the patients are to educate them on how to make lifestyle changes especially for those with elevated risks for type 2 diabetes. The nurses educate the people on type 2 diabetes risk factors that include a poor diet that is rich in saturated fats and high sugar content, high blood pressure, physical inactivity, high levels of cholesterol among other factors (Hjelm, Mufunda, Nambozi, & Kemp, 2003; Munshi, Florez, Huang, Kalyani, Mupanomunda, Pandya,... & Haas, 2016). Other important factors that are also risk factors especially when combined with those earlier mentioned include smoking and alcohol consumption. Therefore, nurse sensitizes the general public especially the on the older population on why they should not smoke and avoid or limit their consumption of alcohol (Peimani, Tabatabaei-Malazy, & Pajouhi, 2010). The nurses educate the general population on ways of reducing their risk of developing type 2 diabetes. The ways include:

- Reducing weight
- Regular and consistent physical exercises
- Reducing alcohol intake and smoking
- Always ensuring that they consume a well-balanced diet low in saturated fats
Since type 2 diabetes can be prevented, people should take these steps to prevent its onset and should visit health care providers regularly to check for any risk factors that may expose them to early onset of the disease (Peimani, Tabatabaei-Malazy, & Pajouhi, 2010). Nurse advise the consumption of the following foods to prevent type 2 diabetes;

“Fruit and vegetables are naturally low in fat and calories and a good source of vitamins, minerals and fibre, whole grains are a good source of fibre which aids digestion, lean meats and fish are high in protein as are beans, pulses, soya and tofu”. (Mahalakshmi, Bhavadharini, Kumar Maheswari, Jebarani, Ninov, Kayal,... & Unnikrishnan, 2016).

6.2 Nurses’ roles in the management of type 2 diabetes

Nursing is one of the professions requiring much more than what is stipulated as nurses are required to acquaint themselves with abilities to adapt in both favourable and unfavourable conditions (Peimani, Tabatabaei-Malazy, & Pajouhi, 2010). Diabetes nurse educators specialize in the care and management of diabetic patients. The can be advanced practice nurses, registered nurses or nurses working in an expanded role. Nurses provide diabetic patients with self-management skills that are necessary for diabetic care and through this support by the nurses the condition can be easily managed to enable the patients to stay healthy and longer (Peimani, Tabatabaei-Malazy, & Pajouhi, 2010). Nurses are, therefore, a necessary cost-effective addition to diabetes prevention and management as they direct their efforts towards improving the care that is required by these patients. The role of nurses in diabetes prevention and management is a modern approach to enhancing the quality of diabetic patient education. Nurses play a specific role in the evaluation of each patient’s needs.
“The nurse educator has specific responsibilities in the evaluation of each diabetic patient. An assessment of not only what that individual knows about his illness and where his educational needs lie but also of each person’s readiness to learn.” (Peimani, Tabatabaei-Malazy, & Pajouhi, 2010).

Physicians have only limited time with the patients hence it is the responsibility of the nurse to spend ample time with the patient and the family. Nurses are required to pay attention to the patients, in terms of how they understand their disease and other problems they may be experiencing prior to starting the teaching and learning process (Munshi, Florez, Huang, Kalyani, Mupanomunda, Pandya,... & Haas, 2016). Nurses should be well skilled on how to go about the teaching and learning process as well as have an adequate background and knowledge of diabetes, related issues and problems. Nurses should also be in a position to evaluate the effectiveness of the process to provide proof that the process provides the diabetic patient with education on self-care through a better understanding of the disease (Munshi, Florez, Huang, Kalyani, Mupanomunda, Pandya,... & Haas, 2016). Proper care by the nurses reduced the diabetic patient’s number of visits to the hospital and hospitalization.

6.3 The role and responsibilities of nurses as educators
According to Munshi, Florez, Huang, Kalyani, Mupanomunda, Pandya,... & Haas, (2016), nurses play an important role and responsibility in treating diabetic patients. The roles are usually specified based on the local workplace guidelines and policies as well as the nurse’s levels of competence with regard to diabetes. Therefore, for nurses to provide effective diabetic care, it is important that they familiarize with the guidelines on diabetes care in their specific work setting. Based on the reviewed articles, there are several specific competencies that have been identified
relating to nurses’ care for patients with diabetes (Haas, Maryniuk, Beck, Cox, Duker, Edwards, ... & McLaughlin, 2012).

6.3.1 Nurses role in screening and early detection of type 2 diabetes
The nurse’s role in aiding prevention and early detection of type 2 diabetes include describing the potential factors of risk for diabetes to the patients. They also explain the need for prevention or early detection for type 2 diabetes onset in high-risk individuals (Haas, Maryniuk, Beck, Cox, Duker, Edwards, ... & McLaughlin, 2012). The nurse has a significant role in explaining the need for regular physical exercise and the role that exercise plays in deferring the progression of type 2 diabetes (Renders, Valk, Griffin, Wagner, & Assendelft, 2001). Nurses also have a critical role in educating the patients the need to control their weight and the role of a balanced diet in stopping the progression of the disease.

6.3.2 Role of nurses in promoting self-care
Nurses support diabetic self-care practices by providing guidance on how to develop personal self-care practices. In most cases, this is usually done by registered nurse practitioners (Jansink, Braspenninng, van der Weijden, Elwyn, & Grol, 2010). The nurses also educate the patients on how to use the self-care practices in the management of their disease. The nurses also make observations and address any issues that they may note regarding a specific patient which may influence their self-care ability. Nurses inspire the patients to only focus on their own individualized self-care practices and not use another person’s.

6.3.3 Nurses role in supporting mental health in type 2 diabetic patients
For nurses to care for type 2 diabetic patients they should be in a position to:
“Have an understanding and awareness of how mental health issues, such as depression and anxiety, can affect people with diabetes. Report any changes that you notice in the patient’s normal mental health, to a registered nurse or doctor. This could include changes in medications adherence, mood and appearance and also anxiety” (Jansink, Braspennin, van der Weijden, Elwyn, & Grol, 2010)

6.3.4 Nurses role in the provision of nutritional education

Nurses educate diabetic patients on their individual nutritional needs by helping them to establish the foods and drinks containing high levels of sugar and are not suitable for them. They also advise them on how to follow their specific nutritional plans and feel free to always report any nutritionally related problems they may experience (Peimani, Tabatabaei-Malazy, & Pajouhi, 2010). Nurses usually measure the height, weight and waist circumference of the patients to check on their BMI. Nurses report to the physicians if the patients are not following the nutritional plans and are not eating a specific food, in addition to reporting on their use of insulin or other therapies targeted at lowering the blood sugar levels (Peimani, Tabatabaei-Malazy, & Pajouhi, 2010).

6.3.5 Monitoring of blood sugar levels

Nurses have a crucial role in the assessment of different parameters and diabetic patients whose role is to monitor disease progression, any related complications and blood glucose levels (Ley, Hamdy, Mohan, & Hu, 2014). They also document all the results according to the local guidelines. Nurses also educate the patients on how to safely use equipment to monitor blood glucose and other associated equipment. The teach them to,

“Perform the test according to manufacturers’ instructions and local guidelines, perform the test unsupervised, document and report the result according to local guidelines and
procedures, recognise and follow local quality assurance procedure, including disposal of sharps used, recognise hypoglycemia and be able to administer glucose, Understand the normal range of glycaemia and report any readings outside this range to the physician”. (Philis-Tsimikas, Walker, Rivard, Talavera, Reimann, Salmon, & Araujo, 2004).

6.3.6 Education on the administration of oral and injectable therapies

Nurses educate diabetic patients on the effective use of their oral and injectable their which are part of their self-care remedies. They teach them how to safely use oral insulin, antihyperglycemic and GLP-1 receptor agonists.

"The effect an oral antihyperglycemic agent has on blood glucose levels, the on-going nature of the therapy, recognise the signs of hypoglycaemia and administer glucose and report any identified problems appropriately”. (Ismail-Beigi, 2012)

For the injectable therapies, they teach the patients how to administer insulin safely and GLP-1 receptor agonists by describing the consequences of insulin on blood glucose levels and how to administer insulin competently where supported by local policy (Ismail-Beigi, 2012). However, all nursing staff involved in the prescription or administration of insulin are required to undertake a training course.

7 Critical review

This study will be critically reviewed by focusing on the study objectives, the transferability, credibility and authenticity of the data collecting methods and analyses. The topic of study is the nurses’ role as educators in the prevention and management of type 2 diabetes. A literature search
was conducted by using FINNA search engine and databases such as Cinalh, Ebsco, PubMed, Emerald, Med-line, ProQuest, Google Scholar, and Sage were used to identify relevant articles for the study. The retrieved information was then critically analysed. The study, therefore, explored the self-management practices for elderly diabetic patients, the risk factors and causes of type 2 diabetes among elderly people and the roles of nurses in the prevention and management of type 2 diabetes among elderly people. From the fifteen articles that were critically reviewed, it was apparent that most studies focused exclusively on type 2 diabetes management in general with very few studies focusing on the preventive aspect as well as the role of the nurses. Therefore, this study attempts to bridge a literature gap by presenting a holistic view of the role of nurses by combining both aspects of preventing and managing type 2 diabetes. By doing so, there’s the hope that the study will reveal more data on the role played by nurses in type 2 diabetes prevention and management.

According to Polit and Beck (2012), there are four criteria used to confirm the trustworthiness of data collected and used in a study. The criteria include; credibility, dependability, confirmability, and transferability. Credibility is the assertion of the accuracy of data collected and analysed. Whereas dependability refers to the consistent approach that the study findings relate to supporting data. Confirmability, on the other hand, prevents study bias by looking at how neutral study participants are while transferability is the shifting of information to other contexts and most importantly for relevant data. Systematic content analysis was achieved by first reading all the fifteen articles and excluding any material not relevant to the study and did not attain the criteria for inclusion. These articles were found to contain relevant information for the study hence were used for data collection. In addition, the theory of self-care by Orem was found to be the most suitable for the current study. The current study faced certain limitations such as the use of content
analysis as the main data collection method and analysis provided results that were limited. The study would have greatly benefited from primary research where nurses taking care of type 2 diabetic patients would have been engaged and their specific roles obtained based on their life experiences. However, due to limitations in time and resources, this was not possible. This study recommended that future studies on the same be conducted while taking into consideration engaging both nurses and patients suffering from type 2 diabetes.

8 Discussion

This current study focused on understanding the role of nurses as educators in preventing and managing type 2 diabetes. This was owing to the increased prevalence rates of type 2 diabetes in the Finland population. Globally, there is an indication that Finland has the highest diabetes prevalence (Finnish Diabetes Association, 2018). This, therefore, resulted in the development of interest to explore the role of the nurses in type 2 diabetes prevention and management.

The study found that nurses play two major roles in type 2 diabetes education. They provide preventive as well as management education to people at high risk or those already suffering from type 2 diabetes. This is possible since nurses have the opportunity to engage patients seeking healthcare services, hence they have the opportunity to educate them about risk factors for type 2 diabetes mellitus. Nurses use a diabetes risk assessment form developed by Professor Jaakko Tuomilehto and Jaana Lindström from Finland which serves as a guide for advice and counselling of the patients at high risk especially on how to stop type 2 diabetes. The form can be used to score patient and if a patient score between 2-14 they should be advised to consider on a very serious note their lifestyle modifications which should include physical activity, nutrition and avoid smoking or use of alcohol and this may prevent one from developing diabetes (Steinsbekk, Rygg,
Lisulo, Rise, & Fretheim, 2012). A score of 15 requires that the patient undergoes further tests such as checking the blood glucose levels.

Based on the reviewed articles it is noteworthy that nurse’s education on lifestyle modifications can prevent the risk of type 2 diabetes. Some of the modifications are; increased physical exercises, balanced and healthy diet which helps to reduce incidences of type 2 diabetes in individuals deemed as high risk (Umpierrez, Hellman, Korytkowski, Kosiborod, Maynard, Montori,, ... & Van den Berghe, 2012). No matter the type of risk that one is exposed to, nurses have the ability to guide a patient on suitable prevention and management ways towards type 2 diabetes.

Based on Orem’s theory, self-care support is inevitable for type two diabetic patients for them to maintain a healthy lifestyle which leads to improved quality of life. This self-care support is achieved through the healthcare providers who help the patients to learn and understand self-care support practices for the control of type-2 diabetes. Self-care control is provided through a nursing agent who helps the patients to increase their independence and autonomy. This study, therefore, focused on Orem’s theory, which served as the theoretical foundation of nurses led care in patients suffering from type 2 diabetes. This is because the theory added structural views explained the way patients are able to undertake their daily care routines (Abotalebidariasari, Memarian, Vanaki, Kazemnejad, & Naderi, 2016). The theory describes the various essential self-care strategies in people with diabetes, yet these can mostly be achieved through the help of the nurses in the treatment and management of diabetes. To support this theory, nurses have referred to self-care as a practical and cost-effective approach for the patient’s self-care assessment. Therefore, the theory was suitable for the current study as type 2 diabetes self-care requires that a patient is keen on making the many dietary and lifestyle modifications required. These modifications are supplemented with the support of the nurses to uphold high self-confidence levels in order to
improve on their quality of life by having successful behaviour change (Santos, Ramos, & Fonseca, 2017). Additionally, Orem’s theory further recommends the nurses to take care of patients whenever they are unable to do so by themselves. This is the case with the theory of Self-care deficit, where nurses are required to have a significant role in meeting the self-care needs of patients. In the case of type 2 diabetic patients, nurses teach, share knowledge and provide physical and psychological care which supports the patient’s development.

9 Conclusion

The aim of this study was expatiating nurses’ roles as educators in the prevention and management of diabetes type 2. Type 2 diabetes, also referred to as adult-onset diabetes, is very difficult to treat and very expensive to manage. Previous studies have indicated that in Finland, a country with a population of about 5.5 million people, there are about 300,000 people living with type 2 diabetes and it is estimated that about 160,000 are undiagnosed with the condition. Additionally, the highest prevalence has been shown to be among the working age group and the figures reaching a peak among the 55-59 years old. In addition, the numbers of people aged 60-74 years have also been shown to be quite high. This indicates that type 2 diabetes rates among the old are growing rapidly and that type 2 diabetes is posing a significant challenge for Finland’s public health care sector. Based on the reviewed literature, the nurse has an important role in the prevention and management of type 2 diabetes. They have a significant role in the prevention of diabetes by being both an advocate and a teacher since have the opportunity to engage patients seeking healthcare services, by educating them on risk factors for type 2 diabetes mellitus.

The current method used for data collection and analysis was challenging as very limited information is available on the nurses’ role in preventing and managing type 2 diabetes. Majority
of the articles retrieved focus on practices of self-care by the patients in preventing and managing type 2 diabetes and not on nurses’ role. Additionally, most of the articles focused on other aspects of type 2 diabetes and not necessarily of prevention and management. This study would have been more interesting if nurses and type 2 diabetic patients were involved for them to give a personal account of these preventive and management strategies. This, therefore, is an interesting venture that future students and researchers can consider as well as focus on if the preventive and management strategies provided by the nurses are working with regard to the increasing rates of type 2 diabetes prevalence in Finland. I believe there is a need for continuous training for nurses so that they can be updated on the latest preventive and management strategies for type 2 diabetes.
References


Peters, A., Laffel, L., & American Diabetes Association Transitions Working Group. (2011). Diabetes care for emerging adults: recommendations for transition from pediatric to adult diabetes care systems: a position statement of the American Diabetes Association, with representation by the American College of Osteopathic Family Physicians, the American Academy of Pediatrics, the American Association of Clinical Endocrinologists, the American Osteopathic Association, the
Centers for Disease Control and Prevention, Children with Diabetes, The Endocrine Society, the International Society for .... *Diabetes care*, 34(11), 2477-2485.


## Appendices

### Table 3. Summary of articles used

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<th>Citation</th>
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<tbody>
<tr>
<td>Atif, M., Saleem, Q., Asghar, S., Malik, I., &amp; Ahmad, N. (2019). Extent and Predictors of Poor Glycaemic Control among Elderly Pakistani Patients with Type 2 Diabetes Mellitus: A Multi-Centre Cross-Sectional Study. Journal Medicina, 55(1), 21.</td>
<td>This study aimed to explore the relationship between glycaemic control and factors that may influence this among elderly type 2 diabetes mellitus (T2DM) patients in Lahore, Pakistan.</td>
<td>This descriptive, cross-sectional study was conducted at the Jinnah and Sir Ganga Ram Hospitals, Lahore using convenience sampling techniques between 1 December 2015 and 28 February 2016. The sample consisted of elderly (&gt;65 years) T2DM patients. Glycaemic values and patient characteristics were obtained from medical charts.</td>
<td>A total of 490 patients were approached and 400 agreed to participate. Overall, nearly one-third (32.2%, n = 129) of patients had glycated haemoglobin (HbA1c) at the target level. Fasting and random plasma glucose levels were within the target range to much the same extent; (36.8%, n = 147) and (27%, n = 108), respectively. HbA1c levels were also higher in patients with co-morbidities (67.4%, n = 229) with diabetes-related complications (73.5%, n = 227).</td>
</tr>
<tr>
<td>Aune, D., Norat, T., Leitzmann, M., Tonstad, S., &amp; Vatten, L. J. Journal (2015). Physical activity and the risk of type 2 diabetes: a systematic review and dose–response meta-analysis.</td>
<td>To investigate the association between specific types of physical activity and the risk of type 2 diabetes in a systematic review and meta-analysis of published studies.</td>
<td>PubMed, Embase and Ovid databases were searched for prospective studies and randomized trials up to 2nd of March 2015. Summary relative risks (RRs) were calculated using a random effects model.</td>
<td>Inverse associations were also observed for increasing activity over time, resistance exercise, occupational activity and for cardiorespiratory fitness. Nonlinear relations were observed for leisure-time activity, vigorous activity, walking and resistance exercise (p nonlinearity &lt; 0.0001 for all), with steeper reductions in type 2 diabetes risk at low activity levels than high activity levels.</td>
</tr>
<tr>
<td>Bonner, T., Foster, M., &amp; Spears-Lanoix, E.</td>
<td>The aim of this systematic</td>
<td>Medline, CINAHL, CENTRAL, and Cochrane</td>
<td>Thirty studies met the inclusion criteria and</td>
</tr>
<tr>
<td>(2016). Type 2 diabetes–related foot care knowledge and foot self-care practice interventions in the United States: a systematic review of the literature. Diabetic foot &amp; ankle, 7(1), 29758.</td>
<td>literature review is to review published studies on foot care knowledge and foot care practice interventions as part of diabetic foot care self-management interventions.</td>
<td>Central Register of Controlled Trials databases were searched. Only foot care knowledge and foot care practice intervention studies that focused on the person living with type 2 diabetes was included in this review.</td>
<td>were classified according to randomized controlled trial (n_9), survey design (n_13), cohort studies (n_4), cross-sectional studies (n_2), qualitative studies (n_2), and case series (n_1).</td>
</tr>
<tr>
<td>Gao, Y., Xiao, Y., Miao, R., Zhao, J., Cui, M., Huang, G., &amp; Fei, M. (2016). The prevalence of mild cognitive impairment with T2DM among elderly people in China: a cross-sectional study. Archives of gerontology and geriatrics, 62, 138-142.</td>
<td>To estimate the prevalence and distribution of MCI in T2DM subjects from China, and identify influencing factors of subjects in MCI with T2DM.</td>
<td>Cluster random sampling of 8213 people aged 65 years and older in Tianjin, a metropolitan city, located in northern China. All participants were interviewed and screened for T2DM. 1109 subjects with T2DM were initially screened with American Diabetes Association criteria for diagnosis of diabetes mellitus and were diagnosed with MCI and dementia according to the criteria of DSM-III-R.</td>
<td>Among all 8213 subjects, overall MCI and dementia with T2DM prevalence were 13.5% and 2.34%, respectively. Compared with ordinary subjects, the prevalence of MCI in the present study was more frequent than the prevalence of MCI for the general population in almost each age group.</td>
</tr>
<tr>
<td>Hjelm, K., Mufunda, E., Nambozi, G., &amp; Kemp, J. (2003). Preparing nurses to face the pandemic of diabetes mellitus: a literature review. Journal of advanced nursing, 41(5), 424-434.</td>
<td>To raise awareness among nurses, nurse educators and nursing students of the global epidemic of diabetes mellitus, its multiple underlying causes, especially social ones, and how to</td>
<td>Reviewing existing literature</td>
<td>The main underlying causes of the disease are genetic and environmental factors, such as urbanization and industrialization, as well as increased longevity and changes in lifestyle from a traditional healthy and active life to a modern,</td>
</tr>
<tr>
<td>Source</td>
<td>Objective</td>
<td>Method</td>
<td>Findings/Implications</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
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<tr>
<td>Jansink, R., Braspenning, J., van der Weijden, T., Elwyn, G., &amp; Grol, R. (2010). Primary care nurses struggle with lifestyle counseling in diabetes care: a qualitative analysis. <em>BMC family practice</em>, 11(1), 41.</td>
<td>To examine which barriers nurses encounter in lifestyle counseling to patients with type 2 diabetes.</td>
<td>In a qualitative semi-structured study, twelve in-depth interviews took place with nurses in Dutch general practices involved in diabetes care.</td>
<td>Nurses felt most barriers on the level of the patient; patients had limited knowledge of a healthy lifestyle and limited insight into their own behavior, and they lacked the motivation to modify their lifestyles or the discipline to maintain an improved lifestyle.</td>
</tr>
<tr>
<td>Ley, S. H., Hamdy, O., Mohan, V., &amp; Hu, F. B. (2014). Prevention and management of type 2 diabetes: dietary components and nutritional strategies. <em>The Lancet</em>, 383(9933), 1999-2007.</td>
<td>To explore prevention and management of type 2 diabetes: dietary components and nutritional strategies</td>
<td>Use of evidence from prospective observational studies and clinical trials</td>
<td>The quality of dietary fats and carbohydrates consumed is more crucial than is the quantity of these macronutrients. Diets rich in wholegrains, fruits, vegetables, legumes, and nuts; moderate in alcohol consumption; and lower in refined grains, red or processed meats, and sugar-sweetened beverages have been shown to reduce the risk of diabetes and...</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Title of the Study</td>
<td>Methodology</td>
<td>Summary of Findings</td>
</tr>
<tr>
<td>-----------</td>
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<tr>
<td>Mahalakshmi, M. M., Bhavadharini, B., Kumar Maheswari, R. M. A., Jebraani, S., Ninov, L., Kayal, A., ... &amp; Unnikrishnan, R. (2016).</td>
<td>Current practices in the diagnosis and management of gestational diabetes mellitus in India (WINGS-5). <em>Indian journal of endocrinology and metabolism</em>, Journal 20(3), 364.</td>
<td>To obtain information on existing practices in the diagnosis and management of gestational diabetes mellitus (GDM) among physicians/diabetologists/endocrinologists and obstetricians/gynecologists (OB/GYNs) in India.</td>
<td>A total of 3841 doctors participated in the survey of whom 68.6% worked in private clinics. Majority of OB/GYNs (84.9%) preferred universal screening for GDM, and screening in the first trimester was performed by 67% of them. Among the OB/GYNs, 600 (36.7%) reported using the nonfasting 2 h criteria for diagnosing GDM whereas 560 (29.4%) of the diabetologists/endocrinologists reported using the same.</td>
</tr>
<tr>
<td>Ouyang, C. M., Dwyer, J. T., Jacques, P. F., Chuang, L. M., Haas, C. F., &amp; Weinger, K. (2015).</td>
<td>Diabetes self-care behaviours and clinical</td>
<td>To examine the influences of patients' background characteristics on the frequency of performing five</td>
<td>All patients had type 2 diabetes diagnosed for more than a year and attended an outpatient clinic at a large university hospital where they had received at least one dietitian-led individual nutrition</td>
</tr>
<tr>
<td>Title</td>
<td>Authors</td>
<td>Methodology</td>
<td>Findings</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Outcomes among Taiwanese patients with type 2 diabetes.</td>
<td>Peimani, M., Tabatabaei-Malazy, O., &amp; Pajouhi, M. (2010). Nurses’ role in diabetes care; A review. <em>Journal of Diabetes and Metabolic Disorders</em>, Journal 9, 4.</td>
<td>To explore the role of nurses in diabetes care.</td>
<td>The associations between patients’ demographics and disease-related characteristics and their performance of self-care behaviours were assessed with logistic regression. Over half followed recommended meal plans and exercised, but fewer performed foot care (38%) or checked their blood glucose levels (20%) regularly.</td>
</tr>
<tr>
<td>Diabetes self-care behaviours that 185 Taiwanese outpatients reported.</td>
<td>Philis-Tsimikas, A., Walker, C., Rivard, L., Talavera, G., Reimann, J. O., Salmon, M., &amp; Araujo, R. (2004). Improvement in diabetes care of underinsured patients enrolled in project dulce: a community-based, culturally appropriate, nurse case management and peer education diabetes care model. <em>Diabetes care</em>, Journal 27(1), 110-115.</td>
<td>A total of 153 high-risk patients with diabetes recruited from six community clinic sites in San Diego County, California were enrolled in a nurse case management (NCM) and peer education/empowerment group.</td>
<td>After 1 year in Project Dulce, the NCM and peer education/empowerment group had significant improvements in HbA₁c (12.0–8.3%, <em>P</em> &lt; 0.0001), total cholesterol (5.82–4.86 mmol/l, <em>P</em> &lt; 0.0001), LDL cholesterol (3.39–2.79 mmol/l, <em>P</em> &lt; 0.0001), and diastolic blood pressure (80–76 mmHg, <em>P</em> &lt; 0.009), which were significantly better</td>
</tr>
</tbody>
</table>

| Renders, C. M., Valk, G. D., Griffin, S. J., Wagner, E. H., & Assendelft, W. J. (2001). Interventions to improve the management of diabetes in primary care, outpatient, and community settings: a systematic review. *Diabetes care, Journal* 24(10), 1821-1833. | To review the effectiveness of interventions targeted at health care professionals and/or the structure of care in order to improve the management of diabetes in primary care, outpatient, and community settings. | A systematic review of controlled trials evaluating the effectiveness of interventions targeted at health care professionals and aimed at improving the process of care or patient outcomes for patients with diabetes was performed. Standard search methods of the Cochrane Effective Practice and Organization of Care Group were used. | A total of 41 studies met the inclusion criteria. The studies identified were heterogeneous in terms of interventions, participants, settings, and reported outcomes. In all studies, the interventions were multifaceted. The interventions were targeted at health care professionals only in 12 studies, at the organization of care only in 9 studies, and at both in 20 studies. |
Table 4. Matrix of Data Collection

<table>
<thead>
<tr>
<th>Database</th>
<th>Keywords/Search items</th>
<th>Hits</th>
<th>Title</th>
<th>Abstract</th>
<th>Relevance to the current study</th>
<th>Articles considered for the study</th>
</tr>
</thead>
<tbody>
<tr>
<td>CINEHL</td>
<td>Type 2 diabetes</td>
<td>78</td>
<td>17</td>
<td>12</td>
<td>5</td>
<td>2</td>
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<tr>
<td>EBSCO</td>
<td>The role of nurses in diabetes prevention</td>
<td>125</td>
<td>24</td>
<td>14</td>
<td>7</td>
<td>1</td>
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<tr>
<td>PubMed</td>
<td>Nurses as educators in diabetes prevention and management</td>
<td>65</td>
<td>18</td>
<td>13</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Emerald</td>
<td>Type 2 diabetes prevention and management</td>
<td>48</td>
<td>32</td>
<td>10</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Med-line</td>
<td>The role of nurses in diabetes prevention</td>
<td>34</td>
<td>23</td>
<td>17</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>ProQuest</td>
<td>Type 2 diabetes and the elderly</td>
<td>24</td>
<td>13</td>
<td>9</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Google Scholar</td>
<td>Prevention and management of type 2 diabetes</td>
<td>102</td>
<td>32</td>
<td>18</td>
<td>12</td>
<td>4</td>
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<tr>
<td>Sage</td>
<td>Type 2 diabetes prevention and management</td>
<td>21</td>
<td>15</td>
<td>12</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>497</td>
<td>174</td>
<td>105</td>
<td>63</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insulin type</th>
<th>Onset of action</th>
<th>Peak effect</th>
<th>Duration of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lispro, aspart, glulisine</td>
<td>5 to 15 min</td>
<td>45 to 75 min</td>
<td>2 to 4 h</td>
</tr>
<tr>
<td>Regular</td>
<td>About 30 min</td>
<td>2 to 4 h</td>
<td>5 to 8 h</td>
</tr>
<tr>
<td>NPH</td>
<td>About 2 h</td>
<td>4 to 12 h</td>
<td>18 to 28 h</td>
</tr>
<tr>
<td>Insulin glargine</td>
<td>About 2 h</td>
<td>No peak</td>
<td>20 to 24 h</td>
</tr>
<tr>
<td>Insulin detemir</td>
<td>About 2 h</td>
<td>No peak</td>
<td>6 to 24 h(^1)</td>
</tr>
<tr>
<td>NPL</td>
<td>About 2 h</td>
<td>Six hours</td>
<td>15 h</td>
</tr>
<tr>
<td>Insulin degludec</td>
<td>About 2 h</td>
<td>No peak</td>
<td>&gt; 40 h</td>
</tr>
<tr>
<td>Insulin U-300</td>
<td>About 2 h</td>
<td>No peak</td>
<td>&gt; 36 h</td>
</tr>
</tbody>
</table>