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QUALITY IMPROVEMENT OPPORTUNITIES FOR DIABETIC FOOT ULCER DOCUMENTATION: HOME NURSES' PERSPECTIVE

Masters's Thesis

Supervisor: Priit Kruus
MSc

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Hereby I declare that this Master's thesis is my original investigation and achievement submitted for Master of Science degree of Tallinn University of Technology.

Current work has not been submitted for any other academic degree

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DIABEETILISE JALAHAAVANDI DOKUMENTEERIMISE KVALITEEDI PARANDAMISE VÕIMALUSED KODUÕDEDE PERSPEKTIIVIST LÄHTUVALT

Magistritöö

Juhendaja: Priit Kruus
MSc

Tallinn 2018

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Abstract

Documentation is an essential part of DFU management. Good quality documentation helps to track the course of the patient's treatment processes, ulcer healing progression, and also helps to notice DFU complications in the early stages. In addition, it has a significant impact on communication between healthcare professionals as using digital documentation facilitates the information exchange, therefore enhancing cooperation. Documenting the provided care is the only evidence home nurses have to prove that care is provided in a correct and legal way, i.e. proper documentation will protect healthcare professionals in cases of complaints and judgments.

The aim of the thesis is to evaluate the need among home nurses to improve the diabetic ulcer documentation in Estonia in order to: increase the quality of DFU documentation; improve multidisciplinary approach to DFU care and; provide the best quality of care to the patients, while the quality of care can be measured in treatment outcomes.

The thesis consists of theoretical and empirical part. Theoretical part gives an overview of *diabetes mellitus* and its complications, home nursing services and diabetic foot ulcer documentation. Later on, information about the legislations, ulcer guidelines and studies related to the documentation quality is provided. The second part of the thesis gives an overview of the methods and methodology used, describes the results, after which the discussion is carried out and conclusions are made. Based on information gathered from the study, seven recommendations about how to improve the documentation quality in Estonia are given.

Two research methods are used: semi-structured interviews with experts nurses (n=8) and one surgeon, and qualitative web-based questionnaire among home nurses with a response rate of 39%.

The study reveals that the documentation process varies by different home nursing service providers in Estonia. Several convenient technological solutions are already in use, but at the same time there are some organizations that use unstructured free-text forms which often ends with information duplication. Noteworthy is the fact that although some organizations have already implemented digital wound card templates, none of them is

compatible with the Estonian Health Information System. This limits the exchange of information between healthcare professionals.

Moreover, the study revealed that nurses do not use rulers in ulcer assessment but on the other hand, but at the same time are willing to use digital assessment tools in their everyday practice if it would be possible. Using digital assessment tools would facilitate the documentation process and make the assessment results objective. Therefore, more studies are needed to find the most appropriate digital tools and applications that could be used in home-based care and that would increase the ulcer assessment quality.

In addition to the documentation process, nurses show the need for consultations with other healthcare professionals, which today is done through informal channels such as email and telephone. Therefore, it is crucial to provide nurses a secure communication channel e.g. special e-consultation service for nurses.

Last but not least, the results show the need for DFU prevention and management guideline and the continuous training to raise awareness and provide knowledge about the importance and impact of documentation.

The thesis is in English language and contains 45 pages of text, six chapters and six figures.

Annotatsioon

Käesoleva uurimistöö eesmärk on välja selgitada diabeetilise jalahaavandi patsiendikäsitluse ja jalahaavandite dokumenteerimise kvaliteedi parandamise võimalusi Eestis.

Töö jaguneb teoreetiliseks ja empiiriliseks osaks. Töö teoreetilises osas antakse ülevaade diabeedist ja selle tüsistustest, koduõendustegevusest ning haavandi dokumentasioonist. Lisaks kirjeldatakse ka dokumentatsiooniga seonduvat seadusandlust, kasutusel olevaid haavandi ravijuhiseid ning Eesti Haigekassa poolt läbiviidud auditit. Välja on toodud ka eelnevalt läbiviidud dokumentatsiooniga seotud uuringute lühikirjeldused. Töö teises osas antakse ülevaade töös kasutatud meetoditest ja metoodikatest, kirjeldatakse uurimuse tulemused, millele järgneb arutelu ning järeldused.

Uuringu esimes etapis viidi koduõdede juhtide ning Eesti haavaravi liidu juhatuse liikmega läbi kvalitatiivsed pool-struktueeritud interjuud (n=9). Intervjueeritavad valiti ettekavatsetud valimi põhjal, kaasates lumepalli meetodil uuringusse koduõdede vanemõdesid ning töö koordinaatoreid. Intervjuude analüüsimeetodina kasutati temaatilist sisuanalüüsi.

Lisaks intervjuudele viidi koduõdede seas läbi veebipõhine küsitlus, mis edastati koduõendusteenust pakkuvatesse asutustesse Harju, Tartu ning Ida-Viru maakonnas. Küsimustiku valimisse kuulus 127 koduõde, kellest vastasid 49 (39%).

Käesolevas magistritöös tuuakse välja seitse peamist soovitust kuidas parandada diabeetilise jalahaavandi dokumenteerimise ning patsiendikäsitluse kvaliteeti Eestis:

- Töötada välja standardiseeritud digitaalne haavaravi kaart, mis ühildub EHIS-ega;
- Luua riiklik minimaalne andmekogum haavandi dokumenteerimise standardiseerimiseks;
- Arendada välja haavandite objektiivseks hindamiseks mõeldud digitaalne tööriist;
- Kaaluda e-konsultatsiooniteenuse laiendamist koduõdedele;
- Luua selgesõnalised juhiseid, kuidas kasutada fotograafiat dokumenteerimise abivahendina;

- Arendada diabeetilise jalahaavandi ennetus- ja ravijuhend;
- Meditsiinipersonali järjepidev koolitus dokumentatsiooni ja selle tähtsuse osas.

Lõputöö on kirjutatud inglise keeles ning sisaldab teksti 45 leheküljel, sisaldab kuut peatükki ning kuut joonist.

Abbreviations

DM	Diabetes Mellitus
GP	General Practitioner
DFU	Diabetic foot ulcer
EHIF	Estonian Health Insurance Fund
CVU	Chronic Venous Ulcer
PU	Pressure Ulcer
IDF	International Diabetes Federation
EHIS	Estonian Health Information System
MDT	Multidisciplinary team

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Introduction

Diabetes mellitus (hereinafter referred to as DM) is a life-long chronic illness, being one of the biggest healthcare challenges in the 21st century. On the basis of all chronic diseases, diabetes is the most common disease in the world being mainly related to lifestyle changes caused by general economic development and urbanization [32]. Due to high prevalence of disease and complications, DM causes substantial financial burden for the healthcare system [22].

DM is associated with several life-threatening complications such as cardiovascular diseases (myocardial infarction, blood vessel damages), retinopathy (loss of vision), nephropathy (decreased renal function), and neuropathy (nerve damages). One of the devastating complications of diabetes is diabetic foot ulcer (hereafter named as DFU) [22]. DFU is commonly caused by three main factors: infection, neuropathy and ischemia, which makes DFUs long course of treatment. Diabetic peripheral neuropathy is the major risk factor for development of diabetic foot ulcer [32], which can lead to limb amputations [2], [22], [23].

An important factor of the treatment outcomes of diabetic ulcer is instant documentation done by healthcare specialist, which shows the course of the disease [5]. The documentation standard for diabetic ulcer should be based on national treatment guidelines. Today, there are no specific guidelines for DFU management in Estonia, but two other guidelines on ulcer care are developed that can be used in management of DFUs. These two lately launched guidelines [38], [39], as well as guidelines worldwide [8],[53] suggest using innovative solutions when delivering ulcer care, which are cost-effective and time saving, and at the same time improve the documentation quality [5], [36]. One of the suggested solutions is the use of photography as a part of ulcer care assessment [38], [39]. Today, Estonian home nurses' DFU documentation is predominantly paper-based, where nurses have to rely on rulers and paper-based wound cards which are analyzed after the patient visit. Therefore, what is needed is novel solutions that ensures a high quality documentation of diabetic ulcers, improves

multidisciplinary approach to diabetic ulcer care and offers best quality of care, which can be measured by the statistics of the results of the treatment.

Hence, the aim of the thesis is to evaluate the need for improvement of diabetic ulcer documentation in Estonia in order to:

- enhance quality of diabetic ulcer documentation;
- improve multidisciplinary approach to diabetic ulcer care, and;
- provide the best quality of care.

The author of this thesis has set out the following research questions to achieve the main goal:

- What are the attitudes of home nurses' about current ulcer documentation and its quality?
- What is the current process of documentation?
- What are the major gaps in current ulcer documentation process?
- Is there a need for adapting digitized solutions for documentation process from the perspective of home nurses?
- What kind of innovative ulcer care solutions have been developed to facilitate documentation process?
- What should be the features of the solutions that fill in the gaps in current ulcer documentation in Estonia?

The original interest in the topic comes from the author's daily work. The first aspect of the problem under consideration comes from the current home nurse's daily work: due to absence of standardized electronic working environment, nurses must carry a large number of paper documents with them in order to perform their work-related duties. Another aspect is the wound description capacity: DFUs are described objectively and mostly in free text. Objective evaluation results may be interpreted in different ways by different persons, therefore leading to non-unambiguous information [5]. Moreover, home nurses use photography for documentation quite often, but this is done in an unregulated manner and patient paper-based medical records are not compatible with digitized tools. More, emails are often used for communication with other specialists, which is not

considered as a legal and secure method for sensitive personal data transfer and storage [31]. As a result of current study, suggestions are given on how to fill the gaps and improve the quality of current documentation processes in Estonia.

First part of the thesis is a literature review, where an overview about *diabetes mellitus* and one of its severest complication - diabetic foot ulcer is given. In the last subchapter of the first chapter, clinical relevance of documentation of diabetic foot ulcer made by home nurses is stated along with the factors that affect it. In chapter 2, an overview of current situation in home nursing documentation in Estonia is given, including a description of legal aspects, developed guidelines as well as documentation quality audit carried out in 2011. Third chapter of this thesis gives an overview of related studies made in the field of using information and communication technologies in ulcer care and its impact on the quality of documentation.

Second, empirical part of the thesis is giving an overview of the methodology used in the study, the results of web-based questionnaire and in-depth semi-structured interviews, and through discussion, in which the results are analyzed and interpreted. At the end of this paper, a list of improvement opportunities and suggestions for further studies are given.

1. Overview of *diabetes mellitus* and the diabetic foot ulcer as main complication and clinical relevance of documentation

Current chapter provides an overview of diabetes mellitus, including the background of the disease, its incidence and prevalence in Estonia and worldwide, as well as foot ulcers pathology and its burden on healthcare system.

1.1 *Diabetes mellitus*

Diabetes mellitus is a life-long chronic illness, which is mainly related to lifestyle changes caused by general economic development and urbanization [32]. The disease is divided into two types: type one and type two. Type one, also known as "childhood diabetes", is an autoimmune reaction, where body's own immune system mistakenly attacks beta cells in pancreas. This leads to disturbances in body's insulin production as beta cells are responsible for producing it. Insulin is a hormone produced in pancreas and its main function is to transport glucose from blood to body cells, where it is converted into energy. As known, energy is essential for the functioning of the organism. People diagnosed with first type diabetes need to inject insulin every day. Type two diabetes usually develops over a lifetime, and there are several risk factors for disease development. In type two diabetes, pancreas is producing insulin, but this is insufficient as body can't use it properly, causing blood glucose tolerance and abnormal sugar metabolism. Obesity, poor eating habits, little physical activity, hereditary predisposition and high blood glucose during pregnancy are the main risks for developing type two diabetes [23].

Therefore, good blood glucose maintenance, low cholesterol and normal blood pressure control is essential for minimizing complications risk associated with diabetes – living with high blood glucose levels increases the likelihood of complications [28].

1.1.1 Prevalence and incidence

According to International Diabetes Federation, the prevalence of diabetes in Estonian adult population was 5.7% in 2015 and is estimated to increase to 10.3% by the year 2030 [32]. Few diabetes prevalence studies have been conducted in Estonia, the largest drafted

in 2008 in Väike-Maarja, where age group 25-70 was studied. The results of this study showed that disease prevalence through Estonia was 8.7% of the adult population, which is significantly higher percent than international sources are stating [29].

In 2014, incidence rate of the first type diabetes in Estonia was 567 people (for comparison, 507 in 2004). In general, the initial incidence rate of first type diabetes has been relatively stable over the decade [32]. The second type diabetes was diagnosed by a total of 5,443 people in Estonia in 2014, and compared to 2004, the rate has risen approximately by a third - when in 2004 there were 247 people diagnosed with type two diabetes per 100 000 inhabitants, by the year 2014, the number has increased to 414 per 100 000 [32].

According to International Diabetes Federation [24], the number of people diagnosed with DM in Europe is estimated to be 58 million in 2017, which is 8.8% of the age group 20-79 years. This is expected to rise to 67 millions of diagnoses by 2045. Although Europe has been ranked as second in having the lowest age-adjusted DM prevalence, there are still countries with relatively high rates in EU, e.g. Turkey. South-East Asia and Western Pacific regions are in the most devastating situation: in China, diabetes is diagnosed in 121 million people and in India, 74 million people [24].

While it is clear that the epidemic of diabetes is increasing, there is still a lack of data in Europe that would be well-comparable at national level. In 2013, 30 European countries out of 47 had some kind of diabetes registries, and seven countries only maintained a registry of gestation DM. Survey conducted by IDF found that 4 million people at the age group 20-79 died in the worldwide in 2017. In EU, DM accounting for 10.7% of the all-cause mortality, which is reciprocal to one death in every eight second [24].

1.1.2 Financial burden

Diabetes establishes a big economic burden for healthcare systems worldwide [28]. This burden can be measured as direct costs associated with diabetes and indirect costs, including e.g. immobility and premature death. Direct costs of DM are associated with financial costs for disease prevention and the treatment of complications, for example

outpatient emergency medical care, inpatient hospital care, medications, medical injection devices and self-monitoring tools [24].

A report conducted by Paat-Ahi & Nurm (2017) stated that diabetic patients in Estonia receive a large proportion of outpatient care from a specialist doctor, but at the same time, also regularly visiting family doctor. Duplicating such activities is clearly a waste of resources, since GPs as well as specialized doctors provide all the preventive services. In 2013, the average number of DM patients visits to healthcare provider was 10.3 per year. Of that, primary healthcare visits accounted for 59% and specialist visits 42% [32].

It is estimated that direct annual costs of DM worldwide are more than 827 billion US dollars [28], [44]. In addition to the fact that DM is costly to the healthcare system, it is also financially burdensome for the patient and his/her whole family. This particularly applies to the first type of diabetes, which requires the purchasing of syringes, needles [28], [52].

For DM, the most costly is to mitigate and treat complications like nephropathy, retinopathy and neuropathies (see Figure 2). Due to neuropathy, diabetic foot ulcer (DFU) can develop, which is also one common complication of DM. In United Kingdom, 5-7% of the people diagnosed with DM currently have DFU, and 25% are expected to have an DFU during their lifetime [53]. In comparison, the number of DFUs in Denmark is estimated to range between 1-6% in people diagnosed with DM [25]. DFU is considered as one of the most costly complications related to DM, forming a large part of the cost of entire DM treatment. In United Kingdom, the treatment of DFUs make up about 20% of total National Health Service expenditure on diabetes care, which is approximately £650 millions per year [53]. These expenditures consist of wound care materials, diagnostics, operational interventions and medical personnel labour forces.

DFUs are non-healing wounds that can lead to limb amputations. Based on National Diabetes Statistics Report made in 2017 by Centers for Disease Control and Prevention (CDC), 108 000 limbs were amputated in U.S in 2014 because of the DM [6]. There is no exact information about it in Estonia, but it has been claimed that the number can be around 400 to 500 non-traumatic amputations per year [27]. In Norway, the below-knee amputation rate is around 400-500 per year [42]. Early amputations in working-age

population reduces their ability to work, creating a situation where the opportunity to pay taxes to the government is replaced by the state expenditures. Both DFUs and amputations are associated with tremendous societal costs, loss of jobs, prolonged hospital days and increased use of social services [2], [33].

1.2 Diabetic foot ulcer

As stated above, one of the severest complications of DM is diabetic foot ulcer. There are several contributory factors to foot ulceration, but for most of the patient's, peripheral neuropathy and/or peripheral arterial disease (PAD) play a crucial role in development of DFUs. Other causative complications of DM are pointed out in chapter 1.1 of this paper. The current chapter gives an overview of the contributing complications for development of diabetic ulcer (Figure 1).

Diabetic foot develops over a long period of time under hyperglycaemic state: it is a result of the blood vessel damage and pathology of joints, peripheral nerves, skin and soft tissue. Hyperglycaemia produces stress on nerve cells, causing neuropathy and nerve cell’s dysfunction, which leads to further ischemia. Due to damage to nerves, sweat gland function is disturbed, causing skin dryness, which leads to dermal breakdown. As a result of above-mentioned changes, ulcers may develop, which damage the bone and joint systems causing non-healing wounds (i.e ulcers) and in more severe cases, limb amputations [33].

The following figure gives an illustrative overview of the development of diabetic foot ulcer.

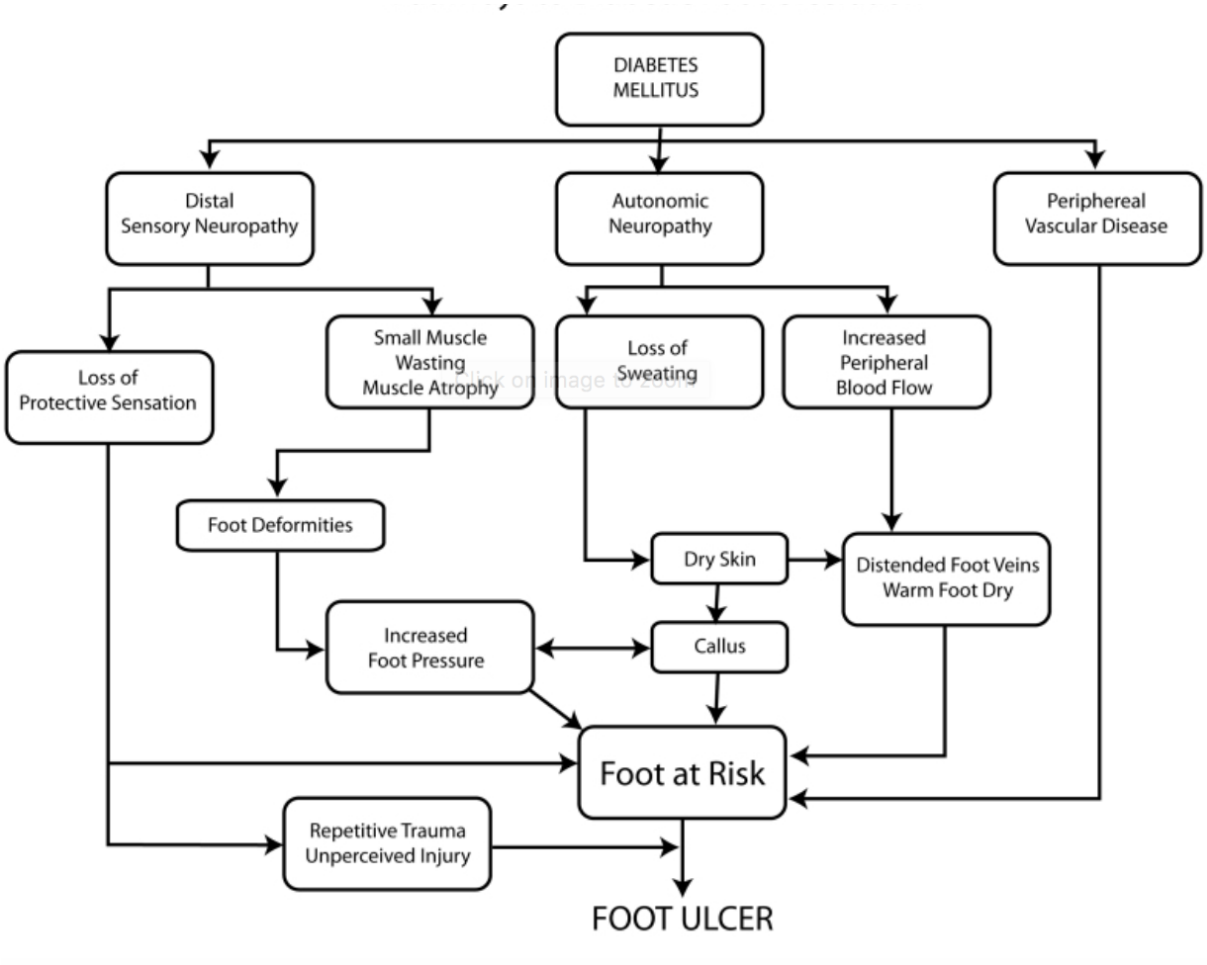

Figure 1. Pathway to DFU development [3]

1.2.1 Neuropathy

Diabetic neuropathy is a common diabetes-specific complication, the diagnosis can be delayed in many cases, especially when the patient does not have pronounced subjective complaints. The first symptoms of nerve or circulatory damages can be stinging, burning or ankle clogging in the legs. Peripheral neuropathy can be divided into three main types of neuropathy: sensory loss, motor nerve damages and autonomic nerve damages. Sensory loss means the inability to feel physical, chemical or thermal contact. Motor neuropathy causes foot distortion and autonomic nerve damage is usually related to dry skin, which causes thickening and cracking of the skin and makes it more receptive to infections [53].

When neuropathy develops with a pain syndrome, medical attention is usually gained earlier, but this is often not a case and in majority of patients, symptoms of neuropathy are

usually modest and the damage is diagnosed in a stage of late complication, such as a diabetic foot [33].

1.2.2 Peripheral arterial disease (PAD)

In diabetics, peripheral blood supply disorder is twice as likely as in the rest of the population who do not have diabetes. Blood supply disorder develops due to atherosclerosis, which is a condition where atherosclerotic plaques stick into artery walls, narrowing the walls of the blood vessels until the extensive blockage of blood supply. Small skin injuries may delve bigger due to reduced arterial blood supply, which results in inability of the tissue to properly heal the wound itself, even when there is only a partial vessel dysfunction [53].

In situations where ulceration has already developed through aforementioned mechanisms, there is a high risk of developing osteomyelitis, which is an infection of the bone tissue. This usually happens due to lack of medical intervention, where the ulcer gets deeply infected and the infection expands up to the bone tissue. People with large and deep ulcers, non-healing ulcers, or bone damage due to radiographic destruction are at high risk of developing osteomyelitis. It is stated that 56% of ulcers become infected and one fifth of them need amputation in some level [22].

1.3 Clinical relevance of documentation

Due to delayed healing, an early detection of foot problems is necessary in order to provide the best quality of care to the patient. The basic examination should include skin temperature assessment, detection of changes in skin colour, identification of arterial blood supply disorders, and assessment of patient movements, including walking pattern [22]. Accurate documentation of the assessment results is essential as it sets the basis for treatment decisions, helps to monitor ulcer healing and detect complications in very early stages [53]. Patient status assessment and documentation is an integral part in healthcare, as this can be used to plan preventive measures or to take into account labor resources ensuring the continuity of information exchange when the patient moves between

stakeholders [39]. Continuous and consistent record keeping, as well as high quality documentation have a positive impact on patient outcomes [40].

2. Current situation in home nursing documentation in Estonia

This chapter focuses on current state of home nursing documentation in Estonia. Legal aspects, ulcer guidelines developed in Estonia are described. More, an overview of documentation quality audit carried out in 2011 by Estonian Health Insurance Fund is given.

2.1 Legislation

Home nursing service is provided since 2003 in Estonia. The main aim of home nursing service is to support, maintain and improve the patient's health and functional status through goal-oriented nursing activities. Home nursing service provides the opportunity to continue the necessary care to the patient in his or her home environment during the recovery period of the illness [13], [17]. According to Estonian Health Insurance Fund (EHIF), home nursing service is intended for patients whose health condition does not require a hospital stay but who still needs expert medical assistance. This may refer to a person with limited mobility, who is not able to attend to a doctor's appointment. Here, especially vulnerable group is the elderly people as they often have multimorbidities [16], [17].

The referral to a home nursing service is decided whether by a family physician or specialist doctor. The referral has to include healthcare provider's notes about patient's health problems, as well as the necessary treatment procedures that must be performed during the home visit(s). Home nursing care is free of charge for people with Estonian general health insurance, paid by the Estonian Health Insurance Fund [16].

Home nursing services are provided by home care nurses. To become a full-fledged home nurse, a special qualification, at least three years of working experience and special training in nursing services for home care must be fulfilled [45].

The provision of home nursing services in Estonia are regulated by the following regulations of the Ministry of Social Affairs: [37], [41], [46], [47], which stipulate the

home nursing documentation regimens. Nursing documentation is defined as official recorded document that consist of several obligatory parts, including nursing activities and monitoring processes. Regulations establish the provisioning of home nursing services [37], [47] and set out how the documentation should be carried out [46]. Section 11 in clause 3 states that the document can be formalized in the form chosen by healthcare provider, but the obligatory parts carried out by law must be fulfilled.

It is suggested that photography should be used in ulcer assessment and documentation processes [38], [39]. There is a law in Estonia that defines the types of medical images, the IT requirements for them and the conditions and procedures for making them available [49]. Nevertheless, this regulation is not directly intended to regulate the use of medical images as a documentation tool, let alone DFUs.

2.2 Guidelines

To date, two guidelines for treatment of ulcers are developed in Estonia. In the following chapter, an overview of these two guidelines are given.

2.2.1 Chronic venous ulcer guideline

Chronic venous ulcer (hereafter named as CVU) guideline was launched in 2017. CVU is an opened soft tissue located between the knee and ankle, and which develops due to venous insufficiency. An ulcer is considered as CVU if it has not healed over the last four weeks. Chronic venous ulceration usually occurs in patients with a long-term history of venous disease (e.g. a varicose veins or post-thrombotic syndrome due to deep vein thrombosis), which in turn has led to chronic venous insufficiency. Venous insufficiency in the lower limbs causes various soft tissue changes in the course of time, mainly in the lower third of the lower limb, culminating in the development of chronic ulceration and non-healing-wounds [38].

CVU guideline provides healthcare professionals with recommendations on how paper based wound card should look like and what kind of ulcer symptoms and signs should be tracked during the healing period. Wound card described in the guideline orders to add a

photo of the ulcer, however, photo storage is not regulated in the guideline. Overall, guideline's general recommendation suggests to use telemedicine interventions in order to provide access for specialist consultation for patients who cannot attend to the appointment.

2.2.2 Pressure ulcer guideline

Pressure ulcer guideline was launched in 2016. The pressure ulcer, also known as *decubitus* or *bedsores*, is a local damage of the skin and/or the subcutaneous tissue which is developed due to the continuous pressure of the tissues. Continuous pressure causes disruption in the tissue blood supply and the onset of tissue necrosis, causing severe and hard-to-treat ulceration. People who are forced to lie in bed for a long time are at the highest risk of developing an ulcer. Pressure ulcers usually occur in areas where there is little soft tissue between the bones and the skin, e.g. sacral bone, heels and neck [39].

The guideline provides recommendations for how to prevent and manage the ulcers, and also how the documentation of the ulcers should be carried out. Proposal number 21 of pressure ulcer guideline suggests to use photography to measure the size of the ulcer, or to measure it with a sterile-clean plastic sheet. When using photography, the same method should be used and the conditions should also be the same or approximate every time when making a photography. General suggestion given in the guideline is to measure the ulcer as often as needed, but not less than once a week [39].

Pressure ulcer guideline states that using a photography for measuring bottom of the ulcer is advantageous, because as it does not require direct contact with the ulceration surface, the measuring instrument does not harm nor irritate the sensitive tissue. In contrast, some assessment methods may be potentially harmful to the patient - using non-sterile tools like rulers or squared plastic sheets in home conditions increase the risk of developing an ulcer infection [39].

Both aforementioned guidelines are giving preventative and treatment-related suggestions how to manage ulcers. Currently, there are no special guidelines for DFU management with prevention and treatment suggestions in Estonia.

2.3 Documentation quality audit

In 2011, a documentation quality audit was carried out by EHIF, which is conjointly the last evaluation of the quality of home nursing services in Estonia [13]. The main objective of the audit was to assess the quality of home-based services in the basis of nursing documentation, that final results were found to be moderate. One sub-objective was to give an overview of the quality compliance of the provisioning of home-nursing services on the basis of the documentation records.

According to the audit, fifty-five (55) percent of all home nursing cases were related to wound treating. Audit detected that eighty-seven (87) percent of all treatment cases were documented, of which only 53% of cases were found to be adequate. Based on these results, proposals were made to reduce the deficiencies in order to improve the treatment outcomes.

In addition, the audit revealed that service providers demand common documentation standards, an integrated documentation software program, and for compatible system that allows epicrisis to be transmitted to the EHIS. More, the report brought out the need to continuously carry out trainings for lead home nurses about the renewed documentation requirements. The trainings could be carried out by trained home nurses, especially since it was found that many home nurses have an interest in education in the field of documentation. Lastly, it was emphasized that regular audits for documentation quality assessment should be carried out.

3. International best practices in using ICT for improving diabetic ulcer documentation quality

Many studies have been conducted with the objective to ascertain which factors influence and determine the quality of ulcer care documentation. Current chapter gives an overview of selected studies carried out in this field. Information was collected from Pubmed and Google Scholar databases, with time limit criteria was set from 2012 to 2018. Keywords used for data search were: diabetic foot ulcer; documentation; home nursing; quality; technology; ehealth. Studies that were in English and that were made in developed countries were preferred.

Pokorná et al. (2015) made an evaluation study in Czech Republic to analyze the methods which are used in inpatient settings to assess ulcers. Focus was on whether the assessment varies among hospitals and could there be any improvements to be made. It was acknowledged that nurses do not assess ulcers measurements because of lack of time, and often, measuring the size of an ulcer is only based on visual inspection. To solve the gap, photography or photogrammetric software was suggested as one possible solution. It was also found that in a presence of a wound-consultant for nurses in the workplace, wound parameters assessment is enforced more often and in a more adequate way. The study brought out that nurses are not using basic ulcer assessment tools because of the lack of unified recommendations and guidelines.

Coleman et al. (2017) conducted a literature overview and carried out an interviews with experts in order to develop national minimum data set to facilitate the chronic wound management. The area of concern was that there are no established national guidance for chronic wounds in the United Kingdom, and this decreases the quality of care. The study stated that using minimum data set has important role in improving the wound care [7].

Tubaishat et al. (2015) compared pressure ulcers documentation quality in two hospitals, where one hospital used paper-based records and another one used electronic medical records. The results showed shortcomings in both settings, but more comprehensive

documentation was obtained using electronic medical record. It was also stated that using templates in documentation is more favourable than using free text, as using templates can be more relevant and time efficient.

Florczak et al. (2012) carried out an observational study in nurse-led clinic with the aim of implementing and assessing an electronic documentation system, focusing on pressure ulcer documentation [19]. The aim of this study was to improve the documentation quality, to examine how to achieve better results in ulcer healing and to improve shared data exchange. The first positive result appeared was the increase in information availability, the information was in a standardized format and therefore more easy to read. Electronic documentation system automatized the tracking of ulcer surface healing process by calculating Pressure Ulcer Scale for Healing (PUSH) scores. Moreover, positive effect was also seen in communication between the team members as it became more streamlined. Last, using electronic documentation system increased the time efficiency, which in turn enabled more time to concentrate on patient and the care process.

The recent studies by Kollveit et al. (2016) are showing that telemedicine have a strong positive impact on ulcer care from the point of view of healthcare professionals. The aim was to identify healthcare professionals' experiences with ulcer record, which was a combination of web-based and mobile-based applications. The results indicated that using ulcer record, increases the wound assessment knowledge and skills of healthcare professionals, as well as improves the quality of documentation. Another positive outcome that emerged from using the ulcer record was that the communication between healthcare professionals (principally between specialists and general practitioners) became more streamlined.

Bowling et al. (2013) carried out a non-systematic review that examined several mobile applications designed for chronic wound care. When conducting the review, three main areas were taken into account: first, accuracy of measurements in wound surface assessment; second, application's ability to use it remotely and; third, users feedback about the application. The results showed that using photography has several advantages and can be beneficial in wound healing process. It also helps to avoid the possible biases that can occur when interpreting the wounds.

As evidence above, problems related to ulcer documentation is also considered a major concern elsewhere in the world. It has been found that factors related to ICT – using electronic documentation system, standardized dataset, ulcer record, and photography as an assessment tool – are directly related to improvement of documentation quality. These results provide a direction in which Estonia should move towards in order to improve the quality of ulcer documentation.

4. Methodology and methods

The aim of the thesis is to evaluate the need for improvement of diabetic foot ulcer documentation in Estonia in order to enhance quality of DFU documentation, improve multidisciplinary approach to DFU treatment, and to offer the best quality of care to patients. To achieve this, the following research questions has been set out:

- What are the attitudes of home nurses about current ulcer documentation and its level of quality?
- What is the current process of diabetic ulcer documentation?
- What are the major gaps in current ulcer documentation process?
- Is there a need for adapting digitized solutions for documentation process from the perspective of home nurses?
- What kind of innovative ulcer care solutions have been developed to facilitate documentation process?
- What should be the features of the solutions that fill in the gaps in current ulcer documentation in Estonia?

Two research methods were chosen to gather information regarding the questions above, these are: web-based questionnaire and qualitative semi-structured interviews.

Based on 7-phase method's first, screening phase [51], DFU patient pathway was drawn as the last part of analyzing the results. The aim of describing the pathway is to help to understand the wider field and study context in a more convenient way, doing it through creating a visual representation. As a result, reader of this paper understands how the patient flow can vary and who are the main stakeholders in current DFU patient management system. The pathway will not be focusing on organization-based specific features and more, no improved pathway is given in current study.

Semi-structured interview was chosen as a data collection method in order to gather attitudes and information from top experts in the wound documentation field in Estonia.
The following specialists were included:

- Wound dressing room nurse from a big hospital (25 years of experience in the field)
- Lead home nurses
- Vascular surgeon

Author chose the interviewees by using purposive sampling technique. Persons who are experts in their positions were included in the study, e.g. wound dressing room nurses and head home nurses, who are closely related to wound care and know its arrangement on higher level. One surgeon was included into the study as being a head of wound care in non-governmental organization.

Nurses who are in a leader position are role models to their colleagues and in order to explore their attitudes, semi-structured interview was found to be the most appropriate method for gathering information that help to answer the research questions. Semi-structured interview method has several advantages, e.g. it helps to collect detailed information about specific topics and questions, and, it is flexible [10], [21]. Another positive aspect is that during the interviews there is an opportunity to gather extra information that the interviewer could not foresee.

The interviewees were selected based on purposive sampling technique and additionally, through recommendations from other interviewees. In order to gather the final number of interviewees in Tallinn and Tartu, an exponential discriminative snowball sampling was used to identify the final number of participants [10].

In current study 9 semi-structured interviews took place in February and March 2018, average duration of an interview was 20 minutes.

The interviews were analyzed by using thematic analysis. Thematic analysis was chosen because it helps to find out the meanings and perceptions that are contained in the data. During the interview, the author introduces the aim and research questions of the study to the interviewee, but in addition to prepared interview questions, additional information provided by the interviewees is also taken into account as some important topics and issues for home nurses can not be foreseen by the interviewer [18].

To conduct the interviews, an interview guide was formed (Appendix 1, 2). The interview guide was divided into three main topics. Interview guide was formed to hold focus on the

topic and get answers to research questions. The first topic was about interviewee background and how documentation is organized in current company. Topic number two was about opportunities and barriers related to home care nursing and ulcer care. Last topic was about digitized channels used in everyday practice. There were conducted face-to-face interviews and interviews by telephone, in both cases conversations were audiotaped for later analysis. The interview participants were recruited from Tartu and Tallinn area. One company from Ida-Viru area was chosen to conduct interview, but it was excluded due to language barrier. In addition to semi-structured interviews, web-based questionnaires was composed.

Interviews provided input for developing the web-based interviews to gather additional information on the topic. Interviews provided relevant background knowledge about the current documentation process and enabled to compile survey questions with higher relevance and quality.

Web-based questionnaire was chosen since having several advantages, adminitersing e-mails is cheap, fast, easy to manage and provides a opportunity to study the distance [20]. An anonymous web-based questionnaire (Appendix 3, 4) was formed because documentation topic can be sensitive. Questionnaires were presented in two languages, in Estonian and in Russian (Appendix 3, 4). The questionnaire consisted of 19 questions. There were presented 5 open-ended and 14 closed questions. The questionnaires was framed to get answers to research questions. The information covered nurse age, years of working experience and working service area. There were topics about documentation, guidelines and communication.

For gathering participants into web-based questionnaire, an inquiry from EHIF contract partners [14] statistics database was made. Later on, was calculated by using MS Excel, all treatment cases in Estonia on the county basis. Next, three biggest service provider counties were chosen, which turned out to be Harju, Tartu and Ida-Viru county. The total number home nursing service treatment cases in Estonia was 38111 in 2017 [15]. Most treatment cases were provided in Harju county with 17 853 cases (47% of total service provided). In Ida-Viru county there were 4025 cases (11%) and Tartu county 3035 cases (8%). When service provider companies were known, an inquiry was made one by one to

Estonian Health Board to get the number of working home nurses the study, which was needed for the final analysis.

To increase the reliability of the study, an extra request was made to EHIF and Estonian Health Board to confirm the number home nurses in Estonia/company based, but unfortunately more precise information is not known in, since there are no specific registries or codes for home nurses. The number of home nurses in current study is estimated to be 127 home nurses. Based on interviews, the total number of home nurses in Estonia is estimated to be around 275.

Later on, questionnaires were sent to the contact person of the home nursing company. Company contact person was asked to introduce the questionnaire to home nurses, with the aim to invite them to participate in study. A confirmation call was done by telephone one week after to confirm if the questionnaires were received. During the telephone call, the accurate number of working home nurses in specific institution was clarified. Questionnaire was sent out to 27 home nursing organizations.

Only two organizations had home nurses work emails available in their web page. There were two cases when lead home nurses forwarded employees emails to provide the author of this study with personal contacts, thereby increasing the possibility to get more respondents. In some cases, the names of employees were available in web page, but principally, only general contact number was provided.

Google Forms free software was used to administer questionnaires. All data was saved automatically into MS Excel file for final analysis.

Data gathered from interviews was taken as the basis for development the structure and content of the questionnaire. Information from the interviews and questionnaires were combined together with background information into thematic categories, which were:

- Format of documentation and interoperability;
- The need for training;
- Digital solutions currently used;
- Ulcer assessment and guidelines;
- Communication and MDT care;

- The need for digitized solutions.

On the principle of triangulation, gathered information was synthesized and assessed from a particular thematic category, based on which, possible DFU documentation improvement opportunities were defined.

Finally, based on literature review and study results, the most commonly encountered problems and solutions were formulated as clear development needs that lead to the enhanced DFU documentation.

Study limitations

Three study limitations are provided below, which could have an impact on study results.

First, the interview participants were chosen by using purposive sampling technique, where the researcher subjectively chose the participants into the study and therefore, the probability of possible bias exists.

Second, Ida-Viru county was excluded from interview study sample because of the language barrier. Therefore, information about the organization of DFU management in one region was lost.

The third limitation is that only three biggest service provider counties was included in the study. Therefore, it is not known which are the areas of concerns and how the documentation is organized in other counties in Estonia. The results may differ from the results of this study as in smaller counties, there are e.g. less treatment cases, and the treatment accessibility and quality may also vary. Therefore, it is not possible to generalize the findings of current study to the national level.

5. Results

Interviews and web-based questionnaires are used as complementary methods in current study, where the anonymous questionnaire provides a wider overview with some facts of the current situation, whereas on the other hand, interviews are focused on specific areas of concern.

This chapter describes the results of the study among home nurses in Harju-, Tartu-, and Ida-Viru county carried out in March - April 2018, and individual semi-structured interviews with experts carried out in March - April 2018. This chapter is divided into, results, related studies and discussion.

The results are presented according to data collection methods. First, summary of interviews and questionnaires are made after which, thematic areas were covered using combined information from both interviews and questionnaires.

5.1 Interviews

A total of nine (9) participants were interviewed, including one surgeon and eight nurses, whereas seven (7) were from Tallinn and two (2) from Tartu. The mean age of nurses was 42 years and the average working experience was 23 years.

5.1.1 Documentation: organizational side

The first objective was to understand how the documentation is organized within home nursing organizations. It was found that every organization has its own method for documentation of home nursing activities.

One hospital's home nursing unit uses a tablet-based program for a year, which is developed by the hospital and which is aimed to facilitate home nurses everyday work routine, enabling instant documentation both at patients homes and at nurses homes. In

this particular hospital, nurses have the access to hospital information system all the time. Another organization had adapted for the home nurses an extra functionality in to hospital information system, enabling supplementary nursing approach. The new functionality enables to add ulcer monitoring information in a more structured way. In this case, documentation is in the first phase written into nurse notebook and later inserted into digital information system. Nurses are using hospital information systems at their homes through Virtual Private Network (VPN) service. Usually home nursing workstation is not used. Other remaining 7 organisations were using regularly paper-based nursing epicrisis and nurse personal notebooks, the final documentation procedure is taken place after patient visit, whether in nurse workstation or at nurse home. In last mention cases LIISA information system is used, which enables documentation only in free text form.

One company is using MS word to record nursing activities, save pictures and patient status, since nurses do not have access to computerized information systems. All information is sent once a month to lead home nurse via email who sends epicrisis into computerized information system and later into health information systems.

5.1.2 Documentation quality

The next section was about documentation and its quality. Seven of eight lead home nurses brought out that nursing documentation quality has improved significantly since the pressure ulcer and chronic venous ulcer guidelines [38], [39] were launched. Three nurses felt worry and said that they have to complete colleague documentation, since there are occurring language barriers and sometimes even wrong terms are used in wound descriptions. It was mentioned two times that documentation quality feedback is given by the head of department. One lead nurse worried about documentation quality, she stated that in the case of audit superintendence, they will not pass. In current company paper based cards are old and not efficient, computerized programs allowing only free text insertion. All eight lead nurses agreed that information which is inserted by college is usually unambiguously understandable.

All 8 lead home nurses claimed that there is a communication barrier between healthcare specialists. It was proposed that there is a need for a deportable tool for home nurses (to carry with them), which would help to facilitate documentation and communication with

other healthcare professionals. Currently, the majority is using emails to consult with other specialists e.g. wound dressing room nurse or family doctor. One barrier noted, was also that information systems are too much customized to doctors and systems do not support the nursing holistic approach.

5.1.3 Digitized tools currently used and future expectation

The third topic was about digitized tools and channels used in everyday practice. 6 nurses agreed that photography is used regularly for monitoring the wounds. Employers have given nurses the opportunity to use company digital camera, since information systems do not support such data storage, the usage differs.

5.2 Web-based questionnaire

Forty-nine (49) home nurses out of 127 answered the web-questionnaire, which makes the response rate 39%. All received questionnaires were taken into consideration as they met the desired requirements. The the largest number of respondents, as much as 67% (n=33) came from Harju county, 8% from Tartu (n=4) and Ida-Viru 24% (n=12). The response rate constitutes 18% the of all home nurses in Estonia. Thirty-eight (n=38) answers came in first notification and 11 responses were received after the call reminder.

The mean age of respondents was 46 years and the average working experience was 20 years. Home nurses assessed their computer operating skills to be dominantly good 45% (n=22) and “rather good” 49% (n=24), nobody rated her skills are “weak” or “rather weak”. 6% (n=3) of respondents were not able to say.

Nurses feelings about managing ulcers were broken down as follows: 22% (n=11) felt themselves as “confident”, 67% (n=33) “rather confident”, 4% (n=2) “rather not confident” and 6% (3) “can not say”. For the question “Do you follow any guidelines managing ulcers?”, one person (2%, n=1) firmly stated that guidelines are not used in the ulcer management processes. About 40% (n=19) of respondents answered “yes”, 29% (n=14) “yes sometimes”, and 29% (n=14) “rather rarely”. If respondent answers “yes” or

“yes sometimes”, it was requested to clarify which guidelines is/are used. In total of 67% (n=33) of the respondents stated that they use guidelines “sometimes” or “every time” and 7% (n=6) out of those were able to specify which guideline they use – pressure ulcer guideline [39] was brought out two times and chronic venous ulcer guideline [38] was mentioned four times. In the remaining cases, the box was left empty or the word "treatment guide" was mentioned, which does not give any relevant information.

The importance of DFU documentation at every visit was found to be very important for 38% (n=19) of respondents, “extremely important” for 14% (n=7), “somewhat important” for 30% (n=15), and “less important” for 16% (n=8) (Figure 2).

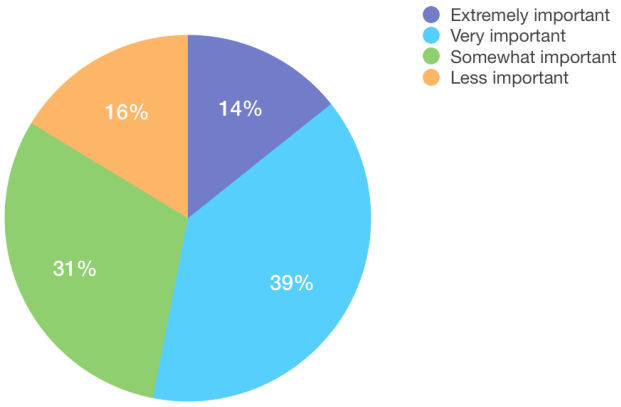

Figure 2. The importance of DFU documentation in every visit.

During the home visits, DFUs are mostly documented on paper-based wound cards (53%, n=26), free text is used by 12% (n=6) and notes are made in a notebook and are later inserted into digital information system by 28% (n=14) of the respondents.

More than half of the respondents (56%, n=27) evaluated the ulcer documentation as “rather time consuming”, whereas 44% (n=21) found that it is rather not. Forty one (41) percent (n=20) of the respondents stated that documentation takes “about 5-10 minutes” to carry out, 22% (n=11) “up to five minutes”, 20% (n=10) “10-15 minutes”, and 16% (n=8) of the respondents stated that documentation takes them “more than 15 minutes” (Figure 3).

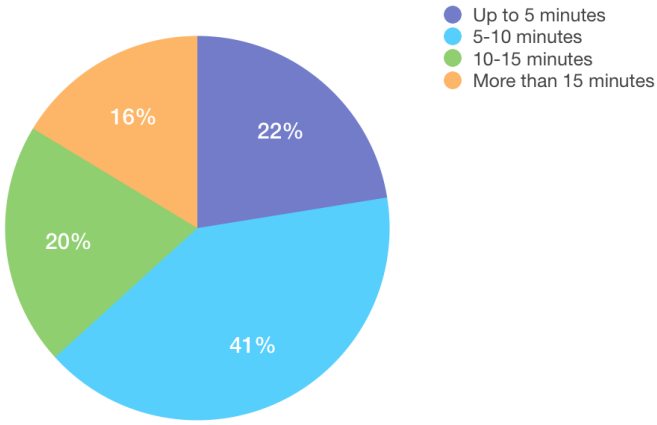

Figure 3. Average dime spent on documentation.

Thirty five (35) percent (n=17) of participants found the describing of ulcer appearance "rather easy", "rather difficult" was chosen 33% (n=15), it is difficult "yes" 10% (n=5) and "not" was chosen 18% (n=9). Four (4) percent (n=2) chose "not sure". A quarter of respondents (25%, n=12) are using ruler on every visit to measure the ulcer surface, the other three quarters (75%, n=37) use ruler occasionally.

Respondents expressed the need for digital instruments in everyday practice as 32% (n=16) stated "yes" and 35% (n=17) "rather yes" to the corresponding question. The answer "no" was chosen by 10% (n=5), "rather no" by 8% (n=4), and "do not know" by 15% (n=7). Twenty-seven (27) percent (n=13) of respondents stated that they use personal telephone for documentation purposes ("yes"), 8% (n=4) "rather yes", 12% (n=6) "rather not" and 47% (n=23) stated that they are not using telephones for documentation purposes. Six (6) percent (n=3) of respondents "could not say".

Four (4) percent (n=2) of respondents have felt that remote consultation based on photography could have been used instead of home visits, 14% (n=7) "rather could have", 22% (n=11) "rather not" and 57% (n=28) "not", "not sure" 2% (n=1).

All the respondents (100%, n=49) brought out that there is a need to ask second opinion or to have consultation with other specialists in their everyday work. It was pointed out that advice is asked from another nurse, e.g. from wound dressing room nurse or primary care nurse (n=14), surgeon (n=22), vascular surgeon (n=4), dermatologist (n=4), family doctor

(n=10) and/or orthopaedic (n=1) (Figure 4). Some respondents gave an undefined answer, such as “of course”, “sometimes” and “yes”. The cooperation between specialists was stated to be “good” by 51% (n=25), “very good” by 14% (n=6), and insufficient by 36% (n=18) of the respondents. The biggest areas of concern were the accessibility to specialized doctor, family doctor and surgeon.

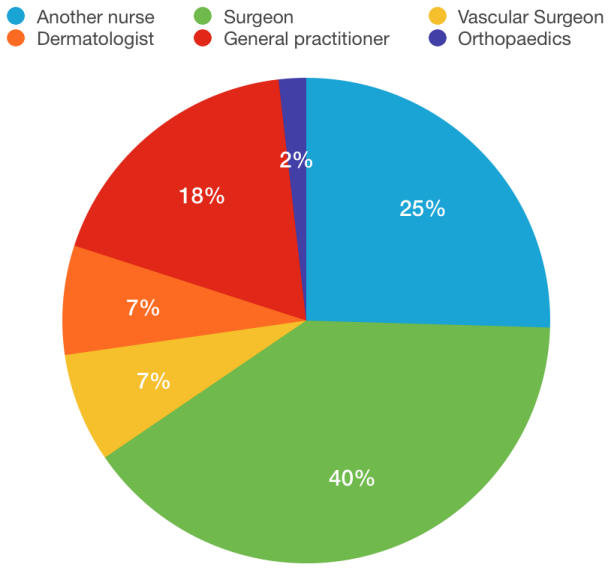

Figure 4. Specialists with whom home nurses have consultations with.

This chapter gave an overview of the general responses received from interviews and questionnaires. In the next chapter, the author contextualizes the results and discusses the areas of concern in more detail.

6. Discussion and recommendations

The current chapter clarifies the study findings basing on thematic categories together with discussion about shortcomings in current documentation process. In addition, recommendations of improvement opportunities are given and furthermore, suggestions for further studies are provided.

6.1 Patient pathway of DFU management

Basing on interviews and literature research an initial DFU patient pathway was mapped on the basis of Estonian healthcare system.

IDF diabetic foot recommendations 2017 are suggesting multidisciplinary team approach in the management of DFUs as it is found to reduce the amputation incidence rate by up to 85% [22]. Multidisciplinary team involves several healthcare specialists e.g. endocrinologist (optimal blood sugar control), surgeons, nurses (efficient local wound care), microbiologist (managing infections in ulcers), orthopaedics (pressure offloading) and vascular surgeon (ensuring the blood flow in vessels) [53]. Multidisciplinary approach is especially important in the most extreme cases, where vascular surgery is needed to re-establish the blood circulation, also when there is a need to change the oral or insulin injection treatment by endocrinologist, quit smoking, counselled on nutrition, and/or supported psychologically [3]. Moreover, to treat DFUs effectively, evidence-based guidance and standardized treatment pathways are essential [25], [43], [50].

MDT approach is provided in Estonia only in one hospital – East-Tallinn Hospital. A special team of specialists has been created to treat the most difficult cases. To provide the highest quality of care to patients who are living in remote areas and beyond from major centres, adapting information and communications technology is considered to be a relevant and effective way, [19]. To enable remote consultations accurate documentation

is crucial, allowing documented dialog between patient and healthcare professional [Bowling et al. 2013]. Providing secure way of communication for nurses helps to keep their self-confidence.

In Estonia, who will treat the DFU patient is depending how good training and skills local physicians have [9]. Following Figure 5. demonstrates how DFU patient pathway can vary between healthcare professionals in Estonia.

Mostly, DFU patients are turning first into GP appointment, where GP decides whether is she able to treat the patient by herself or the patient should be referred into specialist care. Referring to specialist can be done in general waiting list or in the case when intervention is needed urgently, patient is referred to emergency department. In both cases further diagnostics is needed.

At the same time patient can be hospitalized by ambulance directly to the emergency department, where further diagnostics and treatment decisions are made. When patient do not need hospitalization, surgeon refers patient into home nursing care or ulcer care is provided in wound dressing rooms ambulatory. It is common practice that a patient with DFU may need hospitalization and further treatment is organized under inpatient care.

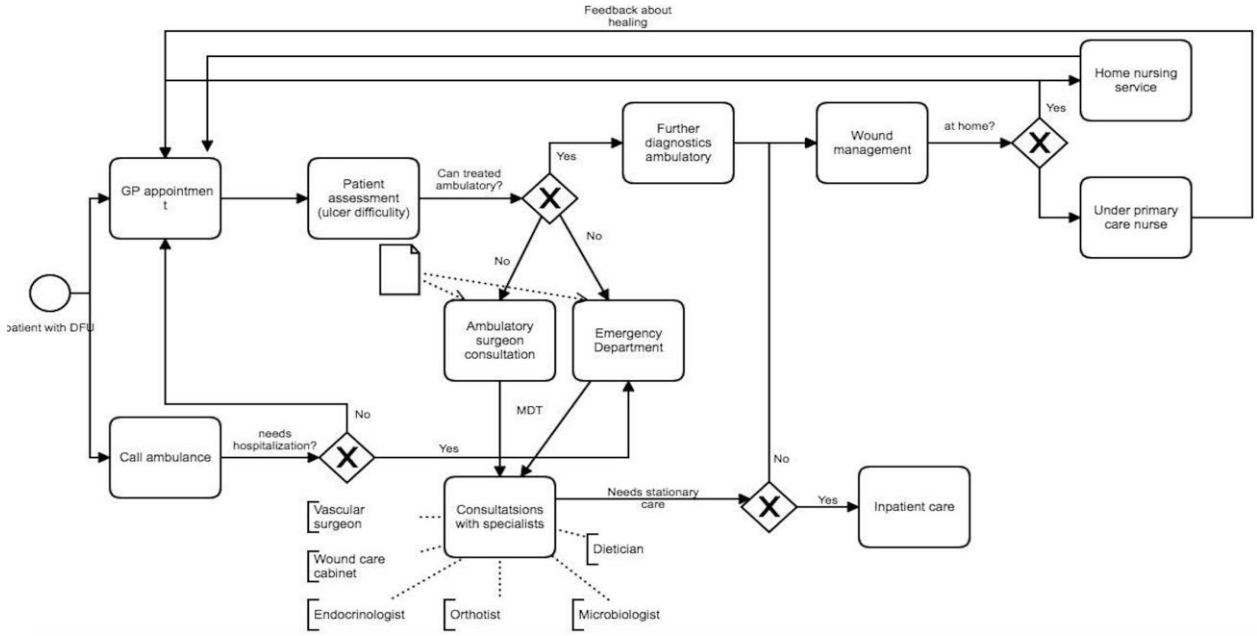

Figure 5. Patient pathway with DFU management in Estonian healthcare system. Composed by the author.

The patient pathway shows the complex nature of DFU management in Estonia, which also emphasizes the need for unified documentation of DFUs since there are many stakeholders involved in the management process. Good quality documentation enables effective collaboration between healthcare professionals.

6.2 Format of documentation and interoperability

The quality of documentation process is unequal across Estonia. Some organizations are using novel hospital information systems which are adjusted for home nurses and which enable tablet-based program view. At the same time, there are organizations that are documenting by making notes into the notebook. In most cases, the ulcers are documented on paper-based wound cards. One worrying fact that the study revealed in relation to how the documentation was organized within an organization was that some home nurses use Microsoft Word (MS Word) as a documentation and record-keeping tool.

Security

The fact that MS Word is used as a documentation and record-keeping tool has several flaws, one of them is that it is considered as insecure way of storing, processing and exchanging the data. Exchanging sensitive information via emails can be acceptable only when the sensitive content is encrypted [11], but it is not known how often the content encryption is used. Furthermore, MS Word does not support online accessibility of data (e.g. previous history, referrals receivement) to different stakeholders. All provided activities and data related to patient and treatment are visible only for that specific nurse that prepared the document. Moreover, the feedback from lead nurse is possible only once he or she has received the MS Word file. This can lead to delayed diagnosis and treatment, which significantly reduces the quality of care and outcomes.

According to the law, employer is responsible for ensuring the continuous training for personnel about the data protection regarding personal data processing under his or her authority [34]. This regulation ensures that personnel is aware and behaves accordingly for the purpose of ensuring the security of personal data both in the workplace and outside it. In this context, this means that home nurses are expected to be aware and follow the principles of data protection when carrying out home visits and/or documentation processes in- or outside their workplace.

Interoperability

Wound cards, both paper-based and digital, are found to be more effective and appropriate way of documentation than using free text. Tubaishat et al. (2015) found that using wound card templates helps to document elements of ulcer appearance in a more structured way, thereby increasing the quality of documentation. On the other hand, the shortcoming of paper-based card is its non-interoperability with electronic medical records, making the data exchange between different healthcare professionals nearly impossible. The only solution in this case is to duplicate the data, inserting it manually to the electronic information system, which, however, takes a lot of time and is therefore cumbersome. The usage of paper-based cards and the consequential lack of interoperability could lead to delayed diagnosis and worse quality of treatment. The latter goes also with other free text

and/or non-electronic ways of documentation, where one of the causes of delayed diagnosis and worse quality of treatment is inadequate documentation.

The number of nurses working in one organization varies from 2 to 5, with the maximum of 15 nurses in one organization. The study revealed that all nurses do not have access to online information systems and to EHIS. The access limitation for employees is mostly due to expensive management of the system. It was explained that in some cases, lead nurse has to transmit all nursing records, that were provided during one month, to the EHIS. The number of epicrisis that must be inserted to EHIS can reach the amount of 30, which makes the whole process time-consuming and bothersome for the lead nurse.

Using digitized templates in documentation creates an opportunity for data to be both machine-readable and human-readable at the same time, which in turn improves the comprehensibility of the data and enables to carry out statistical data analysis.

As it reveals, the ways how documentation is organized is varying between organizations. Some organisations are using contemporary technical solutions and at the same time, some organisations are using paper-based documents, which means extra work for home nurses. Paper-based documents are presenting a plenty of limitations in data exchange and accessibility, which in turn can lead to decreased documentation quality.

Time-use

According to Estonian home nurses action plan (2015), approximate time spent on documentation is estimated to be 10-15 minutes. Current study revealed a controversy related to time spent on DFU documentation – although home nurses found the documentation process rather time consuming, the majority of them also stated that the process takes them up to ten minutes.

Contradictory information can be interpreted in many ways – for some nurses, the documentation process can be time consuming due to information duplication (e.g. paper-based cards are used first, and later the data is inserted to electronic information system), or because of using non-systematized free text insertion which is also time-consuming.

For some home nurses, the documentation process was said to be rather not time-consuming. There may be several reasons for that, both positive and negative. On the positive side, this may be because home nurses are equipped with convenient digitized tools and templates that eliminate the need to duplicate the data and to write a subjective, free text. For example, one hospital had implemented a digital wound card into their hospital information system, where home nurses only need to insert numbers or choose the right description from the predetermined list. On the negative side, the documentation could be considered as not time-consuming because of the lack of knowledge about the importance of documentation. This, in turn, may lead to a deterioration in the quality of documentation and consequently, to the worsening of treatment outcomes [36].

To conclude, documentation process can be influenced by many factors. For example, time-use can be affected by the method used for documentation. Using non-systematized free text or paper-based wound cards are more time consuming as the data often must be duplicated into EMR. On the other hand, using convenient digitized tools which are facilitating the documentation process allow home nurses to spend less time on documentation. There are different ways how documentation processes are organized in different organisations, some of which are more time-efficient, and some which are not.

6.3 The need for training

Nurses are playing a key role in delivering DFU care [1], good-quality documentation is vital for delivering the best quality of care. They have to make frequent treatment decisions independently, and misled by the diagnosis is unacceptable.

The mean age of home nurses in the study was 46 years, which is the same as identified in the United Kingdom in 2013 [4]. The mean working experience of respondents was 20 years, for comparison, in UK the number was 19 [4]. Based on previous information, Estonian and UK home nurses are similar in the basis on working experience and age. The correlation between working experience and importance of documentation was not found.

The attitudes towards the importance of documentation fall into two. Slightly more than half of home nurses are acknowledging documentation rather important, and the other half does not. In current study, home nurses education was not specified, but Petkovšek-Gregorin & Skela-Savič (2015) found the significant positive correlation between education and documentation. Home nurses with higher education were of the opinion that good documentation quality increases the importance and visibility of nursing, and enables better communication with other healthcare specialists. The connection between accurate documentation and enhanced communication was also pointed out in study conducted by Bowling et al. (2013).

Since nurses are not acknowledging the relevance of documentation, continuous training of nurses' understandings of the importance of documentation is crucial, moreover as it is also a legal evidence of the nursing processes in the event of incidents.

6.4 Digital solutions currently used

LIISA is the most widely used information system among home nurses surveyed. The biggest flaw of LIISA is that it enables only free text insertion, whereas the image storage function and digital wound card format is not available. Nurses that use LIISA are mostly using paper-based wound cards first, and later, conclusions are made into information systems in free text format, which means duplicating their documentation process.

One hospital has developed its own software, from where, all home nurses have equal access to hospital's information system. Hospital has created an opportunity to access the information system also from a tablet, therefore making it possible to insert the documentation data directly to system during the patient home visit.

Another organization uses information system that is developed by the centre itself. All home nurses have equal access to information system and moreover, they also have the opportunity to log into the system from home. Recently, the information system was updated in order to facilitate home nurses wound documentation process: now, home

nurses have the opportunity to use digital wound card template. Nevertheless, the digital wound card template is not compatible with Estonian Health Information System, therefore its transfer to EHIS is not possible. This goes with all digital wound cards used in Estonia as they are all specific hospital based and locally regulated and used.

Thus it can be concluded that there is a need for widely applicable solution for DFU documentation, which is interoperable with EHIS standards, enable convenient systematized template approach and at the same time, allow the interaction with other healthcare professionals.

6.5 Ulcer assessment and use of guidelines

Three quarters of nurses surveyed are not using ruler in their everyday practice. This is an indicator of decreased quality in documentation as it can be assumed that if nurses are not using a ruler, DFU measurements are made on a visual observation. This is in turn considered as inaccurate and subjective way of ulcer assessment, reducing the relevance of the assessment results.

Measurements are essential part in monitoring the course of ulcer healing [5] and are recommended to be performed in every home nurse visit, and certainly not less often than once a week [39]. Since nurses do not have the habit to objectively measure the DFU, but are showing the interest in adapting helpful tools in their everyday practice, one of the possible solutions could be the implementation of a software tool, which enables to automatically assess the ulcer surface area, tissue type, depth and temperature. Such solution that automatically and unambiguously measures the ulcer area would help to avoid possible contradictions and biases that could occur in the measurement and moreover, evaluation process would also be more time-efficient. Integrating information technologies into home nurses daily work routine provides standardized care and thereby improves the quality of care and treatment outcomes [19].

Guidelines usage

Guidelines are used just about in 68% of home nurses while treating ulcers, but only less than ten percent of home nurses were able to mention which ulcer guidelines they are following in their everyday practice. Nurses stated that they use either [38] or [39], or both. Based on this information, it can be assumed that nurses are basing on suggestions in aforementioned guidelines. Notable is that neither of these guidelines are directly addressed to DFU management, but these can be (and are) used because of the fact that the treatment of these conditions are similar, and as there is no specific guideline on DFU management. In addition, there is no guidance that would describe how to prevent new ulceration once the DFU has healed. The study reveals that general information for the patient and healthcare personnel about the DFU management in Estonian is lacking. Therefore, DFU guidance on how to prevent and postpone ulcer development is needed in order to provide the best quality of care for the patients who are suffering from DFUs, or who are at the risk of developing DFU in Estonia.

Mentioned CVU [38] guideline is providing suggestions on assessment and documentation of the condition, PU [39] guideline does not specify the information about documentation. The problem is, as every organization has its own wound card template, it is not known whether the cards used in organizations are based on those suggestions and if yes, to what extent. Either way, the wound cards used in different organizations in Estonia are not in common format and therefore, not interoperable. Developing national minimum requirements for ulcer assessment could improve the provided DFU care, as confirmed by the study conducted by Coleman et al. (2017). Using national standards help to avoid situations where organizational recommendations are aged and not evidence-based. From interview revealed from one interviewer that the organization official paper-based wound card is ancient and does not meet the today's recommendations, but it is still in use.

Currently there are no guidance or pathways in Estonia about how to manage DFUs. The need for such guidelines was already emphasized three years ago in project conducted by eMedic [9]. Due to lack of specific guidance, nurses have to rely on suggestions from other two ulcer-related guidelines developed in Estonia (see chapter 2.2). Since CVU [38] guideline is complete and well accepted, one of the possible options is to develop a supplementary chapter for DFU prevention and management, as management in the end

stage of ulceration is basing on the same principles as chronic venous ulcers. Pokorná et al. (2015) highlights the fact that lack of unified recommendations e.g. guidelines is the reason why nurses are not using basic tools evaluating chronic wounds.

Both pressure ulcer guideline and chronic venous guideline are strongly suggesting to assess ulcer measurements. At first, it seemed that nurses are using the guidelines in their daily work, but the analysis of the questionnaires revealed that only small part of respondents (7%) were able to name the above-mentioned guidelines. This controversial situation puts doubt on the use of guidelines and the high rates of guideline usage that was reported in the questionnaires. It can be assumed that the results are biased due to respondents lack of knowledge that the guidelines are launched in Estonia, or because respondents did not understand the question.

Feedback from survey shows nurses self-confidence managing ulcers, and also describing ulcers rather easy task, while latest home nurses documentation audit [13] showed big gap in documentation quality, where half of nursing wound documentation epicrisis were insufficient. One nurse expressed her concern about documentation quality, since she hasn't had surgical background, she struggles often with wound descriptions. She noted "I try to describe the ulcer as good as I can, but no feedback is coming, if those descriptions were right or wrong". Kollveit et al. (2016) found positive outcome by studying healthcare professionals experience by using web-based ulcer record. The results showed that such telemedicine intervention improved the documentation quality and by using the record, nurses gained advanced ulcer assessment knowledge. This shows the impact of multidisciplinary communication on the quality and thus, the relevance of communication is discussed in the following sub-chapter.

6.6 Communication between clinicians for multidisciplinary care

The study shows that nurses are in the need of having consultations with several specialists while treating ulcers. All the respondents (100%) found that there is a need for asking second opinion or have a consultation with college. The most highlighted were getting an opinion from another nurse e.g. from wound dressing room, primary care or nurse colleague from home nursing field. Surgeons and primary care doctors' assistance

were pointed out secondarily. During the interviews it was revealed that nurses have developed over time certain contacts from whom to ask second opinion e.g. they are sending pictures via emails to certain surgeon or wound dressing room nurse. It shows the need for structured specialist-to-specialist consultation, the need of such service was emphasized also in eMedic 2014 project [9]. Final results of eMedic 2014 project showed that the interest of video consultation with specialists is vital and the remote consultation basing on video was precise enough to give further suggestions about treatment.

In order to improve cooperation between primary and specialized care, in 2013, Estonian family physicians were given the opportunity to have e-consultations through health information system with specialists. Aiming to provide timely and high quality medical advice for patients [12]. E-consultation improves the quality of information transfer from a family doctor to a specialist physician and also saves time for patients, as it is not always necessary to turn to a specialist doctor himself - the family physician will consult the specialist electronically and all treatment is coordinated by the family physician. However, if during an e-consultation, the specialist decides that the patient needs to go under specialist care or have further diagnostics, there is an opportunity to arrange the appointment.

Since e-consultation service is well adapted, but used today only for doctor-to-doctor consultation in Estonia, one possibility could be to extended the service with nurse-to-doctor and/or nurse-to-nurse e-consultation, providing thereby secure and easy way of communication. Today, home nurses only have the opportunity to use informal consultations via telephone or email in order to communicate with each other. Creating such e-consultation service for home nurses would facilitate more streamlined communication and thus, help to improve the documentation quality. These expected results that would follow the implementation of nurse-to-doctor e-consultation service were evidenced in the study carried out by Kollveit et al. (2016).

Communication between healthcare professionals is integral part of the care process. Nurses play a key role in delivering DFU care and they often must make decisions independently [1]. Therefore, it is vital to provide them with appropriate communication support solution.

6.7 The need for digitized tools

Nurses are assessing their computer operating skills dominantly good, nobody of respondents rated their skills weak. Which shows nurses self-confidence in using computers, creating the premise to adapt technology into everyday practice. One the other hand, one hospital had implemented digital wound card into hospital information system to facilitate the workflow. With these wound cards, home nurses only need to insert numbers or choose the right description from the predetermined list. Nevertheless, many home nurses still do not use this tool, indicating that they have too little time and they do not consider DFU measurements documentation to be important enough, justifying it in a way that healing process can take even years. Moreover, one home nurse stated that she prefers to document all the ulcers that she has treated during the day at the end of the working day, and doing it only based on memory. The author argues that cannot be considered as reliable way of documentation.

Nurses are showing the need for digitized tool in their everyday practice. Three quarters of respondents showed their interest of automatic solution which would be able to calculate automatically the surface area and depth of the ulcer. Furthermore, Bowling et al. (2013) found that using automatized mobile-based tools in ulcer assessment help to avoid potential bias that could occur when interpreting the ulcer documentations. Their study confirms the evidence that ulcer imaging has positive effect on ulcer healing, improving therefore standards and outcomes. Since nurses are not actively using rulers in their everyday practice and the documentation process is rather time consuming, integrating mobile-based technology could be one of the solutions, which would automatically assess the ulcer area and ulcer bed. When integratable to the EMR, it would facilitate home nurses work and reduce the workload in documentation process.

Regarding personal telephone usage in documentation process, less than a half (41%) of the nurses stated that they use telephones, whereas the majority (59%) said that telephone is not used. These results can be biased due to nurses awareness of the legal requirements for the personal data usage in patient care, and as they think that using personal phone for photographing is not allowed, they might have chosen to answer no to that question. But in fact, the law in Estonia which stipulates the storage of medical images does not prohibit

making photographs with personal telephone. It defines the types of medical images, the IT requirements for those and the conditions and procedures that must be taken for making them available. Subjectively, there seems to be a gap in this regulation as it states that the pictures taken for medical purposes must be promptly uploaded to Estonian health information system, but, it is also stated that it only applies to cases where the used technology meet certain standards (DICOM, HL7). Therefore, if tools are used that do not meet the standards, there is no need to comply with this regulation and the uploading photos is not mandatory. This raises another question: to what extent healthcare professionals are even able to identify that the tools they are using are compliant with the law? It could be concluded that the documentation requirements and standards for storing of images should have more clear guidelines, yet the description of the compliant equipment, as well as uploading and storing processes should be more detailed. For example, Northamptonshire Healthcare has developed a detailed guideline for wound photography [30] that specifies the appropriate equipment which should be used to make the image, and which techniques should be used to ensure the standardization, which is considered as the key to high-quality wound documentation.

The study shows the willingness of nurses and the desire to apply digital solutions into their everyday work with the aim to facilitate their daily working processes. The positive effects of using digital solutions are proven by research, but it should be kept in mind that when implementing new technological solutions, adopting them can be inevitably a challenge.

6.8 Recommendations for raising documentation quality and need for further research

Recommendations

To sum up, recommendations for the most critical problems related to DFU documentation revealed in this study can be listed as follows:

- **Develop a standardized digital ulcer documentation template that is compatible with EHIS.**

Although one step is taken and some organisations have already developed digital ulcer documentation templates, they are still only locally used and not compatible with EHIS. Good documentation quality assumes storing and sharing the data with other healthcare specialists. But, as mentioned above, currently all systems are locally used and there is no central data storing location. To address the latter issue, one possibility is to use EHIS as the central database for ulcer documentation files.

However, using EHIS or any other central data repository requires standardized data format. Using standardized documentation templates in ulcer care has a positive impact on documentation quality since this, compared to free-text insertion, enables standardized and systematized approach. Moreover, standardized data can be shared with other healthcare specialists, which is a basis of better communication and cooperation, leading to improved patient care and outcomes.

- **Develop national minimum data set for the ulcer documentation template.**

When developing standardized digital ulcer documentation template, the minimum required set of data should also be determined. Since the implementation of national minimum data set has shown positive effect on documentation quality and time use, the development of the minimum requirements should be taken into consideration. In addition to documentation quality aspect, using standardized templates with minimum data set allows information processing to be both machine-readable and human-readable, which is, among other things, creating the opportunity to gather statistical information.

Having standardized data format and national minimum data set for the ulcer documentation allows, if wanted, organizations to develop their own documentation template that corresponds to the prescribed standards.

- **Develop an assessment tool for ulcer evaluation**

The study revealed that home nurses are willing to use digital assessment tools in their everyday practice. The need for such tool is even more relevant as it was found that the use of a ruler in ulcer care assessment is rather moderate. This fact is a matter of concern as objective measurements are an important part of ulcer assessment, giving the relevant

information about the condition of the ulcer and about the course of healing. To address this issue, automated planimetry can be one convenient and effective solution.

Internationally, there are several mobile-based applications already in use which have shown positive impact on documentation quality, mostly due to enabling automated assessment on ulcer area, tissue type, temperature and depth. Using such technology helps to avoid possible contradictions and biases that could occur in the evaluation process by making ulcer assessment objective. Moreover, implementation of this kind of solution would make the assessment processes less time-consuming for the home nurses.

- **Consider the extension of e-consultation service for home nurses.**

Today, e-consultation service is well adapted among doctors in Estonia. In this regard, the opportunity to extended the service for home nurses should be considered. The study confirms the fact that home nurses have a need for consultations with other healthcare specialists to improve their cooperation in care processes and therefore, provide better care for the patients. One possibility is to extend the current service that is provided for doctors by adding nurse-to-nurse and/or nurse-to-doctor consultations.

- **Develop explicit guidelines on how to use photography as a documentation tool.**

It has been found that nurses do not use basic ulcer assessment tools because of the lack of guidelines [36]. As photography is frequently used documentation tool elsewhere and its positive impact in ulcer care documentation has been confirmed, efforts should be made in Estonia to contribute and encourage the implementation and use of photography by developing stricter guides. More, using convenient digitized assessment tools like photography facilitate the documentation process, thus allowing home nurses to spend less time on documentation.

Current law [48] stipulates the form, standards and IT requirements for medical pictures. However, this law is not comprehensive as for the healthcare practitioners, there are no clear instructions on how to use photography for the documentation purposes. Therefore, there is a need for detailed descriptions on how and in what conditions to use photography in ulcer care and how to observe it in a lawful way.

- **Develop DFU prevention and management guideline**.

There are currently no specific guidelines on how to manage DFUs in Estonia. Guidelines or clinical pathways are needed to guide healthcare professionals in the treatment and documentation processes, and they should be daily used tools for healthcare professionals that ensure the evidence-based treatment. The need for guideline is even more relevant when taking into account the evidence that the literature about DFU care is insufficient in Estonian language.

- **Continuous training for nurses**

In current study nurses attitudes towards documentation importance fell into two, where half of the respondents are not acknowledging the importance of documentation.

Nurses are playing key role in delivering DFU care and therefore, nurses good knowledge and ability to carry out relevant documentation is crucial. Good quality documentation helps to track the course of the healing and notice complications in early stages, and moreover, when in standardized digital form, the documentation enhances the communication and cooperation between healthcare professionals as the data is exchangeable. It is important to emphasize that documentation is legally regulated and the data entries are official documents, therefore they protect healthcare professional in cases of complaints and judgements.

Therefore, consistent training is needed for home nurses to ensure their knowledge and awareness of the importance of documentation, as well as theoretical and practical aspects of good quality documentation.

Further research

The aim of the thesis was to evaluate the need for improvement of diabetic foot ulcer documentation in Estonia in order to enhance the quality of DFU documentation, improve multidisciplinary approach to DFU treatment, and to offer the best quality of care to patients. Some of the further research areas that emerged during the study are provided below.

As in the course of the study, it turned out that one organization has introduced a novel tablet-based information system that home nurses can carry with and which they can use for data entry during the patient visits. Therefore, further studies are needed to find out how convenient and reasonable it would be to use tablet-based information system. In addition, nurses satisfaction and areas of concern should also be studied. If the study shows positive results, this solution could be considered for deployment to a wider range of home nurses in Estonia.

Since nurses are showing the need for digital tools, there is a need to ascertain, what are the features and technical capabilities that should a mobile-based tool include in order to be convenient for the end user, and at the same time to be interoperable with Estonian healthcare system.

In current thesis, the correlation between education and documentation quality was not studied. Since Petkovšek-Gregorin & Skela-Savič (2015) found the positive correlation between those two aspects, further studies are needed to investigate the need for home nurses continuous training and education planning in Estonia. The home nurses' awareness and knowledge is the basis for conducting a high-quality documentation and for providing the best quality of care.

Conclusion

Current thesis aimed to evaluate the need for improvement opportunities of diabetic foot ulcer documentation in Estonia. Reaching the study aim creates the prerequisite for improving the quality of DFU documentation, enhancing multidisciplinary team approach in DFU management and thereby providing the best quality of care for the patients.

The study shows that the quality of documentation is not uniform in Estonia, and there are several improvement opportunities that can be performed in order to increase the quality of DFU care processes and documentation. Based on the information gathered from the interviews, questionnaires and literature review, seven recommendations have been brought out through which the documentation quality could be improved.

As outlined below, positive factors found in this study that lead to improved quality of DFU documentation are:

- Digital templates compatible with EHIS;
- Standardized digital wound card;
- Minimum data set;
- Photography as assessment tool;
- Accurate measurements of ulcers;
- Home nurses' education and awareness;
- MDT approach;
- DFU guideline.

This research could be useful for home nursing service providers as they could improve the organization's work processes and take notice of the issues related to documentation and its quality. Second, current study could be the most beneficial to the EHIF as it brings out the severity of the problem. EHIF could and should start discussions to resolve the identified areas of concern in order to, among others, reduce healthcare costs in the future. Third, entrepreneurs will benefit from this study since the study highlights some solutions

that could be developed and which would benefit the developers from the entrepreneurial perspective, and would be beneficial for the whole healthcare system.

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APPENDIX 1: Interview guide in English

1. Introduction

1.1 Introducing the aim of the thesis and the interviewer

1.2 Asking demographic information

Topic 1 Background and context

- How documentation is organized
- What is the situation in wound care, what is difficult to perform
- Are diabetic foot ulcers a problem? Are they well managed?

Topic 2 Opportunities and barriers

- How important is for you documentation quality?
- Do you understand nurses recordings?
- What opportunities do you see, when working with this patient group, which has suffered diabetic foot ulcers?
- What barriers do you see when working with this patient group?
- What kind of support would you need in this work?
- What kind of collaboration would be needed between primary care physicians, district nurses and perhaps surgeons?

Topic 3 Digitalized channels used in everyday practice

- Does your company use telemedicine interventions? Which ones?
- Do you see the need for using more telemedicine interventions in chronic wound care?
- How often nurses are using photography as a documentation tool?

Ending

Asking any extra questions or comments that the professional would like to share about the topic. Asking permission for further contact if there are any extra questions analyzing the results.

Thanking the healthcare professional for the participation.

APPENDIX 2: Interview guide in Estonian

1. Sissejuhatus

1.1. Uurimistöö eesmärgi ning intervjuu läbiviija tutvusts
1.2 Intervjueeritava taustinfo kogumine

Teema 1 Dokumenteerimise taustinfo

- Kuidas on dokumenteerimine korraldatud antud organisatsioonis
- Mis on üleüldine haavaravi olukord, mida on keeruline teostada?
- Kas diabeetilised jalahaavandid on probleemiks? On nad hästi jälgitud?

Teema 2 Võimalused ning takistused

- Kui oluliseks peate dokumenteerimise kvaliteeti?
- Kas õdede haigusloo sissekanded on arusaadavad?
- Milliseid võimalusi näete inimestel, kellel on diabeetilne jalahaavand?
- Millist toetust te vajaksite oma igapäevatöös? Koostöös ka teiste spetsialistidega?

Teema 3 Telemeditsiini lahendused igapäevatöös

- Kas Teie ettevõttes on kasutusel telemeditsiinilahendusi?
- Millised suhtluskanalid on informatsiooni vahetuseks kasutusel?
- Kas näeksite vajadust senisest enam kasutada telemeditsiinilahendusi igapäevatöös?
- Kui sageli õed kasutavad fotografeerimist dokumenteerimise tööriistana?

Lõpetuseks

Täpsustavad küsimused, kommentaarid, mida Loa küsimine korduvaks ühenduse võtmiseks, juhul kui andmete analüüsimise käigus tekivad lisaküsimused.

APPENDIX 3: Web-based questionnaire in Estonian

Hea kolleeg.

Minu nimi on Marelle Maiste. Olen Tallinna Tehnika Ülikooli tervishoiutehnoloogia magistrant ning igapäevaselt töötan pereõena. Teen hetkel magistritööd diabeetilise jalahaavandi dokumenteerimise parandamise võimalustest ning sihtgrupiks on just koduõed. Eesmärgiks välja selgitada, kas koduõdedel on vajadust oma igapäeva töösse digitaalset haavaravipäevikut ning sellest lähtuvalt vajaksin Teie abi lihtsa ning anonüümse küsimustiku täitmisel. Küsimustele vastamine võtab aega umbes 5-8 minutit.

1. Vanus:

2. Tööstaaž aastates:

3. Teeninduspiirkond:
- Harjumaa
- Tartumaa
- Ida-Virumaa

Muu maakond, täpsustage

4. Kuidas hindade enda arvuti kasutusoskust
- Hea
- Pigem hea
- Pigem halb
- Halb
- Ei oska öelda

5. Kuidas toimub kroonilise haavandi seisukorra hindamine ja dokumenteerimine visiidi käigus?
- Paberkandjal haavaravilehele
- Paberkandjal vaba tekstina koduõenduslukku
- Teen märkmeid ning hiljem kannan tulemused arvutiprogrammi
- Enamasti ma ei dokumenteeri haavandi paranemist dünaamikas

6. Kas juhindud kroonilise haavandi käsitlemisel ravijuhenditest?
- Jah alati
- Jah mõnikord
- Pigem harva
- Ei

7. Kui vastasid jah, siis millistest?

8. Kui oluliseks peate kroonilise jalahaavandi dokumenteerimist igal visiidil?
- Ülimalt oluline
- Väga oluline
- Mõnevõrra oluline
- Mitte eriti oluline

9. Kas haavandi dokumenteerimine on ajamahukas?
- Jah
- Ei

10. Kesmiselt dokumenteerimisele kuluv aeg
- kuni 5 minutit
- 5-10 minutit
- 10-15 minutit
- Rohkem kui 15 minutit

11. Kas haavandi kirjeldamine on keeruline?
- Jah
- Pigem jah
- Pigem ei
- Ei
- Ei oska öelda

12. Kas haavandi ravimisel tunnete end enesekindlalt?
- Jah
- Pigem jah
- Pigem ei
- Ei
- Ei oska öelda

13. Kas kasutate haavade dokumenteerimiseks sageli oma isiklikku telefoni?
- Jah
- Pigem jah
- Pigem ei
- Ei
- Ei oska öelda

14. Kui tihti kasutatate haavandi dokumenteerimiseks joonlauda ?
- Igal visiidil
- Vahel
- Mitte kunagi

15. Kas igapäeva praktikas tuleb ette vajadust konsulteerida teise erialaspetsialistiga, kui jah siis kellega? (nt teine õde, perearst, kirurg, dermatoloog)

16. Kuidas hindate koostööd erinevate spetsialistide vahel (näiteks koduõde-perearst/kirurg)
- Väga hea
- Hea
- Halb
- Väga halb

Palun kirjeldage, milliseid probleeme esineb koostöös?

17. Kas olete vahel kogenud, et koduvisiidi oleks saanud ära jätta kui patsient oleks edastanud Teile foto haavast ning Te oleksite saanud anda edasised korraldused telefoni teel ?

- Jah
- Pigem jah
- Pigem ei
- Ei
- Ei oska öelda

18. Kas näete vajadust oma igapäeva töös digitaalse tööriista järgi, mis mõõdaks automaatselt haava pindala ning hindaks haava põhja/sügavust?

- Jah
- Pigem jah
- Pigem ei
- Ei
- Ei oska öelda

19. Muud kommentaarid, ettepanekud

APPENDIX 4: Web-based questionnaire in Russian

Дорогой коллега!

Меня зовут Мареллэ Майсте. Я магистрант медицинской технологии Таллинского университета и повседневно работаю медсестрой. В настоящее время пишу магистерскую диссертацию о возможности улучшения документирования диабетических язв ноги целевой группой которой являются медсестры. Цель этой работы выяснить, нужен ли медсестре цифровой раневой журнал. Прошу вас заполнить анонимную анкету, это займёт 5-8 минут.

1. Возраст:
2. Стаж работы (сколько лет):
3. Регион обслуживания:
   - Харьюский уезд
   - Тартуский уезд
   - Ида-Вируский уезд

   Иной уезд, уточните
4. Как вы владеете компьютером

   хорошо
   - довольно хорошо
   - довольно плохо
   - плохо
   - не могу сказать
5. Как оценивается и документируется состояние хронической язвы в ходе визита?
   - письменно на раневом листе (на раневом сайте kui see on arvutis)
   - свободным текстом в истории болезни медсестры
   - делаю заметки и потом вношу результаты в компьютерную программу
   - в большинстве случаев я не документирую улучшение язвы в динамике
6. Следуете ли вы лечебными руководствами при лечении хронических язв?
   - да, всегда
   - да, иногда
   - довольно редко
   - нет
7. Если вы ответили да, то какими руководствами?
8. Насколько важно документировать хроническую язву ноги во время каждого визита?
   - чрезвычайно важно
   - очень важно
   - довольно важно
   - не очень важно

9. Требуется ли много времени документировать язву?
   - да
   - нет

10. Время затраченное на документирование в среднем
- до 5 минут
- с 5 до 10 минут
- с 10 до 15 минут
- больше 15 минут

11. Трудно ли описать язву?
- да
- скорее да
- скорее нет
- нет
- не могу сказать

12. Чувствуете ли вы себя уверенно в лечении язвы?
- да
- скорее да
- скорее нет
- нет
- не могу сказать

13. Часто ли вы используете свой собственный телефон для документирования ран?
- да
- скорее да
- скорее нет
- нет
- не могу сказать

14. Как часто вы используете линейку для документирования язвы?
- каждое посещение
- иногда
- никогда

15. Бывает ли в повседневной практике что надо консультироваться с другим специалистом? (например, другая медсестра, семейный врач, хирург, дерматолог)

16. Как вы оцениваете сотрудничество с разными специалистами (например, медсестра- семейный врач / хирург)
- очень хорошее
- хорошее
- плохое
- очень плохое

Опишите, пожалуйста, проблемы встречающиеся в сотрудничестве?

17. Вы когда-нибудь испытывали, что посещение дома можно было бы отменить, если пациент отправил бы вам фотографию раны, и вы дали бы дальнейшие инструкции по телефону?
- да
- скорее да
- скорее нет
- нет
- не могу сказать

18. Видите ли вы необходимость в цифровом инструменте в ежедневной работе с помощью которого автоматически измерять площадь раны и оценить глубину дна раны?
    - да
    - скорее да
    - скорее нет
    - нет
    - не могу сказать
19. Другие комментарии, предложения

Спасибо за ответы!

APPENDIX 5: Web-based questionnaire in English

Dear colleague,

My name is Marelle Maiste. I am healthcare technology master student from Tallinn University of Technology, on a daily basis, I am working as a primary care nurse. I am currently writing thesis how improve the documentation quality of diabetic foot ulcer, and the target group is home nursing. The main objective is to find out, if nurses are in need of a digital solutions in their daily work and, therefore, I would need your help in completing a simple and anonymous questionnaire. Answering questions will take about 5-8 minutes.

1. Age:
2. Years of service:
3. Service area:
   - Harju County
   - Tartu County
   - Ida-Viru County

Other county, please specify:

4. How to price your own computer skills
   - Good
   - Rather good
   - Rather bad
   - Bad
   - Hard to say
5. How does the assessment and documentation of chronic ulcer condition occur during the visit?
   - To the paper-based ulcer card
   - On paper, as a free text
   - I will take notes into notebook and later insert information into electronic health record
   - In most cases, I do not document the ulcer healing in dynamics
6. Are you following any guidelines managing in chronic ulcers?
   - Yes, always
   - Yes, sometimes
   - Rarely
   - No
7. If yes, which ones?
8. How important is it to document the chronic foot ulcer during each visit?
   - Of utmost importance
   - Very important
   - Somewhat important
   - Not very important
9. Is it time consuming to document the ulcer?
   - Yes

- No

10. Time spent on long documentation
    - up to 5 minutes
    - 5-10 minutes
    - 10-15 minutes
    - More than 15 minutes
11. Is it difficult to describe the ulcer?
    - Yes
    - Rather yes
    - Rather not
    - No
    - Hard to say
12. Do you feel confident in treating the ulcer?
    - Yes
    - Rather yes
    - Rather not
    - No
    - Hard to say
13. Do you often use your own telephone to record wounds?
    - Yes
    - Rather yes
    - Rather not
    - No
    - Hard to say
14. How often do you use a ruler to document the ulcer?
    - Every visit
    - Sometimes
    - Never
15. Does everyday practice need to be consulted by another specialist, if so, then with whom? (e.g. another nurse, family doctor, surgeon, dermatologist)
16. How do you evaluate cooperation between different professionals (for example, a family doctor / surgeon at home)
    - Very good
    - Good
    - Bad
    - Very bad

Please describe the problems encountered in cooperation?

17. Have you ever experienced that a home visit could have been omitted if the patient had sent you a photo of the ulcer and you could have been able to make further arrangements by phone?
    - Yes
    - Rather yes
    - Rather not
    - No
    - Hard to say
18. Do you see the need for your daily work using a digital tool that automatically measures the area of the wound and evaluates the bottom / depth of the wound?
    - Yes

- Rather yes
- Rather not
- No
- Hard to say

19. Other comments, suggestions

Thank you

Appendix 6: Image of diabetic foot ulcer

Figure 6. Neuroischaemic DFU [52]