



# An integrated wound-care pathway, supported by telemedicine, and competent wound management—Essential in follow-up care of adults with diabetic foot ulcers



Hilde Smith-Strøm<sup>a,b,\*</sup>, Marjolein M. Iversen<sup>a,c</sup>, Marit Graue<sup>a</sup>, Svein Skeie<sup>c</sup>,  
Marit Kirkevold<sup>a,d</sup>

<sup>a</sup> Faculty of Health and Social Science, Centre for Evidence-Based Practice, Bergen University College, Bergen, Norway

<sup>b</sup> Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway, Norway

<sup>c</sup> Department of Medicine, Section of Endocrinology, Stavanger University Hospital, Stavanger, Norway

<sup>d</sup> Department of Nursing Science, Institute of Health and Society, University of Oslo, Oslo, Norway

## ARTICLE INFO

### Article history:

Received 1 December 2015

Received in revised form 20 June 2016

Accepted 29 June 2016

### Keywords:

Diabetic foot ulcer

Telemedicine

Patient security

Home care nurse

Professional competence

Continuity of care

Randomized controlled study

## ABSTRACT

**Introduction:** Diabetic foot ulcers are a feared complication of diabetes. Care delivered via telemedicine is suggested to be a more integrated care pathway to manage diabetic foot ulcers than traditionally delivered healthcare. Our aim was to explore patients' experiences with telemedicine follow-up care as compared to traditional care.

**Methods:** Interpretive description was used as an analysis strategy. Data were collected using individual semi-structured interviews in the context of a larger ongoing clustered randomized controlled trial. Twenty-four patients (13 in the intervention group; 11 in the control group), aged 38–88 years were purposively recruited from the RCT in order to obtain a diverse sample in terms of group composition (intervention vs. control), age, gender, marital status, setting, and comorbidities present. The control group received traditional care.

**Results:** Three themes emerged from the interpretive analysis: *competence of healthcare professionals, continuity of care, and easy access*. This was independent of types of follow-up that had limited impact on the patients' follow-up experiences. Competence of healthcare professionals and continuity of care were crucial, because they can either enhance or jeopardize wound care. If these two latter factors were absent, patients would lose confidence in the wound care process. If this happened, patients pointed out that the expert knowledge of a specialist clinic was essential to receive good care. When telemedicine functioned optimally, telemedicine was an advantage in the treatment, because the images quickly captured changes in the wound healing that immediately could be corrected. Easy access is important for patients, but the importance of accessibility appears to be primary when the other two factors were present.

**Conclusion:** The best wound care pathway for patients with diabetes foot ulcers is depended on a combination of competence and professional skills in wound management, and continuity of care. If telemedicine is functioning as intended, it can be an important additional tool.

© 2016 Published by Elsevier Ireland Ltd.

## 1. Introduction

Diabetic foot ulcers severely affect patients' quality of life [1]. They are worrisome complications of diabetes, as they can take months to heal and can lead to osteomyelitis and amputation [2].

In Norway, and in other countries, home care nurses in collaboration with the general practitioner (GP) have the primary responsibility for treatment and follow-up of patients with ulcers in collaboration with the specialist health care service [3–5]. However, in the current system it is reported that the collaboration between primary health care and specialist health service is not sufficient [6]. In particular, problems exist related to lack of competence in wound management among home care nurses and GPs, the GPs and municipalities' roles in treatment and follow-up care are unclear, and capacity problems exist in the specialist health service as well as varying and unclear referral practices between primary

\* Corresponding author at: Faculty of Health and Social Science, Centre for Evidence-Based Practice, Bergen University College, Inndalsveien 28, Bergen, N-5063, Norway.

E-mail address: [hss@hib.no](mailto:hss@hib.no) (H. Smith-Strøm).

**Table 1**  
Characteristics of the participants.

	Telemedicine follow-up N = 13	Traditional follow-up N = 11
Sex		
Men	10	8
Women	3	3
Age		
30–39	–	1
40–49	1	2
50–59	3	–
60–69	4	3
70–79	2	4
>80	3	–
Mean (r)	62.6 (47–88)	60.4 (38–76)
Type of diabetes		
Type 1	2	4
Type 2	11	7
Marital status		
Married/cohabitant	11	10
Widow/widower	1	1
Single	1	–
Employment		
Work full-time/Part-time	5	4
Retired	7	3
Sick leave	1	–
Disabled	–	4
Co-morbidities		
Coronary disease	3	3
Peripheral artery disease	2	2
Neuropathy	7	4
Rheumatism	1	1
None		
Geographical distance from settlement to hospital, km. median (r)	11.4 (0.5–72.6)	10.7 (2.6–30.6)

– and specialist health care service [7–9]. A particular challenge is related to lack of good communication technology between the two levels. Lack of collaboration between levels, with the consequence that the patient does not receive timely treatment can lead to severe consequences for the patients [8]. Diabetic foot ulcers are one of the leading causes of hospital admission for people with diabetes and the most common cause of lower limb amputation [9,10].

Telemedicine is suggested to be one solution used to facilitate the creation of a more integrated healthcare service, with the aim of increasing access, quality, patient satisfaction, and treatment efficiency in patients with diabetic foot ulcers [4,11,12]. Telemedicine has been available in different healthcare disciplines and for various disease groups for decades. In wound care, much literature exists on imaging technology and feasibility of the technology. However, studies that have focused specially on diabetic foot ulcer and telemedicine are scarce. A systematic review from 2014 [13] assessing the effect of telemedicine compared to traditional care among patients with leg and foot ulcer concluded that the evidence is inconclusive due to lack of studies and poor methodological quality of the studies. The authors concluded that RCT studies with larger samples and longer follow-up time are needed. In Denmark, a recently published RCT [14] study including 401 patients with diabetic foot ulcers found no difference in terms of wound healing or amputation. However, they found a higher mortality rate among patients receiving telemedicine follow-up versus traditional care. Based on that, the authors question the role of telemedicine in monitoring diabetic foot ulcers, especially to subgroups of patients that may have poorer outcomes with telemedicine monitoring. In contrast, a large RCT study in UK [15] including 3230 patients with diabetes, chronic obstructive pulmonary disease or heart failure found that telehealth was associated with lower mortality. The latter study did not include patients with diabetic foot ulcer. Hence, more studies are needed to evaluate the effects of telemedicine follow up compared to traditional care as well as how the incorporation of telemedicine impacts on the experiences

of patients receiving such care. Also, few studies have explored patients' experiences with treatment for diabetic foot ulcers and their satisfaction with telemedicine [4,16]. The few existing reviews of implementation of this technology examined patients' satisfaction with telemedicine and included various patient groups, but not patients with diabetic foot ulcers [17–19]. These reviews concluded that the majority of studies varied in quality and had many methodological problems.

There is a need to supplement previous research by exploring the patients' perspective on wound management as patients' experiences are an important contributor to improve the quality of health care services. In-depth knowledge of patients' experiences can help evaluate whether use of telemedicine is an appropriate way to improve the service. In the present study, we employed a qualitative approach, and patients included were part of a larger ongoing cluster randomized controlled trial (RCT) (Clin.Trial.gov: NCT01710774). This trial is investigating whether telemedicine follow-up care for patients with diabetic foot ulcers who receive home care in collaboration with specialist healthcare is an equivalent alternative to traditional outpatient clinical follow-up in a specialist healthcare setting. The main trial outcome for the larger RCT is healing time.

The telemedicine intervention consists of an interactive wound platform, which uses a web-based ulcer record combined with a mobile phone that allows counseling and communication among nurses in community and specialist healthcare. Use of wound images in combination with written assessments of the wound might replace or supplement existing treatment follow-up. Both groups receive treatment in primary and specialist healthcare, and the purpose of patients receiving telemedicine follow-up is to reduce the number of consultations in the outpatient clinic in the specialist health care. More responsibility can then be transferred to primary healthcare that is in line with national guidelines [6,20]. By obtaining knowledge of patients' experiences receiving telemedicine and comparing and contrasting these experiences

**Table 2**  
Main topics covered by the interview guide.

Intervention group	
1.	The patient's experiences with the foot ulcer and what he did when he discovered the ulcer
2.	The patient's experiences with receiving telemedicine treatment and follow-up from the home care nurse
3.	The patient's experiences with being followed up in specialist healthcare
4.	The patient's experiences of being involved in wound management and decisions that concerned his treatment
5.	The patient's experiences with healthcare professionals' use of the telemedicine equipment and healthcare professionals' own views on using images in wound care
6.	Whether the patient observed telemedicine collaboration between the home care nurse and specialist healthcare service during follow-up
7.	The patient's perception of whether he takes more responsibility for his own health
8.	The patient's perception of what is the most important task home care nurses and experts at the outpatient clinic have in treatment and care of patients with diabetic foot ulcers
Control group	
1.	The patient's experiences with the foot ulcer and what he did when he discovered the ulcer
2.	The patient's experiences with receiving traditional treatment and follow-up from the home care nurse
3.	The patient's experiences with being followed up in specialist healthcare
4.	The patient's experiences of being involved in wound management and decisions that concerned his treatment
5.	Whether the patient observed any collaboration between the home care nurse or GP and specialist healthcare services during follow-up
6.	The patient's perception of whether he takes more responsibility for his own health
7.	The patient's perception of what is the most important task home care nurses and experts at the outpatient clinic have in treatment and care of patients with diabetic foot ulcers

with those of patients in the control group, we may get new insight into how this technology influences patients' perspectives. Including patients' perspectives may cultivate a more holistic view and more tailored treatment. The aim of our study was therefore to explore the experiences of adults with diabetic foot ulcers receiving telemedicine compared to patients receiving traditional follow-up healthcare delivered in the context of a clustered RCT.

## 2. Methods

### 2.1. Study design

Interpretive description (ID), as described by Thorne [21], was used as a strategy in the present study. ID is an inductive analysis approach that addresses clinical research questions in a way that can inform and potentially change practice [21].

### 2.2. Patients

Twenty-four patients (13 in the intervention group, 11 in the control group), aged 38–88 years, were purposively recruited from the telemedicine RCT trial so that we could obtain a diverse study sample in terms of group (intervention vs. control), age, gender, employment, marital status, settlement, and comorbid conditions (Table 1). Patients in this study were included if their foot ulcers had healed, or at the end of intervention that last maximum for 12 months. The study nurse organized patient recruitment at two clinical sites in Western Norway that are responsible for the larger, ongoing cluster RCT study. The first author (HSS) contacted patients who earlier consented to participate in an interview in order to make an appointment for the present study. One patient declined participation, citing current unfavorable health conditions. At the time of the interview, patients' foot ulcers had healed completely for most of the patients, except for three patients in the intervention group and four in the control group.

### 2.3. Follow-up of intervention group and control group in the RCT study

Patients in the telemedicine group were followed primarily by home care service. However, every six weeks they visited the outpatient clinic, where their foot ulcer was monitored. At a minimum of once per week, the home care nurse would take a digital image

of the patients' ulcers and would send it to the expert wound care team at the outpatient clinic for assessment and feedback. Assessment of the wound image, together with a written assessment, determined whether a patient would require more frequent consultations at the outpatient clinic.

Patients in the control group underwent wound control every 2–4 weeks at the outpatient clinic, with follow-up by the home care service between consultations. However, this did not take place in combination with telemedicine follow-up. For some patients home care follow up was not needed.

Patients in both groups were included in the trial until their foot ulcer healed, but for maximum of 12 months.

### 2.4. Data collection

All interviews were conducted between March 2014 and May 2015, either in the patients' homes or at their workplace. Each interview lasted between 35 and 55 min.

A semi-structured interview guide was developed, based on the aim of the study, our current contextual understanding of the treatment, and care pathways for patients with a diabetic foot ulcer. The interview guide was piloted with one patient from each group of the trial to assess its usefulness. The guide was perceived as a functional tool, and only minor changes were made.

The interview guide contained eight overall topics with sub-themes for the intervention group and seven overall topics with sub-themes for the control group (Table 2). The topics were similar for both groups, except for questions related to the patients' experiences with health professionals' use of the telemedicine equipment and users' own views on using digital images and remote assessment in wound care.

### 2.5. Analysis

Interviews were transcribed verbatim. The analysis process comprised four phases: [1] researcher immersion in the transcripts, [2] coding and developing of themes, [3] comparing and contrasting themes within the groups, and [4] comparing and contrasting themes between the groups (telemedicine vs. control). By follow these phases, it was possible to obtain comprehensive insight into the data, which in turn afforded us the opportunity to examine the similarities and differences that emerged from the data. Each author analyzed the data individually, and then all authors con-

vened to discuss the data. This was done to ensure credibility and obtain consensus at the interpretation of the individual themes that emerged during the four-phase analysis process.

Immersion in the transcripts began immediately after each interview, in which field notes were prepared containing observations of the setting and overall impressions from each interview. The first author then transcribed all interviews directly after completion of each interview. Each transcript ended with preliminary interpretations of the text, which were used for further analysis. This enabled us to get an overall impression of the data. The transcripts were then read in their entirety in order to get a sense of the whole.

In the second phase, we used open coding. Here, we chose codes to match closely to the language inherent to the data. The different codes were then sorted into groups of data that seemed to be thematically related. In this process, different tentative themes were identified; these were used as a basis for further analysis.

We used a constant comparison method [21] to compare the different parts of and patterns in each interview and to compare the intervention and control groups. In phase three, first we performed a “within-group comparison” by assessing the telemedicine intervention patients for similarities and differences. The same was done with the data from the patients in the control group. Then, we performed a “between-group” analysis by comparing themes from the intervention and controls groups. Both positive and negative patterns emerged from both group analyses. Further analysis revealed remarkable similarities between the two groups (intervention vs. control) and between members within each group. By comparing and contrasting these positive and negative patterns within and between groups, it was possible to conduct a more holistic analysis. This in turn enabled us to identify the final themes within the overall dataset common to both groups.

In the final phase of analysis, we identified three themes; competence of healthcare professionals, continuity of care, and easy access to healthcare services, that appeared to play an essential role in patients treatment and follow-up care.

## 2.6. Ethical considerations

The study was approved by the Western Norway Regional Committee for Medical and Health Research Ethics (2011/1609/REK vest). All participants received written and oral information about the study. Participation was voluntary, and each patient signed an informed consent form.

## 3. Results

The most important requirement expressed by adults with diabetic foot ulcers was to feel secure about or have confidence in their ulcer treatment and follow-up. Fear of amputation or new wounds were fundamental for the patients in both groups. Consequently, experiences of security and confidence were fundamental premises for how they experienced the treatment and follow-up care. Some felt confident they were receiving care that would benefit wound healing. Others felt doubtful that the care they were receiving would promote wound healing. The type of service (telemedicine vs. traditional) seemed less important in terms of how the patients experienced follow-up care. They emphasized *competence of healthcare professionals, continuity of care, and easy access to healthcare services* as the most important elements that helped them gain security and confidence about the wound care they were receiving. Both competence of healthcare professionals and continuity of care were seen as essential for providing high-quality foot ulcer care. The presence of both elements would contribute to improve the quality in handling of the foot ulcer,

whereas their absence would not. The analysis also revealed positive process with telemedicine follow-up care. For instance, with the patients in the telemedicine intervention, taking an image with the mobile phone could quickly capture changes in healing. In a matter of minutes, the home care nurse can take mobile phone images of an ulcer and forward them to the expert team at the outpatient clinic, allowing both of them to evaluate the ulcer and discuss what treatment course to take. Although easy access to wound care was generally important for all the patients, the importance of accessibility appears first when competence of healthcare professionals and continuity of care were present.

### 3.1. Competence of healthcare professionals

With respect to competence of nurses, patients stated that knowledge of ulcer management and ability to teach patients about proper ulcer care were important contributors to the quality of care and patients' sense of security. These sentiments were true for both telemedicine patients and control patients. Meeting nurses and other health professionals who had specialized skills in ulcer treatment, gave them a sense of security that they were receiving high-quality foot ulcer care and that severe complication could be avoided such as osteomyelitis and amputation. Patients viewed frequent assessments by a doctor important only if their wound was not healing as expected.

The patients viewed home care nurses and nurses at the outpatient clinic differently. At the outpatient clinics, all patients (both intervention and control) were assessed by expert wound care specialists. Regarding these meetings, all but two patients described themselves as being “*in secure hands*” due to available expertise and rapid referral, if needed, which was not possible in home care settings. Most patients commonly stated: “*They [specialists] know how to treat ulcers.*” However, several patients also stated that it was important for them to learn about proper wound care from the nurse wound specialists at the outpatient clinic. This gave them a feeling of being empowered, because acquiring appropriate wound care knowledge would help them prevent their ulcer from worsening, prevent recurrence of the ulcer, and prevent new ulcers from forming. As one patient said:

*“If they only treat the ulcer but do not facilitate learning, there is a risk that the patients will come back with a new ulcer” (IG19).*

Contrasting with their experience at the specialist clinics, the patients stated that they encountered large differences in knowledge and experience among home care nurses. This situation made them feel either secure or insecure, depending on the nurse's expertise in wound care. Patients who received care from home care nurses having extensive ulcer management experience described them as possessing a strong commitment and interest in the ulcer healing process. They viewed these nurses as highly skilled, competent in foot ulcer care, and qualified to treat their ulcers. Often, they used descriptions like, “*engaged,*” “*enthusiastic,*” “[having] *great interest in wounds.*”

On the other hand, patients treated by home care nurses who clearly lacked competence in wound management had a very different perception of their nurses. Not surprisingly, nurses who lacked skills and a professional attitude made patients feel uneasy with their treatment. Patients were afraid that these nurses overlooked important signs of ulcer deterioration. Both control patients and telemedicine patients expressed the same concerns. This sentiment was conveyed by one man in his 70s as follows:

*“I do not trust the home care nurses. They are so uncertain. They ask me what to do! I say that I cannot decide that. I feel that I am more of a [wound care] specialist than they are. If changes occur in the ulcer, I have the impression they do not know this is happening,*

because they have not seen the ulcer for 14 days. They have no information about the ulcer treatment process; they do not know what has been done with it. None of the home care nurses who have treated the ulcer have competence in ulcer treatment” (CG 2).

Another patient stated:

*“I had to explain to the home care nurses how they should treat my foot ulcer, because they treated the ulcer very differently. I knew more about wound care than the nurses” (IG9).*

These representative quotes show how lack of competence in home care service affected whether the patients felt secure with the care they were receiving.

### 3.2. Continuity of care

#### 3.2.1. Receiving ulcer treatment from fewer nurses made patients feel more secure

The patients described various experiences when several nurses were involved in performing the follow-up ulcer management care. Regardless of treatment group (telemedicine or control), the number of nurse caregivers influenced whether the patients felt secure with the ulcer care they were receiving. In general, they preferred care from fewer nurses, because they felt that, with fewer caregivers, the nurses would be more familiar with their particular ulcer, would be more up-to-date on the ulcer healing process and treatment procedure, would be more knowledgeable about ulcer treatments, and would have better communication with the outpatient clinic. If this was not possible, patients felt it was important to have only one nurse oversee treatment, so that responsibility over the treatment was not distributed among several nurses. Patients said this arrangement worked well and promoted good communication among the nurses. Being certain that nurses communicated among themselves about the ulcer progress and treatment was very important and was emphasized as necessary in order for the patients to feel secure with the ulcer treatment in primary health-care. As one 60-year-old man expressed it:

*It was fantastic to be followed up by two nurses. They were up-to-date on the ulcer, they were competent, and both had read and followed the procedures that were sent from the outpatient clinic. They had a very positive commitment to wound management. For me, it was very stimulating and very reassuring (CG7).*

One man in the intervention group described follow-up care by home care nurses like this:

*“It was one nurse who had primary responsibility for ulcer treatment and follow-up and communicating with the outpatient clinic. She was available when she was needed, both for me and the other nurses. It was a brilliant way to do it” (IG5).*

Patients followed up by many different home care nurses did not experience such a positive experience. In their case, no one person oversaw their ulcer treatment. Moreover, the nurses involved were not up-to-date on the ulcer’s progress. One patient with a complicated, slow-healing ulcer described his experience with home care nurses in the following way:

*“What was so sad is that a new nurse came almost every time, and when I asked them how the ulcer looked like, they would say that they had no idea. They had not seen the ulcer for one to 1.5 months. Few images were taken. I feel not very secure when they cannot tell me how the ulcer is healing” (IG 12).*

#### 3.2.2. Telemedicine can benefit patients

The patients in the two groups (telemedicine vs. control) had very similar experiences. It seemed, however, that care deliv-

ered via telemedicine could counteract some of the challenges the patients experienced during the treatment process. Still, this depended on whether telemedicine was carried out as intended.

Telemedicine patients who had positive experiences with their telemedicine care stated that images of the ulcer combined with a written assessment contributed positively to ulcer treatment, because the images reinforced the written assessment of the foot ulcer. Several of the telemedicine patients used the adage, “one image speaks more than a thousand words,” to describe their positive experience. The patients stated that the telemedicine protocol worked well, because it gave them the assurance that if something was wrong with their ulcer, it would be quickly caught by the outpatient clinic expert team, who assessed the images. This sense of confidence in the treatment scheme was expressed by one man as follows:

*“The digital communication between the outpatient clinic and the home care nurse, and image transfer gave [me a feeling of] security that, if there was some changes in the ulcer healing, the health professionals at the outpatient clinic would catch it” (IG19).*

Patients also noted that taking wound images was a good tool, because it helped the home care nurses be more observant and improved their wound care knowledge and skills. This notion is exemplified in the following quotation:

*“[The fact] that the home care nurses take images of the ulcer has made them very observant. They do what they should [do]” (IG5).*

The patients also observed that the act of taking and sending images of the ulcers to and having them assessed by the outpatient clinic also gave the home care nurses a sense of security. One 62-year-old man expressed this in the following way:

*“It was reassuring for the home care nurses to communicate with the expert team at the outpatient clinic, because they received feedback on whether they were on the right path or not” (IG20).*

The communication between the home care nurses and outpatient clinic also improved, because the assessed image and treatment procedure were sent directly to the home care nurses through the shared web-based ulcer record used both by experts in the outpatient clinic and home care nurses. That allowed direct communication between the two levels. In the control group, however, the treatment procedure was given to the patient.

The use of images in telemedicine also increased the sense of security of patients who received follow-up care from many nurses with varying expertise. One woman expressed this sense of enhanced security in the following way:

*“There were many nurses involved [in my wound care] who lacked wound skills compared to [those at] the outpatient clinics. It therefore was of great comfort for me that images [of my ulcer] were taken and sent to the outpatient clinic for assessment” (IG 4).*

These examples show that telemedicine can support a treatment intervention in a positive way. However, if telemedicine was not carried out as planned—for example, images were not taken or not sent, or outpatient clinic did not assess the images—telemedicine did not benefit the patients. Some of the telemedicine patients mentioned that some home care nurses did not take images of their ulcers due to lack of mobile skills, during sick leave and vacation. Others reported that the outpatient clinic did not respond to the home care nurses’ request to assess the images. One man in his 50s observed the following:

*“The home care [nurses] did not take any images of the foot ulcer. They did not start [taking] images before the wound was healed (IG17).*



### 3.3. Easy access and close proximity to home care service

Easy access and proximity to the service appeared to be important for the patients. For some patients, this was an excellent care pathway; for others, easy access and proximity were less relevant. These perceptions were independent of whether the patients received telemedicine care or not. If home care service was available and of sufficient quality, patients preferred to receive ulcer treatment and follow-up from a home care nurse rather receive frequent control at the outpatient clinic. As two patients put it:

*“If the home care nurses have the necessary expertise and communicate well with the outpatient clinic via the images, I see no reason to travel often to the outpatient clinic” (IG20).*

*“There are two home care nurses who had the responsible for the ulcer treatment, one each time. I experienced them as being competent and professional. And it is sufficient to have two follow-up checks per month at the outpatient clinic” (CG16).*

Employed participants and sick patients emphasized that receiving treatment close to home afforded flexibility in choosing both the time and place of treatment, which reduced traveling time to and waiting time at the outpatient clinic. For employed patients, this allowed them to go to work during wound healing.

On the other hand, if the home care service lacked competence and continuity, the patients decided to decline the home care service and instead receive all treatment and follow-up at the outpatient clinic. Two patients commented:

*“I would rather use the car and drive to the clinic instead of getting treatment from the home care nurses, because the follow-up by the home care nurse made me insecure” (IG 9).*

*“I have declined home care [because] many nurses lacked competence. I was followed up at the outpatient clinic, but I did the wound care myself between the consultations” (CG15).*

These patients stated that travel time to and waiting time at the outpatient clinic were less important. This may indicate that easy access and proximity were less significant factors than competence and continuity, because the latter contributed most to a feeling of security, a factor that was strongly emphasized by the patients. Some patients also requested more frequent checks at the outpatient clinic, but said that this option was not possible because of capacity problems at the outpatient clinics.

## 4. Discussion

The aim of this qualitative study was to explore the experiences of adults with diabetic foot ulcers receiving telemedicine compared to patients receiving traditional follow up in the context of a clustered RCT study. The discussion will be structured around the main themes identified.

### 4.1. Competence of the health care professionals

This study has shown very clearly that competence in wound management of health professional was of great importance for patients' experience of security during wound care. Nurses' competence at the outpatient clinic emerged as very essential to the patients, because expert knowledge and skills in wound care made the patients confident that if changes in the wound occurred this would be detected and necessary action taken. Patients also stated that effective teaching of patients about wound care occurred mainly at the outpatient clinic by specialist nurses and was less frequently done at home by home care nurses. This perception is in line with other studies that concluded that specialists in wound

treatment have a key role in empowering patients in self-wound care [22].

The level of acquired wound-care knowledge and skills varied among the home care nurses, according to the patients. This perception corroborates findings from other studies [3–5]. Independent of group affiliation (both in intervention and control group), patients who were treated by home care nurses lacking competence felt insecure about their wound management. An important issue was that these patients wanted to receive all their treatment at the outpatient clinic, but this was not feasible due to capacity problems. Nevertheless, for these patients, the outpatient clinic turned out to be an important confidence factor for them, because they received confirmation of whether their wound management received through home care was adequate. Education of home care nurses to ensure appropriated treatment practice is of importance and one of the cornerstones in foot management [23]. The home care nurses interact with people at high risk of severe complications and lack of awareness with regard to treatment and follow-up care practice can lead to unnecessary poor outcomes and hospitalizations [24]. In our study, the patients reported that learning mainly occurred at the outpatient clinic. Thus, improved knowledge among the home care nurses can indirectly empower patients through teaching them about how to recognize foot problems, promote appropriate self-care, and thus contribute equivalent to the expert team in patient education. That can change the current perception among the patients and prevent foot ulcer in people with diabetes [24]. However, a cautious approach of telemedicine monitoring in patients with severe foot ulcer diseases should be considered [14], especially if lack of wound knowledge and training in telemedicine equipment are shortcomings among the staff involved.

When few nurses in home care service were responsible for the wound care, patients' sense of security and confidence increased, and this seemed to be an important issue in wound management for patients. Correctly implementing telemedicine seems to further contribute to this increase. Most patients receiving telemedicine felt that it was a useful adjunct to the other treatment they received. This apparently enhanced their feelings of security, resulting in assurance that the expert team at the outpatient clinics and home care nurses used mobile phone images appropriately. Patients reported that this enhanced wound-management competence among the home care nurses. Current evidence shows that using telemedicine in combination with communication with other healthcare professionals, enhanced competence in wound management among the home care nurses [4,5,25,26]. Using telemedicine, the home care nurses collaborated closely with the nurses at the outpatient clinics. The collaboration involved continual feedback on performed work via discussions and reports from nurses at the outpatient clinics that seem to strengthened patient confidence. This finding is in line with other studies [4,5,27]. Similar collaboration in traditional follow-up in which there is no formal cooperation among levels of care was not experienced in the same way by the patients.

We observed in our settings that use of telemedicine could be questionable in a number of circumstances. Some of the patients receiving telemedicine reported that the nurses failed to take any mobile phone images, and some nurses lacked the necessary mobile-device skills. Similar issues have been reported in other studies [26,28]. If telemedicine is to have any benefit for the patients and operate successfully, these barriers must be removed. Several studies have emphasized that innovative technologies need to be integrated in the stakeholders' routine practice. The technologies must be easy and as fast as possible to use, with necessary initial training and continuously support. If not, there is a major risk of failure [25,26,29].

#### 4.2. Continuity of care

Our analyses also showed that continuity of care in wound management is another confidence-building factor that is essential to patients. Freeman and colleagues [30] described three dimensions of continuity of care: interpersonal continuity, informational continuity, and management continuity. The *interpersonal dimension* refers to the ongoing therapeutic relationship between providers and patients. The *informational dimension* refers to the links of information between episodes of care and transitions, and communication between provider and patient. These two dimensions are identifiable in our data.

Patients in both groups reported that they preferred being followed up by a limited number of home care nurses. This is consistent with the findings of other studies [31–33]. Indeed, receiving care from just a few home care nurses increases patient well-being and security [31]. Constancy of a small number of home care nurses can increase their chances of detecting subtle changes in the ulcer-healing process, thereby avoiding severe complications such as osteomyelitis and amputation. This was a major concern for the patients in this study.

Although continuity of care in primary healthcare has a positive effect on outcomes [32], it can be difficult to implement due to variable shift schedules, and contextual and individual factors [31,33]. The patients of our study were familiar with those issues. Telemedicine can reduce the uncertainty or anxiety that these types of issues can create, because telemedicine can promote continuity of care via efficient information exchange, regardless of which home care nurse follows up the patient. So, any uncertainty a patient may experience can be remedied by the fact that home care nurses have quick access to wound care specialists, who analyze the ulcer images and prepare a written assessment of the ulcer. This enables the nurses to appropriately treat the ulcer in a timely fashion. Patients receiving traditional care did not report similar experiences. This is consistent with other studies that show that telemedicine can increase exchange of knowledge and information between healthcare professionals, between levels of care, and between patients and healthcare professionals [34].

However, continuity of care cannot be viewed as being independent of caregiver skill and knowledge of wound management. Woodward and colleagues [35] found that consistently applied knowledge and skills of several healthcare professionals and consistent care management were important for ensuring continuity of care in home care settings. This was the case in our study as well. Taken together, consistent service and care delivery by knowledgeable and skilled home care nurses were factors that fostered the patients' confidence that they were receiving quality care.

#### 4.3. Easy access

Easy access was an important factor in wound treatment, but it depended on whether competence and continuity of care were established. This outcome was regardless of whether the patient received telemedicine or not. When both factors were presented, follow-up in the primary health care was an excellent care pathway. Thus, it is not necessary to charge the specialist health service with a service that can be done equally well in the primary health care. This is in line with the lowest effective service level (LEON) principle that the services should take place in close connection to the home environment [20]. Telemedicine seem to be an additional factor that may contribute to increase patient satisfaction at LEON level. This will reduce the number of consultations at the outpatient clinic. In this way, resources can be better channeled to patients who need more frequent follow-up by the expert team in specialist healthcare.

Follow-up by the home care nurses gave a flexibility in the wound care that did not happen to the same degree at the outpatient clinic. This flexibility was an important factor for patients who were employed, because they wanted to use the least amount of time on treatment and travel. Without this flexibility, patients reported that they would not be able to go to work. However, for patients who were uneasy with receiving home care follow-up, traveling to and waiting at the outpatient clinic were of little importance. These patients are concerned about feeling safe and secure and having confidence in their treatment. One solution could be to allow the patient to a greater extent be involved to determine ways to be treated. Being involved in their own care pathway and participate in decisions regarding their own health can provide better quality of wound care. This is emphasized in national guidelines [20].

The use of individual face-to-face interviews with the patients was effective in collecting relevant data. The possibility of using a focus group interview instead was a relevant alternative that was discussed, but was not selected because patients lived in different municipalities, often were older on average, had reduced mobility and health, and often depended on help from relatives or healthcare professionals to get from one place to another.

This study included a sample size of 24 patients purposely selected from an ongoing RCT. We believe that this sample size was large enough to sufficiently achieve the aim of the study.

The patients participating in the trial were also a selected group of patients based on inclusion criteria. Their experience might differ from more seriously ill patient populations, who were excluded from participation in the trial.

### 5. Conclusions and implications for practice

Our study shows that an effective wound care pathway for patients with diabetic foot ulcers depended on professionals' competence and professional skills in wound management and on continuity of care. The interaction between the two factors not only promotes more integrated care, but also bolsters patients' confidence in their ulcer care. Telemedicine can be an important supplement in that process, but its efficacy will depend on whether telemedicine is used as intended. Education and practical training in the use of telemedicine should be given to all health care professionals in the primary health care and not simply to a few [25]. Also clear guidelines for delegation of responsibility in case of sickness and vacation among key staff must be clarified. The quality of the service can thus be strengthened and lack of documentation be avoided.

#### Funding

This study was funded by a grant from the Norwegian Research Council, project number 221065, and from Bergen University College. This research was supported also through the authors' involvement in the European Science Foundation Research Network Programme "REFLECTION" – 09-RNP-049. The views expressed are those of the authors and not necessarily those of the European Science Foundation.

The clustered randomized trial (Clin.Trial.gov: NCT01710774) is funded by the Norwegian Directorate of Health, Innovation Norway, the Western Norway Regional Health Authority and the Norwegian Diabetes Association.

#### Competing interests

None.

**Summary points**

## What was already known?

- In the current system, the care pathway for patients with diabetes foot ulcers is not optimal.
- Previous telemedicine research in wound care has primarily focused on technology development and feasibility.
- Few studies have explored patients with foot ulcers experiences with use of telemedicine.

## What this study adds:

- The best wound care pathway for patients with diabetes foot ulcers is depended on a combination of competence and professional skills in wound management, and continuity of care.
- Professional competence and skills in wound management is essential for a flexible health service enabling more patients to be treated in home based care.
- Telemedicine seem to be an important supplement to create a more integrated wound care pathway, but is depended whether telemedicine is implemented as intended.

**Author contributions**

H.S.S., M.M.I., M.K. designed the study. H.S-S. collected the data. H.S.S., M.M.I., M.G., S.S. and M.K. contributed to data analysis. H.S.S., M.M.I., M.G., S.S. and M.K. contributed to drafting the manuscript and read and approved the final manuscript.

**Acknowledgements**

We warmly thank the patients who donated their time to participate in this study and to the study nurses who recruited the patients.

**References**

- [1] L. Ribu, B.R. Hanestad, T. Moum, K. Birkeland, T. Rustoen, A comparison of the health-related quality of life in patients with diabetic foot ulcers, with a diabetes group and a nondiabetes group from the general population, *Qual. Life Res.* 16 (2) (2007) 179–189.
- [2] P. van Battum, N. Schaper, L. Prompers, J. Apelqvist, E. Jude, A. Piaggese, et al., Differences in minor amputation rate in diabetic foot disease throughout Europe are in part explained by differences in disease severity at presentation, *Diabet. Med.* 28 (2) (2011) 199–205.
- [3] L. Ribu, A. Wahl, How patients with diabetes who have foot and leg ulcers perceive the nursing care they receive, *J. Wound Care* 13 (2) (2004) 65–68.
- [4] J. Clemensen, S.B. Larsen, M. Kirkevold, N. Ejskjaer, Treatment of diabetic foot ulcers in the home: video consultations as an alternative to outpatient hospital care, *Int. J. Telemed. Appl.* 1 (2008).
- [5] B. Nyheim, A.T. Lotherington, A. Steen, Nettbasert sårveiledning, Kunnskapsutvikling og bedre mestring av leggsårbehandling i hjemmetjenesten (web-based wound counseling. Developing new knowledge and improved management of leg ulcers in primary health care), *Nordisk tidsskrift for helseforskning*, (2010) 6 1 40–55.
- [6] Ministry of Health and Care Services, The Coordination Reform—Proper treatment—at the right place and right time. In: Ministry of Health and Care Services, Editor. Report No 47 to the Storting (2008–2009), Oslo: Ministry, 2009.
- [7] M. Iversen, M. Hausken, K. Vetlesen, Forsprosjekt. Diabetes fotsår. Utvikling av nye telemedisinske systemer/produkter. (Project. Diabetic foot ulcer. Development of new telemedical system/products), Stavanger: Stavanger universitetssjkehus, (2012) 1–20.
- [8] M. Graue, T. Dunning, M.F. Hausken, B. Rokne, Challenges in managing elderly people with diabetes in primary care settings in Norway, *Scand. J. Prim. Health Care* 31 (4) (2013) 241–247.
- [9] P.A. Lazzarini, D. Clark, R.D. Mann, V.L. Perry, C.J. Thomas, S.S. Kuys, Does the use of store-and-forward telehealth systems improve outcomes for clinicians managing diabetic foot ulcers? A pilot study, *J. Aust. Wound Manage. Assoc.* 18 (4) (2010).
- [10] National Board of Health, Diabetic foot ulcers—a health technology assessment summary. In: Health NBo, Editor: Health technology assessemen, (2011) 3–16.
- [11] R. Currell, C. Urquhart, P. Wainwright, R. Lewis, Telemedicine versus face to face patient care: effects on professional practice and health care outcomes, *Cochrane Database Syst. Rev.* 2 (2) (2000) CD002098.
- [12] C. Chanusot-Deprez, J. Contreras-Ruiz, Telemedicine in wound care: a review, *Adv. Skin Wound Care* 26 (2) (2013) 78–82.
- [13] L.V. Nordheim, M.T. Haavind, M.M. Iversen, Effect of telemedicine follow-up care of leg and foot ulcers: a systematic review, *BMC Health Serv. Res.* 14 (1) (2014) 565.
- [14] B.S. Rasmussen, J. Froekjaer, M.R. Bjerregaard, J. Lauritsen, J. Hangaard, C.W. Henriksen, et al., A randomized controlled trial comparing telemedical and standard outpatient monitoring of diabetic foot ulcers, *Diabetes Care* 38 (9) (2015) 1723–1729.
- [15] A. Steventon, M. Bardsley, J. Billings, J. Dixon, H. Doll, S. Hirani, et al., Effect of telehealth on use of secondary care and mortality: findings from the Whole System Demonstrator cluster randomised trial, *BMJ* 344 (2012) e3874.
- [16] M.V. Trondsen, Managing Everyday Life: A Qualitative Study of Patients' Experiences of a Web-Based Ulcer Record for Home-Based Treatment Healthcare, Multidisciplinary Digital Publishing Institute, 2014.
- [17] F. Mair, P. Whitten, Systematic review of studies of patient satisfaction with telemedicine, *BMJ* 320 (7248) (2000) 1517–1520.
- [18] K. Kidholm, J. Oates, Regions of Europe Working together for HEALTH, 2010.
- [19] D.R.E. Scott, D.F. McCarthy, D.P. Jennett, T. Perverseff, D. Lorenzetti, B. Rush, et al., Telehealth outcomes: a synthesis of the literature and recommendations for outcome indicator, *J. Telemed. Telecare* 13 (2007) 1–38.
- [20] Ministry of Health and Care Services, The primary health and care services of tomorrow –localised and integrated. In: Services MoHaC, Editor: Oslo, Ministry of Health and Care Services, 2015.
- [21] S.E. Thorne, Interpretive Description, Left Coast Press, Walnut Creek, 2008.
- [22] F.A. Sloan, M.N. Feinglos, D.S. Grossman, Receipt of care and reduction of lower extremity amputations in a nationally representative sample of US elderly, *Health Serv. Res.* 45 (6p1) (2010) 1740–1762.
- [23] K. Bakker, J. Apelqvist, N. Schaper, Practical guidelines on the management and prevention of the diabetic foot 2011, *Diabetes Metab. Res. Rev.* 28 (S1) (2012) 225–231.
- [24] J. Dorresteijn, D. Kriegsman, W. Assendelft, G.D. Valk, Patient education for preventing diabetic foot ulceration, *Cochrane Database Syst. Rev.* 12 (2014).
- [25] B.-C.H. Kolltveit, E. Gjengedal, M. Graue, M.M. Iversen, S. Thorne, M. Kirkevold, Telemedicine in diabetes foot care delivery: health care professionals' experience, *BMC Health Serv. Res.* 16 (1) (2016) 1.
- [26] B. Rasmussen, L. Jensen, J. Froekjaer, K. Kidholm, F. Kensing, K. Yderstraede, A qualitative study of the key factors in implementing telemedical monitoring of diabetic foot ulcer patients, *Int. J. Med. Inf.* 84 (10) (2015) 799–807.
- [27] F. Verhoeven, K. Tanja-Dijkstra, N. Nijland, G. Eysenbach, L. van Gemert-Pijnen, Asynchronous and synchronous teleconsultation for diabetes care: a systematic literature review, *J. Diabetes Sci. Technol.* 4 (3) (2010) 666.
- [28] T. Finch, F. Mair, C. May, Teledermatology in the UK: lessons in service innovation, *Br. J. Dermatol.* 156 (3) (2007) 521–527.
- [29] M. Muller, S. David-Tchouda, J. Margier, M. Oreglia, P.Y. Benhamou, Comment on Rasmussen et al., A Randomized Controlled Trial Comparing Telemedical and Standard Outpatient Monitoring of Diabetic Foot Ulcers, *Diabetes Care*, (2015) 38 1723–1729, *Diabetes Care*, (2016) 39 1 e9–e10.
- [30] G.K. Freeman, M. Woloshynowych, R. Baker, M. Boulton, B. Guthrie, J. Car, et al., Continuity of Care 2006: What Have We Learned Since 2000 and What are Policy Imperatives Now, National Co-ordinating Centre for NHS Service Delivery and Organisation R & D (NCCSDO), London, 2007.
- [31] E.R. Gjevjon, T.I. Romøren, B.Ø. Kjøs, R. Hellesø, Continuity of care in home health-care practice: two management paradoxes, *J. Nurs. Manag.* 21 (1) (2013) 182–190.
- [32] D. Russell, R.J. Rosati, P. Rosenfeld, J.M. Marren, Continuity in home health care: is consistency in nursing personnel associated with better patient outcomes? *J. Healthc. Qual.* 33 (6) (2011) 33–39.
- [33] S. Waibel, D. Henao, M.-B. Aller, I. Vargas, M.-L. Vázquez, What do we know about patients' perceptions of continuity of care? a meta-synthesis of qualitative studies, *Int. J. Qual. Health Care* (2011), mzz068.
- [34] F. Verhoeven, L. van Gemert-Pijnen, K. Dijkstra, N. Nijland, E. Seydel, M. Stehouder, The contribution of teleconsultation and videoconferencing to diabetes care: a systematic literature review, *J. Med. Internet Res.* 9 (5) (2007) e37.
- [35] C.A. Woodward, J. Abelson, S. Tedford, B. Hutchison, What is important to continuity in home care? Perspectives of key stakeholders, *Social Sci. Med.* 58 (1) (2004) 177–192.