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A qualitative study of the key factors in implementing telemedical monitoring of diabetic foot ulcer patients

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ABSTRACT

Introduction: The implementation of telemedicine often introduces major organizational changes in the affected healthcare sector. The objective of this study was to examine the organizational changes through the perception of the healthcare professionals regarding the implementation of a telemedical intervention. We posed the following research question: What are the key organizational factors in the implementation of telemedicine in wound care?
Methods: In connection with a randomized controlled trial of telemedical intervention for patients with diabetic foot ulcers in the region of Southern Denmark, we conducted an organizational analysis. The trial was designed as a multidisciplinary assessment of outcomes using the Model of ASsessment of Telemedicine (MAST). We conducted eight semi-structured interviews including individual interviews with leaders, and an IT specialist as well as focus group interviews with the clinical staff. A qualitative data analysis of the interviews was performed in order to analyze the healthcare professionals and leaders perception of the organizational changes caused by the implementation of the intervention.
Results: The telemedical setup enhanced confidence among collaborators and improved the wound care skills of the visiting nurses from the municipality. The effect was related to the direct communication between visiting nurses and specialist doctors. Focus on the training of the visiting nurses was highlighted as a key factor in the success to securing implementation. Concerns regarding lack of multidisciplinary wound care teams, patient responsibility and lack of patient interaction with the physician were raised. Furthermore, the need for clinical guidelines in future implementation was underlined.
Conclusions: Several influential factors were demonstrated in the analysis including visiting nurses wound care training, focus on management, economy, periods with absence from work and clinical care. However, the technology used here could provide an additional option to offer patients after an individual assessment of their health condition.

1. Introduction

Telemedicine is put forward as a potential solution to future challenges in the healthcare sector caused by demographic changes [1]. Telemedicine can be used in the delivery of healthcare services through the use of information and communication technologies, in situations where the participants are at different locations [2]. The term telemedicine applies to the overall intervention or service and not just to the telemedical device used as part of the service.

The implementation of telemedicine often introduces organizational changes in the healthcare sector. Changes that can be overlooked due to lack of knowledge in the planning of a project. However, these modifications in the clinical handling may have severe impact on the effectiveness and outcome measurements [3].

The application of telemedicine is widespread and has been used in rural areas and geographical areas with large distances not sufficiently covered by healthcare. Numerous examples in the use of telemedicine include digital imaging of acute wounds (*e.g.*, burn wounds) to aid in the visitation process and initial treatment [4,5]. Often, the cost-effectiveness of these applications are less well demonstrated and questions relating to qualitative analysis of the level of satisfaction among healthcare professionals, patients and relatives are unresolved.

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Major areas of telemedical applications also include dermatology (*i.e.*, teledermatology) in which it has been applied for several years and found acceptable as a diagnostic and monitoring tool [6].

Research in the field of telemedicine has grown extensively over the last decade and the majority of the literature on wound care is focusing on image technology and its feasibility. The current literature is very heterogenic in areas including wound etiology, scientific approach, level of evidence and areas of concern. Several researchers recommend further studies, especially well-planned randomized controlled trials [7,8]. Terry et al. suggest that the effect of telemedicine varies with different types of wounds, and the study outcome thus depends on the etiology (*i.e.*, diabetic, pressure or surgical wounds) [8]. Most of the studies are focusing only on the feasibility of the technology and not other aspects of telemedicine in the care of patients. Healthcare organizations are complex systems and often consist of more than one contributor (*e.g.*, several municipalities and variable hospital setups). Introduction of telemedicine will affect the workflow, but often also the distribution of tasks and responsibilities between healthcare professionals [9]. Few published studies have analyzed organizational aspects of introducing telemedical wound care [10,11].

In this study, the aspects of introducing telemedicine to patients with diabetic foot ulcers were investigated as part of a randomized controlled trial (clinicaltrials.govid: NCT01608425). Patients included in the trial were randomized to either usual care in specialized hospital-based units or to receive two of three consultations in their own homes, based on store and forward telemedicine [12]. In both cases the actual treatment was the same whereas the workflow differed. A recent publication by the European Wound Management Association has recommended using the Model for ASsessment of Telemedicine (MAST) when evaluating telemedicine in wound care [13]. This approach was undertaken in this paper. To our knowledge this is the first qualitative organizational investigation of large-scale telemedicine implementation in patients treated for diabetic foot ulcers.

The objective was to examine the organizational changes through the perception of the healthcare professionals, regarding the implementation of the telemedical intervention. Our research question was as followed:

What are the key organizational factors in the implementation of telemedicine in wound care?

2. Materials and methods

2.1. Study setting

The study was carried out in the Region of Southern Denmark (RSD) between October 2010 and November 2014, an area comprising approximately 1.2 million residents. The project included all 22 municipalities and the five general hospitals in the region. Standard monitoring of patients with diabetic foot ulcers included a series of consultations in cross-disciplinary hospital-based outpatient clinics. The study was carried out as a pragmatic randomized controlled trial (reported elsewhere). The pragmatic approach is designed to test interventions in a real life setting allowing applicability and generalizability. It allows some flexibility and individually tailoring of the treatment in intervention as well as control group (standard care) [14].

2.2. Intervention

The telemedical intervention was designed as a randomized controlled trial. Patients were randomly assigned to either intervention (*i.e.*, telemedical monitoring) or control in outpatient clinics (standard care). Participants were surgically and medically stratified according to standard clinical guidelines [15] prior to randomization. All staff members at the hospital and in the municipality involved in the study were trained in wound care, ensuring that no difference was made in the care of the patients between the intervention and the standard monitoring.

All healthcare professionals (*i.e.*, hospital and municipality staff) involved received basic training in use of the telemedical system. The training consisted of a one-day hands-on training session providing skills in addressing the online database and the smartphone. A group of professionals who were intended to function as Power-users received training at a more advanced level. The training sessions also presented an opportunity for the visiting nurses and hospital staff to meet and get to know each other prior to cooperating in the project.

Telemedical monitoring was used as a supplementary tool in the monitoring of diabetic foot ulcers. An online-database (www.pleje.net – Dansk Telemedicin Inc., Copenhagen, Denmark) and smartphones constituted the technological platform supporting exchange of healthcare data and clinical images. The system has been used clinically for several years in other parts of Denmark. Prior studies proved the setup feasible, but has not been evaluated as thoroughly as presented here [16].

Fig. 1 displays the intervention (telemedical) and the standard workflow. Left: the telemedical visit schedule for patients in the intervention group. Right: the outpatient visit schedule for patients in the standard care group. The daily care, if needed, was provided by nurses under supervision of a nurse specialized in ulcer care in both groups. No frequency of telemedicine consultations and/or clinic visits was predefined by the protocol but was driven by a clinical judgment at every consultation, be it telemedical or control.

2.2.1. intervention workflow

The per protocol telemedical monitoring consisted of two consultations in the patient's own home using telemedicine, and one consultation at the outpatient clinic. The three-visit cycle was repeated until endpoint. Patients monitored with telemedicine were monitored according to the algorithm displayed in Fig. 1 (left side).

The telemedical consultations were conducted by telephone or online written consultations as contact between the specialized municipal nurse and doctors at the outpatient clinic. These consultations were supplemented by an uploaded image of the ulcer and a detailed written assessment *via* the online database. If needed, the treatment strategy was revised. The next consultation (*i.e.*, telemedical or standard) and the indication for further images were agreed upon by the nurse and physician in common. If the treatment or the patient's health condition needed closer supervision by a hospital specialist (*i.e.*, doctor, podiatrist or specialist nurse), deviation from the workflow algorithm was allowed.

In the municipality, the visiting nurses conducted two of every three consultations telemedically. The telemedical workflow included examination of the diabetic foot ulcers, provided clinical images with smartphones and uploaded the images, as well as any other relevant patient information, to the online database. Subsequently, the hospital staff was consulted, mostly by means of telephone consultations, and in some cases by means of written communication *via* the online database. The consultations were held asynchronously in the sense that the nurse would call the specialists while being away from the patient. After the consultation, the visiting nurse conveyed the results to the patient, either by means of a phone call or returning to the patients home the same day or the day after. In case of complications discovered in the consultation however, the patient was referred to the outpatient clinic on an acute basis.