A digital pen-based telehealth system supporting specialised homecare and patients with advanced heart failure

The research project *Health Diary for Heart Failure (HD4HF)* aims at supporting heart failure patients and professional caregivers in specialised homecare through the use of a telehealth system based on digital pen technology. The telehealth system provides the professional caregivers with frequent patient-reported outcome measures (PROMs) on various symptoms and measurement data for the detection of early signs of deterioration of heart failure. In the home, patients with advanced heart failure use the digital pen and paper Health Diary forms daily to fill in symptom assessments, intake of p.r.n. medications, and measurement data, e.g. weight, blood pressure, and oxygen saturation.

**Introduction**

The prevalence of heart failure is approximately 1-2% of the adult population and increasing to >= 10% among those 70 years and older. Hospital admissions due to worsening condition are frequent, and are often recurrent and costly to health services [ESC Guidelines in EJHF 2012].

Due to the patients’ high age and advanced heart failure the remote monitoring equipment must be possible to use effortlessly for the patients. Since only around 20% of individuals 75 years and older use computers and Internet in Sweden [Findahl, 2011], our choice is to use other technologies than computers, tablet PCs or smartphones. Also, the equipment should be easy to install and there should be no need for fixed broadband in the patient’s home.

Digital pen technology has been evaluated in two earlier research studies in specialised homecare including palliative cancer patients in the end of their lives [Lind et al, 2008; Lind & Karlsson, 2013]. Results from these studies showed that the patients managed to handle the equipment and method in spite of severe illness and difficulties in comprehending the technology and system intervention. During the study the cancer patients participated more in their own care and had a sense of increased security. The medical records showed that there had been a swift response in the medical treatment [Lind et al, 2007; Lind et al, 2008].

During a 13 months’ period we performed a pilot study – *Health Diary for Heart Failure (HD4HF)* – at the Hospital-Based Homecare clinic, Linköping University Hospital, including patients with advanced heart failure using a similar telehealth system based on digital pen technology. The aim of the pilot study was to implement and evaluate the system and method on several levels:

- Effectiveness regarding physical outcomes (palliation of symptoms)
- Patient and family satisfaction (quality of care, participation, perceived control, technology acceptance, and usability)
- Patient self-care management and knowledge on heart failure self-care

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Methods
Developmental and implementation phase: Researchers within medical informatics, Linköping University and SICS East Swedish ICT (formerly Santa Anna IT Research Institute), together with physicians and nurses from specialised homecare in Linköping, and the software company Phoniro Systems, developed the telehealth system for the management of remotely monitoring heart failure patients in their homes. The system was implemented in clinical practice in November 2010.

Evaluation phase: The participating patients assessed and reported on shortness of breath, intake of medications, weight, blood pressure, pulse, and oxygen saturation daily. They were also able to write messages, e.g. about other symptoms. The system generated alarms if values were below/above certain limits.

Data were collected through patient questionnaires and observations, and after study completion both patient and staff interviews were performed. Study data are being evaluated during 2013 according to ease-of-use, QoL, heart failure self-care and knowledge, participation, perceived control and frequency of hospital re-admissions.

Early results
A total of 14 patients with advanced heart failure, NYHA functional class (II)III-IV, were included in the study which lasted from November 2010 – December 2011 (mean 199/median 220 days of inclusion).

The clinicians checked the system daily, and thereby prevented hospital re-admissions through detection of heart failure-related deteriorations at an early stage for all patients during the study.

Future research
Due to the good results from the HD4HF pilot study, the research group and the county council of Östergötland are planning a larger intervention study including both patients with advanced heart failure and/or advanced chronic obstructive pulmonary disease (COPD) in specialised homecare. The patients will be using digital pen technology and report on various PROMs from home.

Project collaboration
The project is collaboration between SICS East Swedish ICT and the Department of biomedical engineering, Medical informatics, Linköping University, Phoniro Systems AB, and, Linköping University Hospital. Both the hospital-based homecare clinic (LAH) and the department of respiratory medicine participate.
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The HD4HF pilot project collaborated with the EU-project Clinical continuity by integrated care, FP7 Health-2007-B. The follow up project collaborates with the on-going Vinnova project Caring for patients at home – a generalized solution based on the care of COPD patients (Vård av patienter i hemmet – en generaliserbar lösning utifrån vård av KOL-patienter), which is managed by SICS, Swedish ICT.

References


