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Digital pen-based telemonitoring of elderly heart failure patients

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Abstract and Objective

Considering that a majority of elderlies are non-users of computers and Internet we developed a telemonitoring system for elderly heart failure (HF) home care patients based on digital pen technology—a technology never used before by this patient group. We implemented the system in clinical use in a 13 months long study. Fourteen patients (mean/median age 84 years) with severe HF participated. They accepted the technology and performed daily reports of their health state using the digital pen and a Health Diary form. Via the system the clinicians detected all HF-related deteriorations at an early stage and thereby prevented hospital re-admissions for all patients during the study, implying improved symptom control and large cost savings.

Keywords:

Telemedicine; Heart Failure; Home care services.

Introduction

Still, a majority of elderlies do not use computers and internet [1-2]. This should be considered when developing telemonitoring systems involving patients with heart failure (HF) since the prevalence for HF is $\geq 10\%$ among those 70+ years old [3]. Inspired by earlier studies where patients with end-stage cancer used digital pens [4] for reporting of health status via mobile internet [5], we performed a telemonitoring study including elderly home care patients with severe HF and let the patients use digital pens when reporting.

Methods

The research group designed, developed, and implemented the system in collaboration with a company, care providers, and patients from a specialised home care unit. The system supported daily reports on shortness of breath, intake of p.r.n. medications, weight and other measurements using a digital pen and a Health Diary form. The Diary also allowed free text messages. The care provider system generated alarms if patient-reported values were below/above certain limits. Study data from observations, questionnaires, interviews, and patients' medical records is being evaluated according to ease-of-use, QoL, HF self-care and knowledge, participation, perceived control and frequency of hospital re-admissions.

Results and Conclusion

Fourteen home care patients (11 men, median/mean age 84 years) diagnosed with HF, NYHA class (II)III-IV, with 0-6

previous hospital admissions (mean 1.7/median 1) during the last 12 months were included in the study which lasted from Nov 2010—Dec 2011 (mean 199/median 220 days of inclusion). Nurses instructed the patients verbally for 30-60 minutes about the method and how to handle the equipment. All patients reported on shortness of breath, intake of p.r.n. medications and weight using the digital pen. Four of the patients also reported self-measured blood pressure and saturation. Results from questionnaires and observations showed that the patients found it easy to use the digital pen and Health Diary; they believed that the method saved their time and made contact with clinicians easier; and, they felt more secure and more involved in their own care. By daily checking the system the clinicians detected all HF-related deteriorations at an early stage and thereby prevented hospital re-admissions for all patients during the study. Since hospital care constitutes a majority of the total HF costs, a prevention of hospital re-admissions implies large cost savings. A larger controlled cohort study including both patients with HF and/or chronic obstructive pulmonary disease (COPD) using the same technology will be performed during 2013-2014.

In conclusion, the digital-pen-based HF tool was accepted and used with success in clinical care, and prevented re-admissions to hospital during HF deterioration periods. Telemonitoring of elderly HF patients does not necessarily demand that patients use personal computers or smartphones to reach an improved symptom control in specialised home care.

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