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Conference Abstract

## Development and Testing of the Intelligent Bed for Heart Failure Patients: A Feasibility Study

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## Abstract

**Introduction:** Each year, more than 3.6 million Europeans are diagnosed with heart failure [1]. In the Danish 'Teledi@log Project', telemedicine applications have been developed and tested with the goal of decreasing the high readmission rate and improving quality of life for heart failure patients [2]. A prototype of the Intelligent Bed was tested in the fall of 2013. The Intelligent Bed is a hospital bed designed with intelligent components, such as sensors indicating the patient is 'out of bed', light under bed, humidity measurement, and patient's weight. Data from the weight sensor was transmitted to a Personal Health Record that could be viewed by both the patient and by healthcare professionals from hospital and the district nursing office. Via smart phones, the district nurses could receive alarms if certain measurements

were cause for concern. An interdisciplinary team consisting of technology staff, a project nurse from a cardiology ward, two district nurses, an engineer, and telehealth researchers participated in the study.

**Aim:** To conduct a feasibility study of a prototype of the Intelligent Bed used for heart failure patients at home.

**Methods:** Two patients with heart failure participated in the study. One patient was excluded due to having a pacemaker. The other patient tested the Intelligent Bed at home for six weeks. The multidisciplinary Model for Assessment of Telemedicine (MAST) [3], which has eight domains, was applied. The evaluation of the study focused on three domains: 'Health problem and description of the application' (technical aspects), 'Patient perspectives', and 'Organizational aspects' [3]. A triangulation of data collection techniques was used comprising documentary materials, participant observation of the patient, technical and organisational issues (n=35 hours), and qualitative interviews with the patient (n=1), healthcare professionals (n=6), and managers from the bed suppliers (n=3). Data was analysed using NVivo 10. The findings were validated in a focus group interview with the patient and three district nurses.

**Findings and discussion:** The study identified technical challenges in transmitting the data from the Intelligent Bed to the Personal Health Record. The weight sensor was not accurate, as it deviated by 1-2 kilograms. There were challenges in weighing the patient in the bed and more testing is necessary to create adequate reliability in order to identify an early accumulation of oedemas. The patient showed improved physical condition, being able to adjust the bed to her swollen legs, etc. The patient also showed decreased feelings of anxiety and insecurity, because the district nurses were able to continually monitor her condition from a distance. Ethical concerns of privacy when being monitored were not identified by the patient. The patient appreciated being able to view the data in her Personal Health Record. The nurses evaluated the collaboration with the patient as beneficial for all parties, as they were able to communicate and share data with the patient via the Personal Health Record. However, a restructuring of workflows is necessary in order to achieve the benefits of having technology to support care. Technical fine-tuning and testing with additional heart failure patients is needed in order to improve the operation of the Intelligent Bed.

## Keywords

telehealth technology; intelligent bed; wireless sensors; heart failure patients

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