Conference Abstract

## M-health for long-term management of COPD

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## Abstract

**Introduction:** With the convergence of computing and communications in smart phones and computer tablets, m-health is playing an increasing role in the remote monitoring of patients with chronic illnesses. We have shown in recent trials that its use for interventions lasting up to six months improves patient outcomes.

**Aims:** The challenge now is to extend the lessons learnt from the development of m-health for short-term interventions to the long-term management of chronic illnesses such as COPD and Heart Failure, with the use of the technology fully integrated into care pathways.

**Methods:** Successful innovation in telehealth requires an understanding of patient physiology and psychology. The need for patients to self-monitor is a daily reminder that they have a chronic illness for the rest of their lives. Providing patients with multi-purpose tablets removes some of the stigma sometimes associated with dedicated telehealth equipment.

The self-management application on the tablet must be made intuitive and easy to use. The design of the human/computer interface requires an understanding of the patient's needs. Our experience in previous clinical trials of m-health has led us to design large icons with bright colours for selecting menu options or answers to symptom diary questions. Similarly, the sensor technology was selected to provide the maximum amount of information on the patient's physiological status for the least possible cost to the patient (in terms of disturbance to the activities of daily life).

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Patients are encouraged to use the m-health application each day at the time of their choice. Careful design of the question tree in the diary allows symptom information to be acquired in the shortest possible time. Patients are then asked to self-monitor with a Bluetooth-enabled pulse oximeter finger probe (Nonin, MN, USA) for 30 seconds. Artefact-free measurements of pulse rate and oxygen saturation (SpO2) are extracted using a Signal Quality Index. We have also developed algorithms to derive estimates of respiratory rate from the breathing-synchronous changes in the pulse oximeter waveform. The symptom diaries and vital sign data are transmitted automatically to a server behind the NHS firewall as the patient finishes using the COPD application on the tablet.

**Results:** Compliance for the 23 patients in our COPD cohort feasibility study has been very high. The percentage of days on which diaries have been completed is 88%: for 1189 monitoring days for the 23 patients, we have collected 1041 diaries. 865 of these have included pulse rate and SpO2 information as well as derived respiratory rate. The mean (standard deviation) values of these vital signs are: 88.5 beats/min (17.8), 93.2% (3.2) and 25.2 breaths/min (8.2). Changes in symptoms or vital signs, with respect to baseline, are more important than their absolute values. We are also gathering evidence that increased respiratory rate may be a marker of a developing exacerbation.

**Conclusion:** M-health software running on tablet technology encourages high levels of compliance with self-monitoring in patients with COPD. Patient-specific changes in symptoms and vital signs, including respiratory rate, may be precursors to severe exacerbations leading to hospital admission.

## Keywords:

**m-health, tele-health, copd, vital signs, respiratory rate**

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