

Telemetry and telecare in patients with respiratory diseases

Agoritsa Koulouri¹, RN, RMN, MSc
Zoe Roupa², MD, RN, PhD
Konstantinos Gourgoulidis³, MD

¹Health Centre of Salamina, Greece

²University of Nicosia, Cyprus

³University of Thessaly, Greece

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SUMMARY. Information technology (IT) plays a crucial role in helping health professionals improve their clinical practice, disease management, treatment strategy and patient follow-up, aiming at anthropocentric health care. Its applications include detection, surveillance, testing and patient treatment, as well as the IT education of medical, nursing and paramedical personnel. Telecare (also referred as telehealth) includes patient usage of telecommunication technology and transmission of biological data and medical signals to a health care centre for specialist consultation. The services provided are based on “smart devices” adapted to the needs of patients. Certain patient subgroups, such as the elderly and those with chronic diseases, such as asthma and chronic obstructive pulmonary disease (COPD), are in great need of continuing contact with the health care team. Introduction of IT in the primary health care (PHC) setting can improve patient access to care, and chronic respiratory diseases are a good example of telecare application. Most telecare programmes continue to be operated alongside the face to face scheduled visits. *Pneumon 2012, 25(4):415-420.*

INTRODUCTION

The utilization of technology in the health sector aims at an anthropocentric system providing patient-centred health services. The provision of such services in the primary health care (PHC) setting is based on medical observation using “smart devices” that adapt to the needs and the capabilities of the individual patient.

Upgrading of the quality of health services, while reducing their cost, is what is needed. To this end, the re-planning of the processes to be implemented in each sector can be aided by the technology of telematics, telecommunication and informatics, which creates a novel environment for working in health care provision venues.

Specific population categories have greater health needs, including people with special needs, the elderly, and people with chronic diseases such

Correspondence:

Agoritsa Koulouri

Tel: +30 6948579784

E-mail: ritsa_koulouri@yahoo.gr

as diabetes mellitus (DM), chronic obstructive pulmonary disease (COPD) and asthma. The dramatic increase in the numbers of patients with chronic diseases and their significant expense, in contrast to the limited resources of the healthcare providers lead to the need for fundamental changes in the advancement of health care.

Information technology (IT) can play a crucial role in providing health care from a distance and can help to meet the new healthcare needs of an aging population.¹

Meystre, in 2005, claimed that long-term patient monitoring in the home and the community is the most promising application of telemonitoring technology, when it comes to cost-effectiveness and quality. The results of the study of Pare *et al.* in 2007 showed that, regardless of their nationality, socioeconomic status or age, patients comply with telemonitoring programmes and the use of technology, maintaining a high level of acceptance and satisfaction with its use.^{2,3}

According to the systematic review of Ram in 2003, telemetry promotes self management of COPD and gives patients the possibility of taking part in their own care and being able to respond quickly in the case of deterioration. In addition, tele-observation can offer support to patients staying in the community, with "healthcare at home" and it reduces the frequent hospital admissions of patients with COPD.⁴

Health services and telemetry

The term «healthcare provision» encompasses a plethora of people, organizations and conveyed information. It includes patients, doctors, nurses, technicians and health officers, infrastructures, health institutions and companies related to the medical devices, IT and health sector training.

The link between the various organizations involved is the information that needs to be conveyed directly and accurately, in order to facilitate the cooperation between the organizations and to promote appropriate decision making.¹

Telemedicine systems constitute a web-based new generation of automatic measurement and wireless transmission of biological signals that includes:

- The electronic medical record, which is a web-based application installed on a central server so that all users can access it.
- Software that sends and receives medical signals, which is installed in the online access to the end-users, in order for them to be able to send the medical examinations and receive direct the opinions of health care professionals.

- Software user authentication that allows authorized access to the information in the computer file.⁵

The implementation of programmes of tele-health and tele-observation from a distance, thanks to the rapid breakthroughs in technology, is creating new standards but at the same time the sensitive nature of health care needs to be maintained and the quality of life of the patients must be preserved.¹

Telehome care

Telemedicine is defined as the direct provision of clinical care, including diagnosis, treatment and advice, via telecommunications, to a patient in a remote setting⁶. Among the basic fields of health care in which IT is applied are telemedicine and health care at home.

The observation of patients at home from a distance involves an automated procedure for the transfer of data describing the status of the patient's health from the patient's home to the facility of the healthcare provider³.

McLean *et al* in 2009 stated that telehealth care includes, but is not limited to, the concept of telemedicine, which describes the modern relationship between the doctor and the patient via data transfer through the internet or a video call⁷. Such technology can take a variety of forms, such as web-based applications, mobile phone connection, dial-up networking and video conversation between the patients and doctors, and a combination of these applications⁸⁻¹¹. The use of technology (specifically, telemonitoring) constitutes an excellent management tool for chronic diseases and a method of observation and provision of health care for patients living in remote areas, and it contributes to the process of evaluation and diagnosis by medical specialists¹².

Tele-healthcare at home opens up many possibilities for the improvement of patient access to health care and health provision¹³⁻¹⁵. The studies of Bondmass *et al* in 2000, Kobb *et al* in 2003 and Bratton *et al* in 2001 underline the scope, the safety and the clinical benefits of telehome care¹⁶⁻¹⁸. The studies of Jennett *et al* in 2003 and Hailey in 2001, which included reports on tele-homecare, pointed out the many advantages derived from technology, such as improved access to health care, better quality of health care and enhancement of the quality of life of patients^{19,20}.

The introduction of technology in PHC to the healthcare providers can improve patient access to health care, but most tele-health programmes are still functioning in combination with programmed home visits by the family doctor¹⁴. In spite of the promising results that have been

documented and the technological progress that has been achieved in many sectors of tele-health, tele-home care included, this technology has not yet been widely introduced in the provision of PHC²⁰⁻²³.

The management of patients' diseases via telemetry systems fulfils 3 requirements (Figure):²⁴⁻²⁷

- the translocation of health care into the community
- the use of technology as a solution to the problems of health care, and
- the self management of the disease by the patients themselves.

Bowles *et al* reported in 2002 that the use of tele-

homecare can reduce hospital re-admissions, improve the health status and promote the overall self management of patients with chronic diseases. Bowles' study indicated a high level of acceptance and usage on the part of the patients and concluded that this technology is appropriate for the PHC of vulnerable groups and the elderly²⁸.

Jennett *et al*, in 2001, suggested that 5 basic factors contribute to the successful implementation of telemedicine systems²⁹:

- preparedness and training of patients and healthcare providers
- systematic analysis of demands

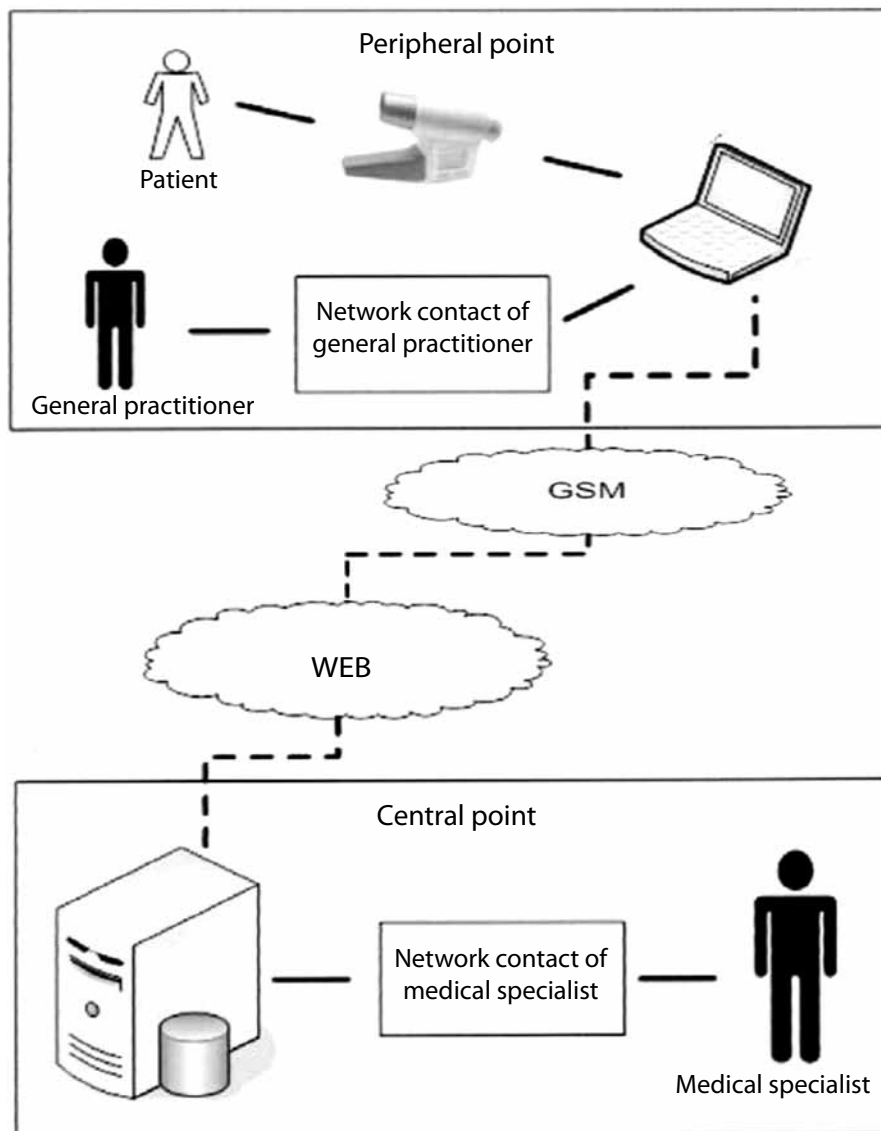


FIGURE 1. Design of the telemedicine system.

- gradual implementation
- interfacing
- programmed evaluation of the system.

Breakthrough applications could include the embedding of tele-homecare data into electronic medical files, interfacing with other healthcare providers, extension of telemedicine applications to the PHC and the introduction of comfort care, support and self management of patients in their community.

Tele-health care and the management of chronic respiratory diseases

Caring for patients with chronic diseases of the respiratory system, such as asthma and COPD, is expensive and constitutes a significant problem that contributes to the exhaustion of healthcare resources at local and international levels³⁰. Respiratory diseases such as asthma and COPD incur a high annual hospitalization cost for National Health Systems, including direct and indirect costs³¹. Increase in the numbers of patients with respiratory disease and the progression of the disease force those responsible for planning and implementing healthcare policies to look for new, cost-effective solutions of providing optimum health care. IT applications can make possible the provision of health care from a distance with the introduction of tele-homecare. A series of systematic reviews has been conducted to investigate the use of technology for managing respiratory diseases^{3,32}. Guidelines have been issued for asthma and COPD which are the basis for the implementation of technological interventions in the context of PHC^{33,34}.

For patients with COPD, exacerbations are frequent, but many are never reported, while some patients go straight to the hospital emergency department for treatment^{35,36}. Exacerbation is one of the greatest fears of patients with COPD³⁷ and there is evidence showing that 1/3 of patients with exacerbation are re-admitted to the hospital within 8 weeks³⁸. Tele-homecare has been used effectively for the management and observation of many chronic diseases including respiratory diseases, and specifically COPD^{2,39,40,41}.

Asthma, COPD and lung transplant are some of the medical conditions that have been studied in relation to telemonitoring^{42,43,44}. These are diseases that demand the training of patients in self-management, and good observation in order to achieve the best possible results and prevention of exacerbations and complications^{45,46}. Tele-observation is an alternative solution for monitoring patients with these conditions and ensures the timely

transmission of clinical data⁶³ and immediate medical intervention for minimizing complications^{47,48}.

The Vontetsianos *et al.* 2005 survey, which included home visits to patients by a nurse with wireless medical equipment, reported a resultant reduction in hospitalization time, emergency visits and use of health services by the patients and even improvement in their self-management⁴⁹. Mirou's 2009 study reported a positive response of patients with regard to their acceptance of telemedicine systems. For patients who had undergone lung transplantation, telemonitoring helped in the early detection of organ rejection and subsequent therapeutic intervention, and also in the diagnosis of complications related to their general state of health. Identification of the early signs of deteriorating health of the patients, and control of acute exacerbations by including reminders and alarms (activated when the measurements are extreme) in the monitoring systems is of utmost importance. The use of complex processes, however, has been associated with poor compliance, while user-friendly systems contribute to good compliance and acceptance on the part of the patients⁵⁰.

In the De Toledo *et al.* 2006 study, patients in an intervention group could contact the care team at any time through a call centre, while the care team had rapid access through a web-based management unit to the electronic records of the patients. The results of this annual intervention showed that integrated home telemedicine can support patients with chronic conditions, and improve their health⁵¹. In addition, Bourbeau *et al* in 2003 and Vitacca *et al* in 2009 claimed that the implementation of tele-healthcare in patients with COPD lowered their number of exacerbations and hospital admissions^{36,52}.

CONCLUSIONS

The transition from treating acute disease to managing chronic diseases requires fundamental changes in the organization and provision of health care, and the providers of health care to patients with chronic disease must continuously evaluate their approach and make new decisions. The services provided in the integrated IT programme of health care are web based and depend upon staff training, better management of demographic data and the enhancement of patient self management in a community of wireless interface between the healthcare professionals and the patients.

Operation of a tele-health care system as part of a wider

home based care system can provide a connection point between family doctors, primary healthcare professionals, nurses, support personnel and caregivers and pharmacists, and the hospital specialist medical personnel. The training of the patients, preparedness of the healthcare provision team, personalized support, good technological backup and effective communication are the basic elements of IT healthcare applications.

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