Home Telecare for the Management of Chronic Disease

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Abstract: We present a home telecare system for the management of chronic disease as an example of the use of integrated information technology for chronic disease self-management. We also report briefly on the outcomes of a clinical trial of patients located in Sydney and Wagga Wagga, which demonstrated a high level of user compliance and satisfaction. A clinical case study is discussed that demonstrates how early identification of adverse trends in clinical signs recorded in the home can be effective in either avoiding hospital readmission or reducing the length of stay.

From our studies and evidence in the literature, we conclude that home telecare supported by multidisciplinary care teams, can promote the development of partnerships between the patient and the care giver, facilitate patient self management, improve compliance with regards measurement and medications taking. Our work also supports the thesis that patient management through home telecare services will improve patient health outcomes.

Introduction: Although chronic disease now accounts for 70% of health expenditure [1], health systems have been slow in changing their focus from managing acute disease (infections and injury) to managing chronic disease, which by its nature is home or community based, requires continuity of care and must be managed by the patient in partnership with a multidisciplinary care team. These characteristics make home telecare an excellent of application for e-health.

A recent report funded by the USA Food and Drug Administration (FDA) specifically identifies home- and self-care as one of the primary developments projected to dominate the evolving medical-device landscape over the next decade. The home telecare market in the USA alone was between $12-20 billion in 1999 and is expected to reach $66 billion by 2003 [2]. Also in the USA, home healthcare has been identified as the fastest-growing healthcare delivery sector [3].

Although pressures for efficiency in healthcare delivery are major motivators for rapid development of home- and self-care products in the USA [4], the move towards telecare in Europe and the UK [5, 6] are being driven by the acceptance that national health services have a responsibility to manage the needs of an ageing population [7] despite a declining work force.

American statistics demonstrate that 80% of all deaths and 90% of all illnesses are attributed to chronic disease at a cost of $470 billion per annum (1995) [8]. These demands will increase as the population ages. Australian statistics and trends mirror the American situation with CHF and Chronic Obstructive Pulmonary Disease (COPD) constituting a large proportion of the Australian health care expenditure. For example, COPD is the fourth leading cause of death in Australia and a significant cause of morbidity. It consumes $2.5 billion (8%) of Australian health expenditure and accounts for 8% of deaths [9].

We present a Home Telecare System (HTS) that was successfully deployed in city and rural Australia for a period of six months [10]. A brief précis of patient and clinician acceptance and system usability is presented, along with a sample case study to demonstrate the potential of this technology for more effectively managing chronic disease.
Figure 1. The prototype HTS shows the home clinical workstation system unit in the background with ECG panel and electrodes in the foreground. Placed on the ECG panel is the blood pressure cuff, spirometry unit and temperature probe. The system unit incorporates an RF receiver to acquire ambulatory data from a pager-sized, belt-worn, triaxial accelerometer. The same ambulatory unit incorporates an alarm button that can be used in the case of medical emergencies.

Methodology: Patients in the study were provided with the technology shown in Figure 1. The Home telecare system (HTS) comprised a home clinical workstation, a wearable ambulatory monitoring unit, a home personal computer (PC), a 56 kB modem and access to the Internet. The home PC interface was specifically designed for ease of use, even by elderly and frail patients, with features including a graphical user interface whereby all functions are accessed via large graphical icons on the screen. The patient’s doctor can fully control the scheduling of all measurements (including questionnaire delivery). There is the facility to manage medications remotely over the Internet.

This system was successfully trailed with a small population of 22 patients located in the Sydney area and in Wagga Wagga, a rural centre 400 km southwest of Sydney. Patients were selected as having a primary diagnosis of CHF or COPD and having been hospitalised for that condition in the previous year. Participants were asked to complete initial, follow up and final evaluation questionnaires. Patients were monitored for a period of three to six months.

Results:

Questionnaire Responses
A summary of patient responses (N=22) to the evaluation questionnaire follows. All patients (100%) found the HTS easy to use.

- 94% of patients were satisfied with the HTS.
- 75% rated the home telecare system as either Very Good or Good and 19% Adequate.
- 75% either Strongly Agreed or Agreed that the home telecare system can play an important role in managing their health.
- 69% Agreed that the home telecare system gives them more control over managing their health while 19% Disagreed.
- 94% of patients used the HTS system at least once a day.
- 87% of patients reported few or no problems with the operation of the HTS.
- 87% of patients agreed that use of the HTS gives them extra piece of mind
- 75% of patients were not concerned that the confidentiality of their health information was threatened.
- 94% of patients wanted to continue using the home telecare system on a regular basis.
Figure 2. The three panels depict heart rate (bpm), lung function (FEV1 and FVC in litres) and weight (kg) for the patient over a six-week period. The steady increase in heart rate and weight with a decline in respiratory reserve demonstrates a potentially serious degeneration in the patient’s health.

With regard to clinician perceptions, 93% stated that they were either very satisfied or satisfied with the system, while 7% were neutral. 67% stated that they would like to continue to use the home telecare system on a regular basis, whilst the remainder was undecided.

Case Study
Mrs BB was a 58-year-old woman living in Wagga Wagga who had a history of multiple infective exacerbations of COPD. She had been diagnosed with severe emphysema relating to her heavy smoking history. She was enrolled into the telecare trial and automated monitoring of her lung function, temperature, heart rhythm, weight and blood pressure was conducted and reviewed regularly by her GP. Figure 2 demonstrates the trends for key measurements performed by Mrs BB over six weeks, commencing from a date very close to her discharge from hospital. During this period of home monitoring, there was a changing trend in her measurements (increased heart rate – the raw data showing an obvious sinus tachycardia, decreasing respiratory reserve (FEV1, FVC), increased weight due to fluid retention). The GP was alerted to these results. The patient was then contacted and it was discovered that she was indeed acutely short of breath. As a result, the patient was readmitted to hospital for two days after being diagnosed with lung infection and heart failure.

This case study illustrates a real-life example of home monitoring assisting in the medical management of a patient with chronic disease by identifying earlier a deterioration in health status, thereby avoiding subsequent morbidity, and also assessing treatment progress. In this instance the intervention was a manual examination of the data by our clinical project director, who then initiated action to ensure the patient’s medical condition was further investigated.

Discussion: The trial has demonstrated a high level of patient compliance and satisfaction that did not diminish over time. The care team, based on the severity or progress of the patient’s symptoms can schedule a range of clinical measurements remotely. These are carried out by the patient in his or her own home and become immediately available to members of the care team on their own computers using a simple browser.

Although the clinical trial was not intended to assess health care outcomes or demonstrate cost-benefits, case studies demonstrated that clinically significant adverse trends in patient data could be identified and used effectively to better manage the patient’s condition. Our work supports the evidence in the literature that management of chronic disease with home telecare will reduce hospital readmissions. Similarly, evidence in the literature does lend support to the thesis that home telecare is cost effective. In a UK report on Technologies for Telecare in the Home [11], the authors concluded that for a typical Community Health NHS Trust, 15% of home visits could be replaced with telecare, saving £1.26 million per annum in the first year after accounting for establishment and operating costs. A retrospective review [12, 13] of home nursing visits in the UK similarly
suggested that between 14-16% of these visits could be replaced via telecare services. A similar and very comprehensive study in the USA concluded that 46% of all activities carried out by on-site nursing could reasonably be replaced by tele-nursing [14].

Studies on the cost effectiveness of home telecare are most compelling for chronic disease. Even as far back as 1988 Capone et al. [15] reported on a trial of 1004 post infarct patients using trans-telephonic cardiac surveillance. They found that more than 58% of patients presented with a range of new complex ventricular ectopics and arrhythmias. A highly significant relationship was found between detection of these new events and a three-fold increase in mortality. More recently, a study [16] of patients with chronic disease in the USA demonstrated savings of over $8,000 per patient arising from a reduction of costs from $100 for conventional visits to $15-40 for telecare services. In another study [17] on cardiac rehabilitation for congestive heart failure (CHF) in the home, a 74% reduction in readmission rates was demonstrated at 90 days.

From our own studies and evidence in the literature it is probable that home telecare supported by dedicated multidisciplinary care teams, can promote the development of partnerships between the patient and the care giver, facilitate patient self management, improve compliance and medications management and reduce the readmission rate for patients with chronic disease.

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References