Abstract – An overview of the system architecture of a home telecare system (HTS) that was successfully deployed in city and rural Australia is presented. We describe a case study from a patient with chronic obstructive pulmonary disease who was monitored in her home for a six-month period. A summary of patient and clinician responses to initial and final evaluation questionnaires is presented. There was generally a high level of acceptance of the HTS with both patients and their general practitioners responding favorably on its ease of use, effectiveness and likely impact on improving management of chronic disease.

Keywords – home telecare, chronic disease, Internet, home monitoring

I. INTRODUCTION

Home telecare can be broadly defined as the use of information, communications, measurement and monitoring technologies to evaluate health status and deliver health care services to the home from a distance [1,2].

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. Also in the USA, home healthcare has been identified as the fastest-growing healthcare delivery sector [3].

An obvious application of home telecare is in the active management of chronic disease. 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) [4]. These demands will increase as the population ages. Australian statistics and trends mirror the American situation with Congestive Heart Failure (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 [5].

We present a Home Telecare System (HTS) that was successfully deployed in city and rural Australia for a period of six months [6]. 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.

II. METHODOLOGY

Patients in the study were provided with the technology shown in Fig. 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 Web.

This system was successfully trialed 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.
III. RESULTS AND DISCUSSION

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. Fig. 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.

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 18.8% Adequate.
• 75% either Strongly Agreed or Agreed that the home telecare system can play an important role in managing their health.
• 87% 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
With regard clinician perceptions, 89% stated that they were either very satisfied or satisfied with the system, while 11% were neutral. 67% stated that they would like to continue to use the home telecare system on a regular basis, whilst the remainder were undecided.

IV. CONCLUSION
A comprehensive home telecare system has been developed and trailed on a representative population of patients suffering from CHF and COPD. The usability, functionality and effectiveness of the system was demonstrated from both patient, clinician and operational aspects. The six-month monitoring undertaken in this trial was too short to allow an effective and detailed evaluation of health care outcomes and cost benefits of the clinical trial given the long-term and multifactorial etiology of chronic disease. However individual case studies and evaluation of user perceptions suggest that this home telecare system could have a profound impact on the active management of complex and chronic disease.

V. REFERENCES

Fig. 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 in December 2001. The steady increase in heart rate and weight with a decline in respiratory reserve demonstrates a potentially serious degeneration in the patient’s health.