

# **COPD in Scotland: the possible roles for Telehealth**

Dr John Haughney

Dr Iain Small

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## ***Executive summary***

COPD is a common chronic condition, to some extent ignored for many years but recently the subject of considerable academic, clinical and organisational interest.

Telehealth is the use of technology to aid communication in the practice of medicine and thus to support, and hopefully improve, the interaction between a clinician and his or her patient.

The current evidence base supporting the use of telemedicine in COPD is limited. However, a considerable number of projects addressing the management of people with COPD using telehealth technology are ongoing in Scotland and elsewhere. Most seek to identify episodes of deterioration in a patient's condition and then to respond with appropriate interventions or support for the individual. The instigation of a national programme of this type is appealing for both patients and, potentially, the NHS in Scotland. The scoping-out of the design of this prospective service could run in tandem with the current projects to allow early and widespread adoption.

There is also a need to offer support to health care workers in Scotland involved in these projects; at the very least to allow the sharing of ideas and best practice.

A national conference on telehealth in Scotland (to include COPD) is now appropriate, with subsequent (tele)communication solutions to inform and link interested individuals and groups.

Apart from smoking cessation, pulmonary rehabilitation is the most effective non-pharmacological intervention in the management of COPD and has a strong evidence base to support its use. Geographical and physical barriers can prevent the participation of some patients in a full programme. We believe that telehealth could play a useful role in helping to deliver this useful service to a wider range of patients with COPD in an equitable way. It is proposed that pilot studies be developed to test this hypothesis.

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## **Introduction**

### **The project**

The Scottish Centre for Telehealth (SCT) is interested in exploring the possible use of telehealth in the management of COPD in Scotland. The evidence base supporting the use of telemedicine in COPD is limited. A literature review to identify the evidence base to support proposals is attached at Appendix A.

This report:

- Collates key reported studies
- Details the COPD telehealth projects known to be ongoing in Scotland, with examples of ongoing studies from elsewhere
- Introduces, examines and proposes options for the use of telehealth nationally to help with the management of people with COPD in Scotland.

### **What is telehealth?**

Telehealth is the practice of medicine by means of communication technology, where the clinician and patient are not in the same place and sometimes not present at the same time. The technologies used include telephone and videoconferencing for real-time consultations, and email, fax, voicemail, SMS texting and the use of web-servers in other situations. Telemedicine is not a new concept; the telephone, for example, has been used by clinicians and patients for years. Communication is part of the art of medicine and adapting to developments and trends in communication techniques and technologies can be considered as important as utilizing new medicines or diagnostic techniques. Obviously, developments and advances in clinician-patient communication need to demonstrate safety, efficacy, effectiveness and costeffectiveness.

## Telehealth and COPD: published reports

The SCT maintains a modest database of telemedicine related studies. <sup>1</sup> A Dutch study employed a home-based telemonitoring device, the Health Buddy (HB). The HB provides daily symptom-surveillance by a case manager and education to enhance disease knowledge and self-management. 115 patients were enrolled. Compared with the control group, the HB group showed a significant decrease in hospital admission rates and number of exacerbations. No significant changes in Health Related Quality of Life were observed. The authors conclude that “telemonitoring in everyday clinical practice is feasible and can substantially improve care and decrease healthcare utilization of patients with moderate to severe COPD.” <sup>2</sup>

Eighteen well motivated patients with advanced chronic obstructive pulmonary disease, who had been hospitalized on at least four occasions during the previous two years, were included in a home-based telemedicine study <sup>3</sup>. A visiting nurse was equipped with a case containing a laptop computer and a number of medical devices, including an electrocardiogram, spirometer, oximeter and blood pressure monitor. It also contained a videoconference camera, for realtime audiovisual connection with the hospital using the patient's TV set. A single ISDN line was installed in each house before the study began. After nine months, there was a decrease in hospitalizations, emergency department visits and use of health services. The patient's disease knowledge and self-management also improved. Although the authors conclude that, “it seems likely that adopting telemedicine in everyday clinical practice could substantially improve the care of chronically ill patients”, in the absence of a control group, given the number of interventions employed and the characteristics of the study population, it would seem reasonable to conclude that “more studies are required”.

Duschek et al report a Bavarian study (in German) using “continuous monitoring” in patients’ home surroundings. In this study, patients “self assess their lung function” and transmit it to a service centre. They receive telephone counselling. Although it appears that the study was designed to “reduce exacerbations”, the report focuses on a reduction in symptoms but reports no improvement in quality of life <sup>4</sup>.

This study emphasises some key issues on structure, process and outcome. Firstly, there is a great deal of concern about the validity of self-reported lung function testing. Secondly, there is a poor correlation between lung function (the “intervention”) and symptoms (outcome reported) in COPD. Thirdly, COPD is, by definition, predominantly a fixed disease. How much room for improvement in symptom score and quality of life is possible using the measures employed?

An updated literature search (December 2008) identified a number of other papers concerning telemedicine and home telemonitoring in COPD (see Appendix A). These are summarised below.

## Summary of clinical trials of telemedicine in COPD

Author	COPD patient numbers	Technology (connected by PSTN unless otherwise stated)	Comment
Dale et al., 2003	55	Home unit for pulse rate and oximetry	Pilot trial (no control group). Some evidence of reduced hospital admissions
Dang et al., 2006	17	In-home messaging device (Health Buddy)	6-month before-after study (no control group). Some reduction in hospital beddays (NS)
Demiris et al., 2003	3	Videophone	Pilot trial (no control group). 122 video visits reviewed (3 COPD patients plus 7 others). Minor technical problems.
de Toledo et al., 2006	67 intervention, 90 control	Home laptop unit connected by ADSL; spirometry	Significant reduction in hospital re-admissions
Di Re et al., 2000	67	Home telemetry	Significant reduction in hospital admissions; improved compliance
Finkelstein et al., 2006	7 (video intervention), 11 (video + monitoring intervention), 7 control	Home unit with videophone and monitoring (BP, spirometry etc)	Better outcomes and lower costs in the two intervention groups (?not significant)
Lamothe et al., 2006	82 (COPD or hypertension or heart failure or diabetes)	Home monitoring unit for BP, temp, oximetry	Qualitative study (no control group). Positive (qualitative) results for patients and caregivers; patients were satisfied.
Liddy et al., 2008	5	Home unit for monitoring BP, oximetry etc	Feasibility study (no control group). Patients and staff satisfied
Maiolo et al., 2003	20	Home unit for monitoring heat rate and oximetry	12-month before-after study (no control group). Significant reduction in hospital admissions; significant reduction in acute home exacerbations
Mair et al., 1999	6	Videophone	Pilot trial (no control group). Some technical problems.
Nguyen et al., 2005	16	Internet education plus monitoring, inc spirometry	3-month before-after study (no control group).

			Significant improvement in dyspnoea
Pare et al., 2006	19 intervention, 10 control	Web phone plus spirometry monitoring etc	Fewer home visits, lower hospital costs in intervention group. Lower overall cost of care in the intervention group (?significant).
Petty et al., 2006	72 (intervention A), 69 (intervention B), 73 control	Customised videotapes (A) or standard videotapes (B) of Pulmonary rehabilitation exercises	Improvement in quality of life, a reduction in fatigue, and an increase in exercise compliance with the custom videotape intervention.
Rice et al., 2004	15	Home telemetry unit	Trial in progress
Roberts et al., 2007	22	Telephone consultations	Telephone consultations were an effective alternative to traditional consultations in one-third of respiratory patients attending for hospital follow-up.
Trappenburg et al., 2007	59 intervention, 56 control	In-home messaging device (Health Buddy)	Significant decrease in average hospital admissions and in exacerbations in the intervention group
Vitacca et al., 2006	17	Home monitoring of pulse oximetry	Feasibility study (no control group).
Vontetsianos et al., 2005	18	Home videoconferencing plus spirometry etc. ISDN line to the home.	9-month before-after study (no control group). Fewer hospitalizations, ED visits after intervention; disease self-management also improved
White et al., 2007	312 tests	Email	Remote reporting of primary care spirometry was feasible and useful
Whitten & Mickus, 2007	83 intervention, 78 control (COPD and/or CHF)	Videoconferencing and vital signs monitoring	Patients felt comfortable in using the devices and with videoconferencing; similar QOL scores in both groups

Not all studies are conclusively positive in terms of outcomes <sup>5</sup>, procurement, staff training and capacity <sup>6</sup>. Measured benefit could be “offset” by an increase in, for example, telephone contacts <sup>7</sup> but whether this measure is a marker of better or worse outcomes has not been debated. The British Thoracic Society's Guidelines for Hospital at Home 2007 <sup>8</sup> conclude “there is insufficient evidence to justify setting up telemetry for Hospital at Home at present”.

## ***COPD challenges in Scotland***

### **The impact of COPD**

COPD is a common chronic condition that was ignored by health care thinkers for many years on the grounds that little could be done for those with the disease. There is no known “cure” and the progression of the disease probably cannot be halted except through cigarette smoking cessation. Broader thinking around the goals of treatment (quality of life, improvements in activities of daily living, reductions in exacerbations), together with further research and treatment options over the last ten years have re-generated clinical interest. Simultaneously, recognition of the burden COPD causes to individuals and health care systems has directed greater interest in the condition.

There are thought to be about 100,000 people in Scotland living with COPD with a predicted increase in prevalence of 33% in 20 years. It is the third most common reason for hospital admission in Scotland. In 2003/2004, 19% of patients admitted to hospital with COPD were readmitted once more and 16% at least twice more <sup>9</sup>. Scotland has many of the highest localities for COPD admissions in the UK <sup>10</sup>. Audit Scotland has estimated the direct cost of COPD to the NHS in Scotland to be around £100 million per annum <sup>9</sup>.

In keeping with national policy, Managed Clinical Networks (MCNs) are being developed in the geographical Health Boards and this process is nearly complete. Central Government has encouraged, and to some extent supported this. The British Lung Foundation (BLF) Scotland is a very strong and successful lobbyist on this matter. NHS Quality Improvement Scotland has agreed to develop Standards for COPD, to address related matters and has appointed a Medical Advisor.

### **The management of COPD in context**

As is often the case, COPD presents with a spectrum of disease ranging from very mild to very severe and end stage. There is a particular issue around identification: it is thought that many people with the disease do not come forward because of guilt (“it’s because of my smoking, it’s just my own fault”), because of a failure to recognise their symptoms as abnormal (“it’s just a smoker’s cough”), or because of a fear of the outcome of a consultation (STOP SMOKING!). The BLF describes this group as “the missing millions”. Confirmation of diagnosis relies on the provision and interpretation of spirometry. Scotland has many examples of excellence in this field, but its provision is neither universal nor consistent.

Most patients with COPD are managed in the community by GPs and their Practice Nurses. Scotland has a commendable record of staff education in this area, but again this is patchy. MCNs help to co-ordinate the roles of all health care practitioners.

There is an increasing acceptance that COPD is not just a disease of the lungs. Higher than expected incidences of, for example, heart disease, osteoporosis and depression are noted in those with COPD. People with COPD may have deconditioning, loss of muscle bulk, nutritional issues and, of course, given the demographic of the population, many concurrent medical conditions (e.g. arthritis, vision problems, dementia). It is a condition that lends itself to a holistic approach to health care, provided by a variety of health care professionals. Finally, there is an increasing awareness of the need to provide end-of-life support to people with COPD in the way this is currently available to people with cancer.

## **Features of COPD management**

Health communities and patients face a range of challenges in managing the impact of COPD in Scotland. Solutions to these challenges will incorporate the work of general practices (through the Quality and Outcomes Framework, QOF), community pharmacists (new pharmacy contract), Out of Hours organisations, hospital specialist services, health promotion and public health departments, charities, professional education bodies and MCNs. Telehealth has already been identified as offering support and solutions to some of these challenges.

Some of the key challenges are:

- Initial assessment and diagnosis
  - Spirometry
- Treatment
  - Smoking Cessation
  - Vaccination
  - Pulmonary Rehabilitation
- Monitoring and case management
  - Oxygen
- Patient education, self management and guided intervention
  - Exacerbations

### **Spirometry**

Objective evidence of (fixed) airways obstruction confirms the diagnosis of COPD. This is identified using spirometry. Spirometry can be performed “by any health care worker who has undergone appropriate training.....”<sup>11</sup>. There are issues around training, consistency equipment, logistics and staff time. A variety of models are currently in evidence in Scotland.

There is considerable debate as to how this can best be undertaken in Scotland. Potential problems include:

- Possible differences in approach between diagnosis and review
- Accessibility and availability for all patients
- Equipment maintenance and calibration
- Agreement and consistency of use of definition of interpretation of results
- Quality assurance (consistency of operator/patient)
- Quality Control (consistency of equipment)

### Smoking cessation

- COPD is a condition that is almost always, in the UK, associated with cigarette smoking. Giving up smoking is the most valuable element in the management of COPD. NHS Health Scotland \* and ASH Scotland \* monitor and drive attempts to reduce smoking across the population. People with COPD should be considered a special target group. All Health Boards provide stop smoking services.

[http://www.canstopsmoking.com/Local\\_Stop\\_Smoking\\_Services.htm](http://www.canstopsmoking.com/Local_Stop_Smoking_Services.htm)  
(Health Scotland). This issue is well addressed elsewhere.

### Vaccination

A recommendation of vaccination against both pneumococcus and influenza for people with COPD is national policy.

<http://www.healthscotland.com/topics/health/immunisation/index.aspx>

There is evidence to suggest a reduction in both hospital admissions and death for those immunised <sup>12</sup>.

A well coordinated vaccination programme already exists.

### Pulmonary rehabilitation

Apart from smoking cessation programmes, pulmonary rehabilitation (PR) is the most effective and cost effective non-pharmacological intervention <sup>13</sup>.

PR is a multi-disciplinary programme of disease specific education, together with a programme of physical exercise. In addition, patients receive a more holistic assessment of the impact of their disease on their physical, psychological and social well-being. The exercise programme is designed to reverse the process of deconditioning discussed previously, and to enhance the power and endurance of respiratory musculature in particular. Achieving this over a minimum period of 12 weeks has been shown to result in a range of health improvements, including improved exercise tolerance <sup>14</sup>, health related quality of life, exacerbation rate, long-term effectiveness of pulmonary

rehabilitation in patients with chronic airway obstruction <sup>15,16</sup>, and length of hospital stay <sup>17</sup>. There is an increasingly robust evidence base for providing PR for all patients with COPD beyond a moderate level. Although PR can be delivered in a range of different environments, as yet there is no standard prescription for a Pulmonary Rehabilitation programme, in terms of exercise content, education content or duration of course. PR can be delivered both in hospitals and in the community, and even in the patient's home. As such, rehabilitation service development lends itself to the diversity of both communities and geography in Scotland.

## Oxygen

Domiciliary oxygen is helpful for those with more severe disease satisfying certain criteria, and will prolong survival in such patients <sup>18</sup>, but needs well considered systems and management. Oxygen use in the community may broadly be categorised into three patient groups:

- Those with a requirement for Long Term Oxygen Therapy (LTOT); usually for a minimum of 15 hours per day <sup>19</sup>
- Those requiring short burst therapy (about which there is currently considerable debate)
- Those being treated palliatively

Initial assessment of patients, together with ongoing monitoring is time consuming and difficult, for clinicians and patients alike. Patient safety is important, both from the risk of combustion and the potential harmful effects of high flow oxygen on patients with carbon dioxide retention. New guidelines on the use of oxygen in the acute setting have just been issued <sup>20</sup>.

## Exacerbations

Exacerbations of the disease are important. They can be defined (as is usual for clinical trials) as episodes requiring medical intervention or, from a patient perspective, as episodes when the symptoms (breathlessness, cough and sputum production or colour) deteriorate beyond the normal daily variability. COPD exacerbations are major life events. They are associated with hospitalisation, step decreases in quality of life <sup>21</sup>, economic burden <sup>22</sup> and mortality <sup>23</sup>. Their impact is underestimated by health care professionals <sup>24</sup>. Consequently, their prevention or reduction provides a useful target for management interventions. It is important to understand the relationship between physical conditioning and exacerbations, both in terms of the positive influence good conditioning has on exacerbation frequency, and on the individual's ability to recover, and recover quickly.

Although it is recognised that most exacerbations of COPD managed in the community, and indeed those resulting in hospital admissions, are isolated

'unexpected' events, there are a small group of patients who suffer multiple, recurring episodes. It may be that these patients have a set of characteristics which increase their likelihood of hospital admission. These include:

- severity of disease
- social / home care difficulties
- sub-optimal treatment (including concordance/compliance issues, inhaler technique)
- poor perception of symptoms of impending or early intercurrent illness
- co-morbid conditions

Recent audit data from NHS Grampian reporting frequency of exacerbations of COPD for individual patients suggests the following:

One admission per year 52%

3 or more admissions per year 27%

5 or more admissions per year 12%

15 or more admissions per year 0.05%

Although representing a small percentage of overall COPD admissions, those patients suffering multiple admissions are at significant personal risk, and have a significant resource implication for the service.

One intervention to help address this problem is case management.

Traditional case management involves regular visits to "at risk" patients by either a member of the primary care / community team, or a dedicated member of the secondary care respiratory team reaching out into the community. Both models have been described in the literature <sup>25</sup>.

## **The roles for telehealth in COPD**

Some key spheres in the COPD patient's pathway are listed above. Future research on a role for telehealth in COPD should evaluate its potential role in these areas.

## **Diagnostic support**

The primary care community has a key role to play in the identification and diagnosis of patients with COPD. The use of spirometry is central to this. The provision of diagnostic spirometry services across Scotland is variable, the quality is probably patchy and the delivery is under review in many areas. Different community settings may require different approaches. Centralised reporting systems have been developed using equipment/software packages

such as Vitalograph Spirotrac. Pulmonary function data can be encrypted and transferred to a web based data management system, allied to expert opinion. This opinion is rapidly returned to the peripheral operator, and comprises both a technical quality assessment and a clinical opinion.

Such a system has now become established in the performance of standardised spirometry as part of a clinical trial protocol, and indeed Nextrials and Vitalograph market the tool for this purpose <sup>26</sup>. We have no knowledge of this system being used in clinical practice, but the technology has the potential to transfer to this environment.

## **Smoking cessation**

This important area is not addressed in this report.

## **Vaccination**

Comprehensive information technology systems are in place and, in general, run well.

## **Patient “self-management” augmented with central support**

In seeking to reduce the impact of COPD exacerbations on individual patients and health economies, health professionals have a range of options, from those that provide “minimal intervention strategies” for large numbers of people, to those involving complex interventions for individual patients. Supported self-management aims to achieve small levels of change which have significant impact due to the large number of patients involved.

This remote identification and notification of a worsening of the patient’s health status and consequent advice on appropriate intervention is an area of particular interest to many clinicians interested in the use of telehealth in the management of COPD. The concept of “self management”, where patients make therapeutic, behavioural, and environmental adjustments in accordance with advice from healthcare professionals is well established for many diseases, notably in the management of asthma. Written, personalised asthma action plans have been shown to improve a variety of health outcomes for people with asthma <sup>27</sup>. These plans are concerned with guiding responses to day-to-day variations in symptoms and signs, with a view to reducing symptoms and avoiding or minimising the severity of exacerbations. Unlike asthma, COPD has been thought of as a condition with static symptoms and treatment and therefore less attention has been paid to patient self-management.

What work has been published has a greater emphasis on patient education, exercise or management plans aimed specifically at the self-treatment of exacerbations <sup>28</sup>. What little evidence there is would suggest that self

management plans in their traditional 'reactive' format are not effective for patients with COPD <sup>29</sup>.

The impact of COPD on the individual, and his/her risk of exacerbation is widely variable, and to some extent unpredictable. Certain factors, such as rapid reduction in ambient temperature, for example, may have an impact on exacerbation risk. Alerting large numbers of patients as to how to protect themselves from such risk has been proposed as a strategy for reducing morbidity due to exacerbations <sup>30</sup>. Further and more detailed evaluation of such a strategy is needed, however, before conclusions can be reached.

### **Possible patient tools, supervised remotely from central clinical resources**

Some patients with COPD have high health care needs. Traditionally, individual clinical monitoring and intervention has been considered the best way to manage such patients, and telehealth solutions can aid this process.

Monitoring is, in itself, an intervention which alters behaviour. Glasziou *et al.* have described the complementary roles of periodic professional reviews and on-going patient self-monitoring <sup>31</sup>. Interventions involving biofeedback can objectively demonstrate symptom severity and the impact of medication compliance <sup>32</sup>.

In COPD, a number of markers of the deterioration in a patient's clinical condition have been identified as possible indicators of a need for therapeutic intervention. All have a sound theoretical base but the evidence to support their use for given populations in given scenarios is patchy. Similarly, there is not a strong evidence base to support their effectiveness or cost effectiveness for specific outcome measures.

Whilst it is appealing to aim to propose an intervention applicable for the whole COPD population, for both practical and clinical reasons, some targeting of participants through "entry criteria" to a project is inevitable. It is logical from a clinical perspective to target an intervention at those most likely to benefit from it. In the field of COPD, this is likely to be those at greatest risk of exacerbations which are, in general, those with the most severe disease. From a practical point of view, these patients are better known to the Health Care systems and therefore, more approachable for recruitment.

### **Remote monitoring of markers of deterioration**

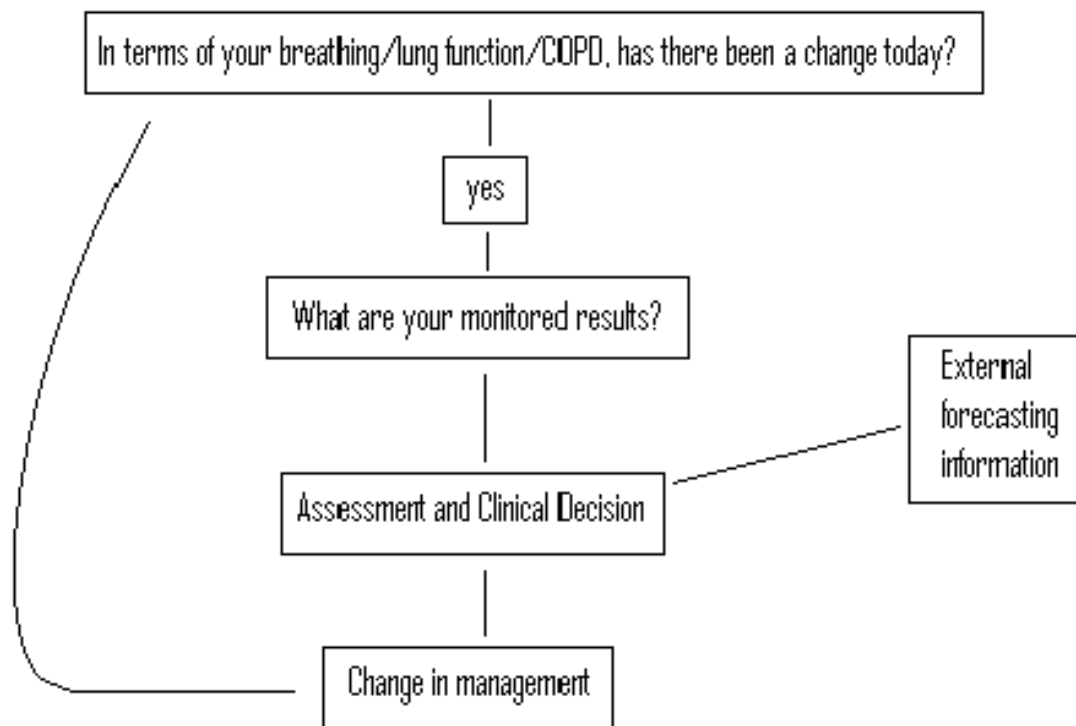
In order to attempt to prevent exacerbations, it is necessary to accurately predict their onset. Ideally, patients themselves would be able to monitor their symptomatology and forecast the onset of an "attack" or "crisis" <sup>24</sup>, which would trigger a change in their self-management program or a call for professional assistance. However, COPD symptom measures, on their own,

are only modestly related to the occurrence of medical events<sup>33</sup> and self reported objective measurements such as spirometry have not yet been shown to be reliable. In contrast, the majority of patients report that they experience idiosyncratic 'warning signs' (such as breathlessness) prior to a serious crisis<sup>24</sup>, suggesting that patient judgments about the likelihood of an impending attack may improve upon the predictive power of symptom measures.

A combination of monitoring of breathing problems and patient judgments about the likelihood of an exacerbation may most accurately predict these events. However, these judgments are not captured by any existing measure, should and are, being studied. A simple measure, if shown to be valid, is appealing. The observation that there is little *inter-* patient consistency of subjective and objective change prior to an exacerbation but considerable *intra-* patient consistency deserves further consideration. Such a question could be: "in terms of your breathing / lung condition / COPD, has there been a change today?"

An approach which takes this patient driven assessment, puts it together with robust measures of biological change (measured remotely, by the patient or carer), and adds in **extra** patient factors (such as exposure to infectious illnesses in others, and the effect of weather or temperature), might see the emergence of a valuable set of predictive features. These features might then trigger an early intervention by the patient, preventing the development of an exacerbation.

Such a system might be described thus:



## **Using Telehealth solutions in case management**

The concept of case management is outlined above. Telehealth solutions could add efficiency to this arrangement by providing monitored information directly to case managers who can access this at base (or potentially anywhere) and thus triage and prioritise patients. A model for working in long term conditions has been described using any one of a range of currently commercially available tele-monitoring devices <sup>34</sup>. Examples of available telehubs include the Tunstall Genesis Model, Tunstall Technologies, Whitely Lodge Whitely Bridge Yorkshire and Telemedcare, Medcare Systems, Rosebury, New South Wales, Australia.

Although there is anecdotal evidence for such an approach, and some early published work <sup>35</sup>, there is a lack of good quality prospective evidence to support this strategy.

## **Long term oxygen therapy**

Long-term oxygen therapy is usually supplied only to patients with the most severe disease, who are therefore the most vulnerable, restricted and perhaps isolated. Oxygen is an effective but potentially dangerous and expensive therapy. There are likely to be potential telehealth solutions to a number of clinical and practical aspects of the care of patients on long-term oxygen.

## ***Review of current activity***

### **Telehealth and Rurality**

A variety of projects applying elements of telehealth to the management of people with COPD are currently running in Scotland. These range from formal, ethically approved, randomised clinical trials to individual enthusiasts or groups gaining familiarity with technology and its possible use. Both the Scottish Centre for Telehealth and the British Lung Foundation Scotland attempt to monitor and, where appropriate, support these projects, but due to the differing organisation, setting and funding, no comprehensive “register” exists.

Professor Dave Godden, University of Aberdeen in Inverness, is a leader in the field of rural health. He has explored the distribution of people with common, chronic respiratory disease across NHS Highland. His data (drawn from GP Quality and Outcomes Framework returns) suggests that COPD, but not asthma, is related to clinical peripherality (albeit with a J-shaped pattern). Forty seven percent of people with COPD are located in the most peripheral practices (clinical peripherality scores 4 & 5) <sup>36</sup>. Professor Godden notes the implications for services such as access to smoking cessation and pulmonary

rehabilitation and will continue his research in these areas. (D Godden, personal communication)

Of course, services such as smoking cessation and pulmonary rehabilitation might be as inaccessible to a patient with COPD who lives in a tenement in Bridgeton as a croft on Benbecula, due to possible issues with house access and transport availability. A further study exploring the prevalence of COPD in urban “inaccessible areas” could reveal an unmet need.

Other current and proposed projects include:

### **Patient “self management” augmented with telehealth support**

Glasgow West Community Health and Care Partnership is one of a number of organizations currently involved with the Met Office COPD pilot. Patients registered with the scheme receive telephone alerts when the weather conditions will affect their COPD. This project is due to end in December (J. Kinnaird, personal communication). Moray CHP ran this service in a number of practices over the winter of 2007-8.

In total, there were 17 temperature alert calls during the winter period, with a 44% reduction in admissions from 31 (2006-7) to 17 (2007-8). Most probably due to the small number of patients and practices involved, statistically significant results were not achieved.

The Met Office winter programme conducted throughout the UK in 2007-8 showed a reduction in admission rate from 3.9 to 3.2 per 100 patients. This represented a 5% fall in admissions across the whole study population in the study period. The net reduction in hospital admissions in the intervention group was 13%<sup>37</sup>.

A study, partly supported by SCT, is currently in set-up led by researchers from Edinburgh University. It is currently in its pilot phase with 25 out of 40 subjects already recruited. A randomised, controlled trial with 150 subjects in each arm will follow. The study design involves the transmission to a central monitoring service (for appropriate action) of patient reported symptoms augmented by 24 physiological measurements: O<sub>2</sub> saturation (see above) and spirometry, (FEV<sub>1</sub> and peak flow). Issues around false alerts (symptom driven) and reliability of unsupervised spirometry will need to be addressed. (B McKinstry, personal communication)

In Lanarkshire, the respiratory Managed Clinical Network in conjunction with clinicians, IT specialists, Social Work Departments and a private company, AxSys, have set up a project to promote supported self-care and to develop the role of Care Managers to provide early intervention at the time of an exacerbation of COPD. Patients with severe COPD (FEV<sub>1</sub> < 50% with more than two exacerbations or a hospital admission within the last year) are recruited to regularly use their own telephones to make initial contact using an Interactive Voice Response system (the Excelicare system). This can trigger

an intervention, probably via a Care Manager. Electronic COPD patient records will be developed.

There are nine trigger questions in the algorithm:

- Spit
  - Amount increased?
  - Thicker?
  - Darker?
- Breathing
  - More use of blue inhaler?
  - More short of breath?
  - Sleeping more?
- Other
  - Shoes tighter
  - Not coping
  - Like some contact

(M Carroll, personal communication)

Argyll & Bute Strategic Health and Care Partnership have a well considered telehealth plan, supported by the Telehealth Solutions (THS) strategy. This system involves placing monitors in patients' homes or other accessible areas. These can record a variety of readings on a daily basis and transfer the information to clinicians. There are three pilot studies planned; one specifically for people with COPD and two for people with a variety of long term conditions.

A total of 15 remote monitors are available for the Cowal and Bute project. These will be sited in the homes of people with COPD. They are linked, by telephone line, to a secure server where the data can be accessed by general practitioners, community nurse teams and by a distant respiratory nurse specialist.

On the Isle of Luing, a remote island with no on-site healthcare, a monitor will be sited in a communal venue, such as village hall, for the use of people with a variety of long term conditions. Finally, in Lochgilphead, the communal area of a nursing home will host a monitor for use by the home's residents and other members of the community.

Initially there were issues regarding the safe transfer of patient information electronically with all these projects, but these have been addressed (L Garrett, personal communication).

Within Renfrewshire, there is already good evidence of partnership working between Health and Council services. This close co-operation (and joint

funding) is being utilized to develop a new service that aims to improve the care of patients with COPD by early identification and treatment of symptoms. The intention is that this will prevent crisis interventions and avoid admission to hospital.

The pilot objectives are:

- Reduce the number of hospital admissions through timely support and access to expertise as patient requires. A 10% reduction in hospital admissions is a target
- Support reduction in hospital length of stay by at least 1-2 days by provision of a safe, facilitated discharge
- Demonstrate an improvement in access to GP services

Current admission rates are as follows

<b>COPD &amp; Bronchiectasis</b>	<b>Sep-06</b>	<b>Dec-06</b>	<b>Mar-07</b>	<b>Jun-07</b>
No. of Discharges	161	187	203	99
Rate per 100,000 Population	94.9	110.3	119.7	58.4
Average length of stay in days	4.9	6.8	7.6	7.9

The team involved note that patients with COPD who have recurring exacerbations require a high level of input from the health and social care providers and also have a high dependency on their carer(s). They strive to improve quality of life for people with COPD.

These patient-centred goals are in keeping with patients' views on their condition and its management as reported in a clinical study <sup>38</sup>. Organisationally, the project hopes to see the further development of an Intensive Care Manager to provide early intervention to patients with COPD, practice based nursing staff developing increased skills in managing patients with COPD and consequently, a reduction in home visiting for respiratory specialist staff. Pending a decision on and the appointment of an identified project manager, the service is restricted to patients registered with a single general practice (T Daniel, personal communication).

Co-Creating Health is a Health Foundation initiative that NHS Ayrshire & Arran are involved in, along with another seven sites in the UK, to test how they can introduce and support self-management for people with long term conditions (via agenda setting, goal setting and goal follow-up). In Ayrshire & Arran the focus is on people living with COPD.

The initiative consists of three inter-related programmes that have been specifically designed for Co-Creating Health - a training programme for

clinicians, a training programme for people living with COPD and a Service Improvement Programme that will allow them to change the way they deliver services to better support self-management. An opportunity to utilise telehealth in this programme may arise (A Anderson, personal communication).

In Fife, a similar burden on both individual patients and health care services has been identified. It is reported that currently in Fife there are approximately 735 emergency admissions with COPD annually and 44% of patients are readmitted within 90 days. COPD accounts for 4% of the total number of hospital bed days used and 3.7% of total admissions. A similar possible solution has been identified: "Patient-centred telecare can support the intermediate care of COPD patients".

Joint working with the Renfrewshire project (see above) is planned. Twenty-one home pods will be made available for COPD patients in Fife. The home pod provides patient centred clinical monitoring of the patients COPD status which will be fed back to the GP practices involved in the pilot. Patient recruitment will utilise SPARRA data and the objectives of this pilot are, as in Renfrewshire, to achieve a 10% reduction in hospital admissions and a one to two day reduction in hospital length of stay. An additional benefit will be to help develop the patients' knowledge of their condition, provide more (intermediate) care for the patient in their home environment and reduce the need for crisis management. Funding for this nine month pilot is currently being sought with a view to the project starting in Summer 2009 (S Brannan, personal communication).

## **Other studies of interest**

A prospective study is currently recruiting in Salford PCT (Greater Manchester) [Personal communication June Roberts, nurse consultant Hope Hospital and Salford PCT] using a model described below, which may point towards the most effective way to use telehub technology within an innovative case management system, the Salford Telehub Trial.

Patients with two or more hospital admissions are recruited to the study and randomised either to "usual care" (involving Salford PCT Early supported discharge (ESD) team, pulmonary rehabilitation (PR) and practice based nurse and GP services), or to Telehub monitoring.

The Telehub group are provided with a Tunstall Genesis hub, capable of feeding information into a password protected web based central information point, accessible by the patient's dedicated case manager, GP and consultant.

Following a series of prompts, and blinded to the results, the patient supplies the following:

Hub measured data-

- Blood Pressure
- sPO2
- Pulse
- Temperature

Prompted patient questions (Answer better, much the same or worse for each case);

How is your level of anxiety

- Tiredness
  - Dyspnoea
  - General Health
  - Activities of daily living
- With regard to colour, amount and thickness of sputum
- With regard to ankle swelling

In addition the patient confirms attendance at Rehabilitation class y/n

(NOTE that the technology can also link to portable FEV1 measuring equipment not being used in this project).

Upon access, the case manager can view the most recent results, trend data, and a colour coded display of clinically significant changes. Clinically significant changes can be predefined, on the one hand, as the accumulation of individual changes likely to forecast exacerbation, or on the other, a major change in a single important parameter.

If either situation takes the patient through a predefined watershed, case managers/GPs are automatically notified by an agreed mechanism (such as e mail, SMS Text or telephone). The course of action taken is left to the judgement of the individual case manager.

A study of structured intervention to better achieve disease control in people with **asthma**, supported by Asthma UK, is currently being conducted, led by researchers from Aberdeen and Edinburgh Universities. In this randomised, controlled trial, the researchers hypothesise that the use of mobile phonebased lung function and symptom monitoring with patient feedback will improve the asthma control achieved and patient self-efficacy. (D Ryan, personal communication). The evidence base for asthma, guided self-

management and mobile phone technology is more advanced and growing 39.

## Possible telehealth supported interventions

### Clinical measurements

Most of the studies above comprise of reasonably complex assessments leading to possible interventions. Some single, specific measures of deterioration in a patient's condition have been proposed, and any benefit should be easier to assess. The simplicity this offers is appealing, but single measures may fail to address the idiosyncratic presentation of a step worsening in the patient's condition as described above. There is, of course, an opportunity to group several specific measures, but this approach currently lacks an evidence base.

Bronko test

The following section is taken from the BronkoTest website  
<http://www.bronkotest.com/BronkoTest.html>.

*“BronkoTest is a simple tool that has been developed by clinical scientists to help with the management of exacerbations of COPD. It has been used in many clinical trials over 20 years and its principles are being incorporated into all the guidelines on clinical management of COPD. The COPD Monitoring Pack contains a simple-to-use card to determine the colour of the sputum (and hence the need for and response to antibiotics). This enables both the patient and the doctor / healthcare professional to be clear that they are talking about the same thing. In addition there are monitoring cards that the patient can fill in to identify which symptoms have got worse and how these have responded to treatment. For instance, yellow or green sputum should return to normal colour for the patient in 5-7 days (unless bronchiectasis is present which may take 7-10 days and require a longer course of antibiotics (up to 2 weeks). On the other hand patients with mucus-like sputum during the exacerbations can occasionally develop infected sputum later which requires reconsideration of adding antibiotics to the treatment.*

*The Pack is a robust vinyl wallet that contains:*

*An action plan*

*Information for you to share with your doctor / healthcare professional*

*Daily monitoring cards for when your condition gets worse*

*Sputum colour charts to check the colour of your sputum (phlegm)”*

We have quizzed the originators of this tool to attempt to identify its potential use:

**Q.** “Is this a test that can be reliably performed by people with COPD?”

**A.** “Yes they can use it sensibly if trained”

**A.** “I have previously submitted a proposal to do this as part of an NIHR project and am currently working to resurrect this. The study I was working on used telemonitoring to detect changes and be proactive in contacting the patient with advice.” (Prof Rob Stockley, personal communication)

**Q.** “Has it been used with any form of telemonitoring?”

**A.** “There is a PCT wide study of self management in Doncaster involving all practices and their COPD patients. Patients were given antibiotics and a BronkoTest sputum chart and instructions on what to do when they had an exacerbation. We’re still gathering the data.....” (N Kendle, personal communication).

The BronkoTest group are happy to offer advice, meet and supply materials for any planned project.

## **Pulse oximetry (SpO<sub>2</sub>)**

Pulse oximetry is useful in the routine assessment of patients with COPD, in particular when considering patients for the administration of Long term oxygen therapy (LTOT) 11, and is being used increasingly commonly in Primary Care in the UK 40.

The role and usefulness of pulse oximetry in driving treatment decisions in acute exacerbations of COPD is also well established. Clinicians are, on the whole, able to recognise extreme hypoxia (SpO<sub>2</sub> <89%) purely on clinical grounds, without measurement, but find pulse oximetry helpful in guiding management decisions at higher saturation levels 41. Furthermore, such management decisions might involve the care of patients in a ‘hospital at home’ environment, where remote monitoring would have a role as an adjunct to good quality clinical care and review 42.

<sup>32</sup>Current national COPD guidelines recognise the value of pulse oximetry in patient assessment during an exacerbation 11, but make no statement as to what absolute values should drive decisions. There is no supportive evidence to suggest that a change in SpO<sub>2</sub> can, in itself, be used to *predict* the onset of an exacerbation.

Assessment of dynamic lung function during an exacerbation, together with their ability to maintain adequate oxygen saturation has been effectively used to predict the risk of respiratory failure during an exacerbation. However, this strategy requires two complex measures of ventilation to be performed, together with blood gas monitoring 43 and has not been repeated outside hospital.

In conclusion, the value of oxygen saturation measurement as an adjunct to clinical decision making is well established. Its role in the assessment and

ongoing management of patients with exacerbations of COPD has been described, but there is no good evidence that it can be used as a tool to predict exacerbations, and no uniform transferable level (nor percentage change from baseline) of saturation has been shown to lend itself to a workable telehealth model.

## Lung Function

Spirometric measurement of lung function is of value in establishing an accurate diagnosis in chronic lung disease. It is dependent on four factors:

- The accuracy of the equipment used
- The ability of the patient to perform to their maximum capacity
- The ability of the clinician to gain best results
- The accurate interpretation of data, when added to other clinical information

Across the country, a number of different strategies have been employed to achieve these goals, ranging from, at one extreme, a system embedded fully in primary care, to the other, where a centralised service is provided through a Pulmonary Function Laboratory. Technology exists which allows for the remote assessment of patients, but requires centralised data interpretation and diagnosis (e.g. Vitalograph Spirotrac). Such systems may have a place, particularly where diagnostic support is less available, but require that the first three of the above parameters are met.

Changes in lung function (FEV<sub>1</sub>, PEF) are notoriously difficult to measure with accuracy and reproducibility at the onset of and during exacerbations of COPD. One proposal has been to employ a videolink to monitor and encourage patient performance remotely. Although feasible, a validation study is necessary.

## **Clinical management**

Given the number of projects ongoing (and still to report) that address ways of supporting patients at the time of a deterioration in their clinical condition, an alternative approach is to look at the delivery of a therapeutic intervention. Pulmonary Rehabilitation (PR) lends itself to delivery in a variety of settings. There is some evidence supporting its use in hospitals, community programmes (community hospitals, community centres etc) and in the patient's home <sup>44</sup>. There are currently two separate initiatives being developed in Scotland merging the well established techniques of delivering PR and new technology.

## Teleconference facilities and PR

Commonly, a PR class is run by a trained Physiotherapist (or Nurse) with a Healthcare or Physiotherapist Assistant adding capacity, by supervising additional pupils. The Perth and Kinross model places these Physiotherapist Assistants at remote sites, linked by standard (Tandberg) videoconference technology to the central site in Perth. The model delivers a 10 week programme of exercise and education, with pre and post class assessments being made at the remote site by the lead physiotherapist from Perth. The project has been running since October 2008, with 12 patients attending the central class and three in the remote location. The project is at too early a stage to evaluate, but informal feedback suggests that:

- Patients find the link easy to get used to
- Additional localities could be added
- There is an access distance beyond which tele-rehabilitation is the preferred option
- More than one remote location could be added, given multiscreen technology
- A maximum of two remote sites has been suggested by staff.

The benefits of this system are as follows:

- Economic saving in costs of trained staff
- Near patient service for rural patients
- Continued 'group' benefit of meeting others with similar condition
- Uniformity of programme

The disadvantages of this system are as follows:

- Pre and post assessments still need physiotherapist at remote site
- Patient access to remote site
- Trained staff not on site for clinical problems/risk
- Equipment and overheads needed at all sites
- Difficulties ensuring maximum tolerable patient effort
- Depersonalisation

(J Dernie, personal communication).

PR at home

A second project plans to deliver PR on an individual basis using video conference facilities and gaming technology in people's homes. This is a commercially sensitive development, which is at an early stage, and as a result, further information has been difficult to gather.

## **Traditional telehealth**

Like most conditions, the availability of linking with a colleague with greater knowledge or expertise to offer advice on diagnosis, assessment or management has appeal for the management of people with COPD.

## **Education: “distance learning” for clinicians and patients?**

Many organisations provide educational programmes for clinicians with differing styles and goals. These can range from diploma (level 2)<sup>45</sup> and degree (level 3) courses<sup>46</sup>, to short updates or topic-specific education from a wide variety of providers. The obvious partner for SCT to consult with to explore a potential role in this area is NHS Education for Scotland.

A number of internet sites provide information for people with COPD and their carers. As always, these are variable in their quality and may not always have entirely altruistic purpose. A *Google* search “COPD Scotland” returns an SCT website as the first result (20 September 2008). A popular site is a joint venture between Patient Information Publications and EMIS, the general practice computing systems organisation<sup>47</sup>.

National specialist groups such as the British Thoracic Society<sup>48</sup>, and NHS organisations<sup>49</sup>, have useful, if occasionally limited, websites as do patient

charities<sup>50</sup>. There is a danger that nation-specific (English) information can be misleading and confusing for a Scottish reader. Discussion with BLF Scotland could be useful. Developing more complex distance learning educational interventions would require careful consideration.

## **Peer opinion**

One of the initial aims of this report was discussion with clinicians and others to identify:

- That a problem exists
- That a telehealth intervention could help tackle that problem
- That a telehealth intervention is appropriate
- That a telehealth intervention is practical

Given that that a potential suite of telehealth uses has emerged, stakeholder opinion should be sought initially for those identified as priorities.

## **Conclusion**

COPD presents a burden to patients, clinicians and the Health Service in Scotland. The employment of telehealth interventions to assist in the management of COPD is appealing. A number of projects attempting to identify and subsequently intervene at the time of the deterioration of an individual patient's clinical condition are ongoing. The results of these studies are awaited but consideration of the development of a nationally led service could begin in tandem with them. Pulmonary rehabilitation is a well established, useful therapeutic input. Telehealth interventions could help overcome geographical and physical barriers to the involvement of deserving patients in these programmes and help provide a more equitable service.

## **Recommendations**

The authors recommend:

- A database of those working on telehealth (COPD) projects is set up and regularly updated
- A database of telehealth (COPD) projects is set up and regularly updated
- A national telehealth (telehealth and COPD) conference is arranged in 2009
- Work begins to describe a possible national COPD telehealth service
- A further report is commissioned. This report will seek to assess the strengths and successes of the COPD telehealth projects currently underway and identify the challenges that remain.
- A pulmonary rehabilitation project scoping report is commissioned. This project will propose the use of remote exercise coupled with real-time, remote feedback of the patient's performance, combined with other established elements of a pulmonary rehabilitation programme

A traditional "access to specialist advice" service from remote sites to assist with the diagnosis and management of people with COPD, education and information for patients and education and information for staff should also be considered in conjunction with appropriate partners.

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John Haughney     j.haughney@abdn.ac.uk

Iain Small         iain.small@nhs.net

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## Appendix A

### COPD – telemedicine & home telemonitoring (incorporates SCT website papers plus December 2008 NHS search)

<p>Alonso A. A new model for home care for COPD. Studies in Health Technology &amp; Informatics. 103:368-73, 2004.</p>	<p>A new model for home care of COPD patients is investigated, as a part of a coordinated provision model across levels of care. In the Spanish pilot of the e-Vital project, relevant vital signs for COPD are closely monitored and used for early detection of deterioration in the state of the patient and all prompt treatment. This can also reduce the need for in-person check-ups and re-admission to hospital.</p> <p>Later analysis aims to determine whether the system has significant economic impact, and whether it will provide more convenience for patients and healthcare professionals. The present trial focuses on the impact of community based nurses visiting each patient in the home as a part of this shared care.</p> <p>The visits are part of the regular follow-up for patients with chronic conditions who belong to any of the home care programs currently available in our institution. In each one of these visits, the nurse performs a number of tasks in order to assess patient status. Vital signs are collected and may be transmitted to the data monitor centre automatically using 2.5-3G technology. Sensors communicate through a Body Area Network (BAN) with a PDA configured to display the data and transfer it to the server using GPRS. Patients can be trained to use the equipment on their own. Results so far are encouraging. In the previous phase, a similar set-up without monitoring facilities at the patient's home showed improvements in several clinical indicators (ER visits, SGRQ, Quality of life, LOS and costs) for a home hospitalisation program and in a prevention of exacerbation program. The current set-up aims at increasing such benefits and further extending the target population.</p>
<p>Botsis T. Hartvigsen G. Current status and future perspectives in telecare for elderly people suffering from chronic diseases. [Review] Journal of Telemedicine &amp; Telecare. 14(4):195-203, 2008.</p>	<p>We reviewed the literature on home telecare for elderly patients suffering from chronic diseases. Articles published between 1990 and 2007 were identified via the PubMed database. The literature search yielded 485 papers. After reviewing the title and abstract from each, 54 were selected for closer examination. They were published in 37 different journals. The number of papers increased from one in 1997 to 14 in 2006. The diseases in which home telecare had been used were diabetes (14 studies), heart failure (13 studies), cognitive impairment (dementia and/or Alzheimer's disease, 10 studies), chronic obstructive pulmonary disease (5 studies), chronic wounds (4 studies) and mobility disabilities (4 studies). Patients were generally satisfied with home telecare, but they preferred a combination of home telecare with conventional health-care</p>

	<p>delivery. Health-care professionals were positive about telecare. Users felt that on many occasions telecare led to a reduction in costs due to time savings and avoidance of travelling. Even though there were important benefits from home telecare, there are organizational, ethical, legal, design, usability and other matters that need to be resolved before widespread implementation can occur. [References: 65]</p>
<p>Brooks D, Fancott CA, Falter LB, McFarlane A, Nonoyama ML. The development of a helpline for chronic obstructive pulmonary disease (COPD). Patient Educ.Couns. 2004 Sep;54(3):329-336.</p>	<p>BACKGROUND: The goal of the helpline is to assist individuals with chronic obstructive pulmonary disease (COPD) better manage their disease through improved understanding of COPD, its symptoms and treatment. OBJECTIVES: The purpose of this project was to develop and validate a protocol for a COPD helpline. METHODS: Ten key informants with expertise in helpline development or COPD were interviewed. Fifty individuals with COPD participated in content validation of the protocol.</p> <p>RESULTS: An initial protocol for the helpline aimed to provide: (1) information and education regarding COPD and its management via the telephone and with written materials; (2) guidance regarding course of management; (3) resource links to other support services and programs locally, provincially, and/or nationally; and (4) caring support and reassurance to those with COPD and their families. The majority of the calls from individuals with COPD sought medical information (74%) and required 36.6 +/- 14.5 min (range: 15-85) to complete. Many different topics were discussed, with medication and exercise being the most common. The availability of the call center was identified as one means of replacing information sought from other health care providers, mainly physicians and pulmonary rehabilitation staff.</p> <p>CONCLUSION: A protocol of a helpline for COPD has been developed based on the literature, theoretical knowledge, and input from key informants and individuals with COPD.</p>
<p>Burkow TM. Vognild LK. Krogstad T. Borch N. Ostengen G. Bratvold A. Risberg MJ. An easy to use and affordable home-based personal eHealth system for chronic disease management based on free open source software. Studies in Health Technology &amp; Informatics. 136:83-8, 2008.</p>	<p>This paper describes an easy to use home-based eHealth system for chronic disease management. We present the design and implementation of a prototype for home based education, exercises, treatment and following-up, with the TV and a remote control as user interface. We also briefly describe field trials of the system for patients with COPD and diabetes, and their experience with the technology.</p>

<p>Dal Negro R. Optimizing economic outcomes in the management of COPD. International Journal of COPD. 3(1)(pp 1-10), 2008.</p>	<p>Attention to COPD is increasing worldwide because its high prevalence, morbidity, and mortality present a challenging problem for all healthcare systems. The burden of COPD, which is usually measured in terms of progressive lung function decline, impact on patients' symptoms, patient's disability, and quality of life, together with the corresponding use of health care resources, is still a major aspect of the disease. Recommendations to treat COPD according to the most accepted guidelines have expanded in recent years even though COPD still remains unacceptably underdiagnosed and under-treated worldwide. Obviously, more severe degrees of COPD receive major attention both in terms of monitoring of clinical outcomes and of assessing the economic value of therapeutic interventions. The role of different strategies against COPD should be valued on the basis of their effectiveness in outcome optimization, which primarily depends on the efficacy of prevention activities and of early diagnosis programs. It is generally agreed that the main proportion of COPD burden still depends on the clinically uncontrolled disease and on its high exacerbation rate, which frequently leads to the patient hospitalization. In COPD, the effects of guideline recommendations have been only sporadically investigated in pharmoeconomic terms, even though symptoms and disability have declined substantially; the corresponding improvement in quality of life, and a significant decrease in both direct and indirect costs have been proved to depend on appropriate rehabilitative and pharmacological long-term treatment of the disease. At present, more precise indices and more fitting outcomes are continuously sought and found in order to assess more effective strategies for controlling COPD.</p>
<p>Dale J. Connor S. Tolley K. An evaluation of the west Surrey telemedicine monitoring project. Journal of Telemedicine &amp; Telecare. 9 Suppl 1:S39-41, 2003.</p>	<p>We conducted a three-month pilot study of a home monitoring service for patients with chronic obstructive pulmonary disease. 55 patients were recruited. They transmitted physiological data to a monitoring centre once a day. During the period of the study, 36 escalations were reported to have occurred. Of these, 29 (81%) were managed at home; the other 7 (19%) resulted in acute admission after emergency telephone calls. Although only a small number of patients were involved for a relatively short period of time, there was evidence of a substantial (approx 50%) decrease in rates of hospital admission. The service was highly acceptable to patients.</p>

<p>Dang S, Ma F, Nedd N, Aguilar EJ, Roos BA. Differential resource utilization benefits with Internet-based care coordination in elderly veterans with chronic diseases associated with high resource utilization. <i>Telemed J E Health</i>. 2006 Feb;12(1):14-23</p>	<p>Our objective was to evaluate in a demonstration project whether our T-Care Program, telecare management via an Internet-based home-messaging device, reduces resource utilization by patients with congestive heart failure (CHF), diabetes mellitus (DM), and chronic obstructive pulmonary disease (COPD). Study participants were drawn from a group of high resource-utilizing veterans over age 60 and included 19 patients with CHF, 23 with DM, and 17 with COPD. Data were gathered on hospital admissions, bed days of care (BDOC), outpatient admissions, and emergency department visits 6 months before and 6 months after enrollment in the telecare program. Nonparametric tests examined pre- and postintervention effects. For patients with CHF, significant decreases were found with T-Care in total emergency department visits (30 to 10, <math>p = 0.03</math>) and hospital admissions (20 to 8, <math>p = 0.03</math>). The decrease in BDOC (179 to 53) was not significant (<math>p = 0.07</math>). Outpatient visits were unchanged (71 to 83, <math>p = 0.38</math>). There were no significant changes for patients with COPD: the apparent BDOC decrease (115 to 46) was not significant (<math>p = 0.24</math>). The outpatient visits by patients with DM decreased significantly (199 to 143, <math>p = 0.03</math>), but no significance was found for changes in their emergency department visits, hospital admissions, and BDOC. The apparent BDOC increase (38 to 198, <math>p = 0.23</math>) was related to two patients with extended stays for an amputation and mitral valve surgery. We found that telecare models may reduce resource utilization in elderly patients with chronic diseases, especially in patients with CHF. Because of the small sample size and lack of controls, larger and more carefully designed follow-up trials are needed to determine cost efficiency for different chronic diseases, and the relative value of the interpersonal contact versus the technological components of this care coordination model.</p>
<p>Demiris G, Speedie S, Finkelstein S, Harris I. Communication patterns and technical quality of virtual visits in home care. <i>J Telemed Telecare</i>. 2003;9(4):210-5.</p>	<p>Ten patients in a home care study received virtual visits from nurses via analogue video-phones in their homes. They received standard home care services and two virtual visits per week. The visits were video-recorded and then reviewed. The study involved 10 patients and 10 nurses from one urban and three rural home care agencies. Six of the patients had congestive heart failure, three had chronic obstructive pulmonary disease and one required diabetes-related wound care. The average age of the patients was 78 years (SD 12). All but one lived in rural areas. One hundred and twenty-two virtual visits were reviewed for technical quality. Their mean duration was 21 min (range 5-60). The technical quality was given an average rating of 95% (range 57-100%). There were no technical problems in 78 visits (64%); in 10 cases (8%) there was difficulty establishing a connection. A content analysis of 30 of the visits identified 13 themes, such as assessing the patient's clinical status, promotion of compliance with medication and treatment, psychosocial issues, general informal talk and patient education. In general, the technical problems were minor and did not appear to interfere with care.</p>

<p>de Toledo P. Jimenez S. del Pozo F. Roca J. Alonso A. Hernandez C. Telemedicine experience for chronic care in COPD. IEEE Transactions on Information Technology in Biomedicine. 10(3):567-73, 2006 Jul.</p>	<p>Information and telecommunication technologies are called to play a major role in the changes that healthcare systems have to face to cope with chronic disease. This paper reports a telemedicine experience for the home care of chronic patients suffering from chronic obstructive pulmonary disease (COPD) and an integrated system designed to carry out this experience. To determine the impact on health, the chronic care telemedicine system was used during one year (2002) with 157 COPD patients in a clinical experiment; endpoints were readmissions and mortality. Patients in the intervention group were followed up at their homes and could contact the care team at any time through the call center. The care team shared a unique electronic chronic patient record (ECPR) accessible through the web-based patient management module or the home visit units. Results suggest that integrated home telemedicine services can support health professionals caring for patients with chronic disease, and improve their health. We have found that simple telemedicine services (ubiquitous access to ECPR, ECPR shared by care team, accessibility to case manager, problem reporting integrated in ECPR) can increase the number of patients that were not readmitted (51% intervention, 33% control), are acceptable to professionals, and involve low installation and exploitation costs. Further research is needed to determine the role of telemonitoring and televisit services for this kind of patients.</p>
<p>Di Re L. Orsini A. Telemetric control programme, in Teramo province on patients in LYOT for chronic respiratory failure. Three years of follow up. Giornale Italiano di Farmacia Clinica. 14(3)(pp 150-155), 2000.</p>	<p>Telemetric control programme, in teramo province on patients in LYOT for chronic respiratory failure. Three years of follow up. Background. Telemetric control systems are known to be useful in managing home residents on Long Term Oxygen Therapy (LTOT) for chronic respiratory failure by reducing the disease exacerbations and hospital admissions. A telemetric control programme for LTOT has been set up by the local health authorities (ASL) in Teramo province. Aim. Aim of this study was to verify the attainment of three objects: 1) property of such telemetric programme for LTOT in the Patients management and in their O<sub>2</sub> consumption; 2) the reduction of the disease exacerbations and the hospital admissions; 3) The effectiveness/efficiency of a managing Team (physicians, chemist and nurses). Methods. Data about 399 Patients in LTOT was collected. DDD of oxygen has been defined. Compliance to prescribed LTOT, during the 12 months proceeding initiation of the telemetric programme and in the 36 months following the programme started, was investigated in sixty-seven Patients. Hospital admissions of this patient cohort during the study period were calculated. Results. The prevalence of the Patients in LTOT was 1.3/1000. Most of those Patients suffered from Chronic Obstructive Pulmonary Disease (COPD). In sixty-seven Patients a progressive improvement of compliance to LTOT was observed following initiation of the telemetric programme. Hospital admissions decreased modestly over the 36 months period but a significant decrease, from 669 (2.7% of patient days) to 272 (1.5%), was observed in the last 12 months. Conclusions. The telemetric control programme of LTOT in Teramo province, results to be effective in reducing hospital admissions in patients with chronic respiratory failure.</p>

<p>Duschek S. Schandry R. Werner B. Changes in quality of life in patients with chronic airway diseases participating in a pilot project on home-telecare. Prevention und Rehabilitation. 18(2)(pp 57-67), 2006.</p>	<p>Due to their increasing prevalence and high psychosocial and health-economic impact, chronic airway diseases constitute an important challenge to rehabilitative care. At this, the continuous monitoring of the affected patients in their home surroundings based on telemetric techniques can be a helpful contribution. The AOK Bayern (Bavarian branch of a national health insurance association) and the hospital of Donaustauf are jointly conducting a pilot project on telecare of patients with asthma and chronic obstructive pulmonary disease (COPD). The treatment particularly aims to reduce exacerbations and to improve general wellbeing by means of regular self-assessment of lung function and transmission of the values to a telemetric service centre, as well as by telephonic counselling. The present article gives an insight into changes of health-related quality of life during the first two years of the project. Both in patients with asthma and COPD a significant reduction of subjective symptoms was observed, whereas unspecific parameters of quality of life remained widely unchanged. The magnitude of the symptom reduction turned out to be independent of age and the extent of the impairment of lung function. Telemedicine proved to be a promising method to optimize the treatment of chronic airway diseases without any restriction to specific subgroups of patients.</p>
<p>Finkelstein S.M. Speedie S.M. Potthoff S. Home telehealth improves clinical outcomes at lower cost for home healthcare. Telemedicine Journal and e-Health. 12(2)(pp 128-136), Apr 2006.</p>	<p>Patient outcomes and cost were compared when home healthcare was delivered by telemedicine or by traditional means for patients receiving skilled nursing care at home. A randomized controlled trial was established using three groups. The first group, control group G, received traditional skilled nursing care at home. The second group, video intervention group V, received traditional skilled nursing care at home and virtual visits using videoconferencing technology. The third group, monitoring intervention group M, received traditional skilled nursing care at home, virtual visits using videoconferencing technology, and physiologic monitoring for their underlying chronic condition. Discharge to a higher level of care (hospital, nursing home) within 6 months of study participation was 42% for C subjects, 21% for V subjects, and 15% for M subjects. There was no difference in mortality between the groups. Morbidity, as evaluated by changes in the knowledge, behavior and status scales of the Omaha Assessment Tool, showed no differences between groups except for increased scores for activities of daily living at study discharge in the V and M groups. The average visit costs were \$48.27 for face-to-face home visits, \$22.11 for average virtual visits (video group), and \$32.06 and \$38.62 for average monitoring group visits for congestive heart failure and chronic obstructive pulmonary disease subjects, respectively. This study has demonstrated that virtual visits between a skilled home healthcare nurse and chronically ill patients at home can improve patient outcome at lower cost than traditional skilled face-to-face home healthcare visits.</p>

<p>Hung SH. Tseng HC. Tsai WH. Lin HH. Cheng JH. Chang YM. COPD - endurance training via mobile phone. AMIA ... Annual Symposium Proceedings/AMIA Symposium.:985, 2007.</p>	<p>The purpose of this study is to encourage patients who suffer from Chronic Obstructive Pulmonary Disease (COPD) to get regular daily exercise via walking. When the patient is exercising at home, the platform generates a short message service (SMS) message to the patient inverted exclamation marks mobile phone telling him/her at what level of intensity (i.e. music tempo) he/she should be exercising.</p>
<p>Joseph AM. Care coordination and telehealth technology in promoting self-management among chronically ill patients. Telemedicine Journal &amp; E-Health. 12(2):156-9, 2006 Apr.</p>	<p>With an increasingly complex healthcare system, the need to coordinate the care for chronically ill patient often goes unmet. This results in increased utilization of services at significant costs. In addition, providing patients with the tools to manage their own disease processes over the long term is also lacking in the healthcare environment. The Veterans Health Administration (VHA) approached these challenges by creating a Care Coordination program using technology to promote self management for veterans. Although a relatively new program, the Veterans Integrated Services Network (VISN) 7, has shown substantial gains in both decreasing the use of high cost care, such as emergency department (ED) visits and hospitalizations, as well as improving clinical outcomes with better glycemic control for patients with diabetes and improved lipid management for all patients.</p>

<p>Koizumi T. Takizawa M. Nakai K. Yamamoto Y. Murase S. Fujii T. Kobayashi T. Hatayama O.</p> <p>Trial of remote telemedicine support for patients with chronic respiratory failure at home through a multistation communication system.</p> <p>Telemedicine Journal &amp; E-Health. 11(4):481-6, 2005 Aug.</p>	<p>To create and test a multistation telemedicine support system, three remote locations were connected: the homes of two patients with chronic respiratory failure, the hospital of the attending physician, and the hospital of the pulmonary specialist. Real-time connections were set up between the three locations. Medical history and biologic variables were noninvasively recorded, including blood pressure, arterial oxygen saturation, three-lead electrocardiogram, and end-tidal carbon dioxide. Both physicians shared in these data real-time. If necessary, the respiratory specialist could provide medical advice to the attending physician based on the patient's condition. The trial program resulted in the same information being exchanged remotely using the multi-station telemedicine system that would be exchanged in a direct, face-to-face encounter. This result, together with the improvement in quality of life and the establishment of appropriate treatment and cooperation between the respiratory specialist and attending physician, suggests our system can be considered useful and promising for further use.</p>
<p>Lamothe L, Fortin JP, Labbé F, Gagnon MP, Messikh D.</p> <p>Impacts of telehomecare on patients, providers, and organizations</p> <p>Telemed J E Health. 2006 Jun;12(3):363-9</p>	<p>Over the last decades, development of home care services is an important component of ongoing health care systems reforms. However, their full integration into hospital or primary care services is still progressing slowly. It appears that telehomecare (THC) could help create networks of services between hospital and primary care providers. Even though their potential to increase access to services and improve quality of care and health outcomes is recognized, their widespread adoption has not yet been achieved. Various barriers need to be overcome. In this paper, we present our comparative exploratory process analysis of the use of THC to follow the treatment of elderly people suffering from severe chronic conditions (chronic obstructive pulmonary disease [COPD], hypertension, cardiac insufficiency). The technology was first introduced as a pilot project in three sites (one site in Quebec and two sites in Manitoba, Canada). Our study is based on qualitative methods. It includes a longitudinal analysis of implementation processes and monitoring of results. Our analysis allows us to identify some of the major impacts on patients and providers, and explain how they may be achieved.</p> <p>Also, because of the major changes in work processes, THC introduces new models of home care delivery. Two models are identified: a specialized model and a planned polyvalent model. Such profound changes raise two major challenges for managers and providers. First, the organisation of work, traditionally based upon preestablished intervention plans, must adapt</p>

	to respond to ad hoc patients' needs and alerts. Second, constant linkages between the traditional and new models of services delivery become mandatory.
<p>Liddy C. Dusseault J.J. Dahrouge S. Hogg W. Lemelin J. Humbert J. Telehomecare for patients with multiple chronic illnesses: Pilot study. Canadian Family Physician. 54(1)(pp 58-65), Jan 2008.</p>	<p>OBJECTIVE: To examine the feasibility and efficacy of integrating home health monitoring into a primary care setting. DESIGN: A mixed method was used for this pilot study. It included in-depth interviews, focus groups, and surveys. SETTING: A semirural family health network in eastern Ontario comprising 8 physicians and 5 nurses caring for approximately 10 000 patients.</p> <p>PARTICIPANTS: Purposeful sample of 22 patients chosen from the experimental group of 120 patients 50 years old or older in a larger randomized controlled trial (N = 240). These patients had chronic illnesses and were identified as being at risk based on objective criteria and physician assessment.</p> <p>INTERVENTIONS: Between November 2004 and March 2006, 3 nurse practitioners and a pharmacist installed telehomecare units with 1 or more peripheral devices (eg, blood-pressure monitor, weight scale, glucometer) in patients' homes. The nurse practitioners incorporated individualized instructions for using the unit into each patient's care plan. Patients used the units every morning for collecting data, entering values into the system either manually or directly through supplied peripherals. The information was transferred to a secure server and was then uploaded to a secure Web-based application that allowed care providers to access and review it from any location with Internet access. The devices were monitored in the office on weekdays by the nurse practitioners. MAIN OUTCOME MEASURES: Acceptance and use of the units, patients' and care providers' satisfaction with the system, and patients' demographic and health characteristics.</p> <p>RESULTS: All 22 patients, 12 men and 10 women with an average age of 73 years (range 60 to 88 years), agreed to participate. Most were retired, and a few were receiving community services. Common diagnoses included hypertension, diabetes, cardiovascular disease, and chronic obstructive pulmonary disease. All patients had blood pressure monitors installed, 11 had wired weight scales, 5 had glucometers, and 5 had pulse oximeters. The units were in place for 9 to 339 days. Three patients asked to have the systems removed early because they did not use them or found them inconvenient. The other patients and their informal caregivers found the technology user-friendly and useful. Health care providers were satisfied with the technology and found the equipment useful. They thought it might reduce the number of office visits patients made and help track long-term trends. CONCLUSION: These pilot results demonstrate that telehomecare monitoring in a collaborative care community family practice is feasible and well used, and might improve access to and quality of care.</p>

<p>Maiolo C. Mohamed El. Fiorani CM. De Lorenzo A. Home telemonitoring for patients with severe respiratory illness: the Italian experience. Journal of Telemedicine &amp; Telecare. 9(2):67-71, 2003.</p>	<p>We investigated the feasibility of telemonitoring services for patients with severe respiratory illness. In the first phase of the study, patients were observed and treated using face-to-face medical visits for 12 months. In the second phase of the study, the patients were monitored at home for 12 months, during which time determinations of arterial oxygen saturation and heart rate were performed twice a week, and the data were automatically transmitted to the hospital's processing centre via a normal telephone line. 30 patients on long-term oxygen therapy were enrolled in the study; 23 completed the 12 months of home telemonitoring. The numbers of hospital admissions and of acute home exacerbations during the telemonitoring phase of the study decreased by 50% and 55%, respectively, in comparison with the first phase. Estimates of hospitalization costs for the patients during the second phase were approximately 17% lower than those for the first phase. Patients were satisfied with the quality of the personal telemonitoring process in 96% of cases.</p>
<p>Mair FS, Wilkinson M, Bonnar SA, Wootton R, Angus RM. The role of telecare in the management of exacerbations of chronic obstructive pulmonary disease in the home. J Telemed Telecare. 1999;5 Suppl 1:S66-7</p>	<p>We examined home care as an alternative to hospital admission in exacerbations of chronic obstructive pulmonary disease (COPD). We performed a pilot study to investigate the feasibility of using telecommunications technology to assist in the support of acutely ill patients with exacerbations of COPD at home. Realtime, interactive video, via an analogue video-phone, was used to allow patients in their own homes to obtain nursing support from a nurse located at a distant base station. Six individuals, four male and two female, had video-phones installed in their homes by members of the nursing intervention team. The age range was 52-72 years, mean 61.5. These patients used the system on 18 occasions. Experience in home telecare, via interactive video, has been limited to provision of ongoing support for relatively stable individuals with chronic illness. This pilot project represents the first attempt at providing home telecare in the UK to those experiencing an acute exacerbation of their chronic illness, who would otherwise have merited acute hospital admission.</p>
<p>Mair FS. Goldstein P. May C. Angus R. Shiels C. Hibbert D. O'Connor J. Boland A. Roberts C. Patient and provider perspectives on home</p>	<p>A randomized controlled trial of home telecare for the management of acute exacerbations of chronic obstructive pulmonary disease has been undertaken in the north-west of England. A videophone was used that communicates via the ordinary telephone network. The intervention period for each participant was two weeks. Participants in the telecare arm of the trial were asked to complete logbooks to record their experiences of each telecare encounter. A simple, self-completed, 10-item questionnaire was used that consisted of a Likert scale, ranging from 1 (totally disagree) to 5 (totally agree). Fourteen nurses completed 150 logbooks and 22 patients completed 145 logbooks. These results demonstrate significant differences in perception between patients and their health-care providers with regard to telecare encounters across all the domains</p>

<p>telecare: preliminary results from a randomized controlled trial. Journal of Telemedicine &amp; Telecare. 11 Suppl 1:95-7, 2005.</p>	<p>addressed. Participating patients consistently demonstrated more positive views of the telecare encounters than their healthcare providers.</p>
<p>Mair F.S. Hiscock J. Beaton S.C. Understanding factors that inhibit or promote the utilization of telecare in chronic lung disease. Chronic Illness. 4(2)(pp 110-117), June 2008.</p>	<p>OBJECTIVES: To perform a process evaluation of a randomized controlled trial (RCT) of home telecare for the management of acute exacerbations of chronic obstructive pulmonary disease (COPD), using the normalization process model (NPM) as an explanatory framework. Methods: Semi-structured interviews were carried out with patients (n = 9) and nurses (n = 11) participating in a RCT. A framework approach to data analysis was used. Results: The telecare service did not provide an interactional advantage for the nurses providing this service and did not fit with the nurses' views of the most appropriate or preferred use of their skills. The telecare service seemed unlikely to become normalized as part of routine healthcare delivery, because the nursing team lacked confidence that it was a safe way to provide healthcare in this context and it was not perceived as improving efficiency.</p> <p>DISCUSSION: The NPM effectively mapped onto the study findings and explained those factors that inhibited the routine delivery of COPD services by telecare.</p>
<p>Nguyen HQ. Wolpin S. Chiang KC. Cuenco D. Carrieri-Kohlman V. Exercise and symptom monitoring with a mobile device. AMIA ... Annual Symposium Proceedings/AMIA Symposium. :1047, 2006.</p>	<p>Mobile PDA/phone devices allow remote monitoring of clinical and behavioral parameters. However, passively expecting patients to use these devices may lead to low response rates. Our study, aimed at collecting exercise and symptom data from an older clinical population of patients with COPD, employed push technology principles by delivering automated prompts to patients in an effort to increase response rates. We found acceptable response rates with subjects preferring to have prompts delivered to coincide with their exercise activity though usability issues had adverse effects on response rates and time.</p>

<p>Nguyen HQ. Carrier-Kuhlman V. Rankin SH. Slaughter R. of this Stulbarg MS. Is Internet-based support for dyspnea self-management in patients with chronic obstructive pulmonary disease possible? Results of a pilot study. Heart &amp; Lung. 2005 Jan-Feb; 34(1): 51-62.</p>	<p>Background: As of 2003, approximately 67% of US adults have Internet access. The purpose study was to determine the feasibility and preliminary efficacy of an Internet-based dyspnea self-management program (iDSMP) for people with chronic obstructive pulmonary disease. A related aim was to compare the differential effects of the iDSMP on 2 different groups: (1) to test a "booster" effect and (2) to evaluate the program as a primary intervention. Methods: Two groups (n = 16) were evaluated at baseline and at 3 months after completing the iDSMP, which included education, exercise, self-monitoring, and support. Dyspnea, self-efficacy, perception of available support, and exercise behavior were measured. Paired, independent t tests and Mann-Whitney U tests were used.</p> <p>Results: Most subjects (87%) reported that the program increased their access to information and resources for managing dyspnea. Dyspnea with activities of daily living and self-efficacy for managing the symptom showed significant improvements (both P &lt; .01), whereas more modest changes were noted in perceived support and exercise behavior in the overall sample. There were no differences between the 2 groups on these outcomes. Conclusions: The findings suggest that additional investigations of Internetbased interventions to promote self-management in patients with chronic obstructive pulmonary disease are warranted.</p>
<p>Pare G. Jaana M. Sicotte C. Systematic review of home telemonitoring for chronic diseases: the evidence base. [Review] Journal of the American Medical Informatics Association. 14(3):269-77, 2007 May-Jun.</p>	<p>OBJECTIVE: Home telemonitoring represents a patient management approach combining various information technologies for monitoring patients at distance. This study presents a systematic review of the nature and magnitude of outcomes associated with telemonitoring of four types of chronic illnesses: pulmonary conditions, diabetes, hypertension, and cardiovascular diseases.</p> <p>METHODS: A comprehensive literature search was conducted on Medline and the Cochrane Library to identify relevant articles published between 1990 and 2006. A total of 65 empirical studies were obtained (18 pulmonary conditions, 17 diabetes, 16 cardiac diseases, 14 hypertension) mostly conducted in the United States and Europe.</p> <p>RESULTS: The magnitude and significance of the telemonitoring effects on patients' conditions (e.g., early detection of symptoms, decrease in blood pressure, adequate medication, reduced mortality) still remain inconclusive for all four chronic illnesses. However, the results of this study suggest that regardless of their nationality, socioeconomic status, or age, patients comply with telemonitoring programs and the use of technologies. Importantly, the telemonitoring effects on clinical effectiveness outcomes (e.g., decrease in the emergency visits, hospital admissions, average hospital length of stay) are more consistent in pulmonary and cardiac studies than diabetes and hypertension. Lastly, economic viability of telemonitoring was observed in very few studies and, in most cases, no in-depth cost-minimization analyses were performed.</p> <p>CONCLUSION: Home telemonitoring of chronic diseases seems to be a promising patient management approach that produces accurate and reliable data, empowers patients, influences their attitudes and behaviors, and potentially improves their</p>

	<p>medical conditions. Future studies need to build evidence related to its clinical effects, cost effectiveness, impacts on services utilization, and acceptance by health care providers. [References: 91]</p>
<p>Pare G. Sicotte C. St-Jules D. Gauthier R. Cost-minimization analysis of a telehomecare program for patients with chronic obstructive pulmonary disease. <i>Telemedicine Journal &amp; E-Health.</i> 12(2):114-21, 2006 Apr.</p>	<p>A cost-minimization analysis was performed on a telehomecare program for patients with a chronic obstructive pulmonary disease (COPD). The research was quasi-experimental and included a control group. We compared the effects and costs of care provided to a group of 19 patients under a telehomecare program to a comparable group of 10 patients receiving regular home care without telemonitoring. Our results clearly indicate that there were fewer home visits by nurses and hospitalizations for patients in the experimental group. However, these patients made more telephone calls than patients in the control group, although this difference was not statistically significant. Of utmost importance, the cost-minimization analysis yielded positive results. Indeed, telemonitoring over a 6-month period generated \$355 in savings per patient, or a net gain of 15% compared to traditional home care. Our study confirms the findings of previous studies that analyzed the efficacy of telemonitoring for patients with COPD. Patients were found to easily accept the idea of using the technology, and the telehomecare program demonstrated significant clinical benefits. Financial advantages of the program could have been more pronounced had it not been for the cost of technology that effectively erased a good portion of the savings.</p>
<p>Petty TL, Dempsey EC, Collins T, Pluss W, Lipkus I, Cutter GR, et al. Impact of customized videotape education on quality of life in patients with chronic obstructive pulmonary disease. <i>J. Cardiopulm. Rehabil.</i> 2006 Jan;26(2):112-117.</p>	<p><b>PURPOSE:</b> To compare the impact of a library of pulmonary rehabilitation videotapes versus an older videotape and usual care on quality of life and ability to perform activities of daily living in persons with chronic obstructive pulmonary disease.</p> <p><b>METHODS:</b> Two hundred fourteen patients diagnosed with chronic obstructive pulmonary disease, emphysema, or chronic bronchitis were recruited and randomized to receive customized videotapes, standard videotapes, or usual care. Outcome measures included the Fatigue Impact Scale, Seattle Obstructive Lung Disease Questionnaire, and the SF-36(R) Health Survey.</p> <p><b>RESULTS:</b> Differences in coping skills and emotional functioning on the Seattle Obstructive Lung Disease Questionnaire were found among the 174 subjects who completed the study. The customized videotape group improved by 8.6 and 4.8 points, respectively, whereas the score of the other groups decreased by less than 1 point for the coping skills, and the scores of the standard video and the control groups decreased by 3.0 and 2.1 points, respectively, for emotional functioning (P &lt; 05, all comparisons). The scores using the Fatigue Impact Scale also improved for the customized videotape group, whereas the scores of the others remained unchanged. Videotape users demonstrated better conversion to and retention of exercise habits, with over 80% of customized videotape subjects who reported exercise habits at baseline continuing the habits as compared with 40% in the usual care group. Sedentary subjects at baseline were more likely to begin and maintain exercise if randomized to videotapes. <b>CONCLUSIONS:</b> These findings demonstrate increased quality of life, lower fatigue, and better compliance with</p>

	<p>a prescribed exercise regimen among subjects using the customized videotapes. There was a significant improvement in emotional functioning and coping skills among customized videotape subjects.</p>
<p>Rahimpour M. Lovell N.H. Celler B.G. McCormick J. Patients' perceptions of a home telecare system. International Journal of Medical Informatics. 77(7)(pp 486-498), Jul 2008.</p>	<p>Goal: To identify any major factors that could affect patients' perceptions of a Home Telecare Management System (HTMS) and use the findings to contribute to development of theoretical framework for patient acceptance of HTMS. Materials and methods: Ten Focus Group Interviews (FGIs) were conducted with patients suffering from congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), or both, from seven different ethnic groups in Sydney. Six key discussion points were used to conduct the FGIs. The participants were shown a video demonstrating the HTMS and its operation, followed by the demonstration of an HTMS prototype. The participants, who had no prior experience with the HTMS, were then asked questions to access their perceptions in potentially real situations. The discussions were audio-taped and content analysis performed.</p> <p>Results: Four major themes and 16 sub-themes were identified. The themes were: intention to use the HTMS, the impact of the HTMS on patients' health management, concerns associated with using the HTMS, and the impact of the HTMS on healthcare services. Conclusion: Most participants perceived the system as a useful and convenient mode of health care delivery, expressed positive attitudes toward the HTMS and expressed intent to use the system. However, there were concerns centred on the issues of cost, ease of use, clinical support, low self-efficacy and anxiety related to the use of the HTMS. The findings of this study suggest that HTMS self-efficacy and anxiety are likely to be important constructs in patients' acceptance of home telecare. Therefore, we propose these two factors be included in future HTMS acceptance models. Also it is suggested that in order to develop training programs for patients to use HTMS, tailored training components should aim to reduce 'HTMS anxiety' and improve 'HTMS self-efficacy'. Participants agreed that the HTMS would save cost and time by reducing hospital admissions, emergency department and medical practitioner visits and associated travel. Participants generally agreed that the HTMS could inform patients of their health conditions, thus promoting active participation in their health management and empowering them to perform better self-care. Also, they agreed that the HTMS could improve their health management by their doctors by providing more accurate and up-to-date information, to help them make better decisions. They suggested that the HTMS could have a preventative role in terms of providing early warning when their health conditions were deteriorating, which could lead to on-time appropriate interventions. The latter may result in reducing the use of emergency services and hospital admissions.</p>
<p>Rice T. Doughty K. Alleviating the COPD burden with ICTs [corrected] [published]</p>	<p>The Going Home, Staying Home demonstrator project was established by Fold Housing Association, Foyle Health and Social Services Trust and the Northern Ireland Housing Executive to test the effectiveness of medical telemonitoring equipment in managing the effects of chronic obstructive pulmonary disease (COPD). Fifteen COPD sufferers are taking part in the three-year trial, due to complete in March 2005. While at home, the patients take two measurements per day using the S21</p>

<p>erratum appears in BR J HEALTHC COMPUT INF MANAGE 2004 Mar;21(2):28]. British Journal of Healthcare Computing &amp; Information Management. 2004 Feb; 21(1): 27-8.</p>	<p>telemedicine monitor. Each person checks his/her own temperature, blood pressure, pulse rate, blood oxygenation and breathing rate. Results are sent via conventional phone lines and a secure server to a database accessible by the attending clinicians. An automated alert mechanism is embedded in the communications technology, which is triggered when abnormal results are reported. Since its implementation the trial has played a significant role in reducing the number of bed-nights used by COPD patients with exacerbations, freeing up NHS resources and improving the quality of life of the patients involved.</p>
<p>Roberts M.M. Leeder S.R. Robinson T.D. Nurse-led 24-h hotline for patients with chronic obstructive pulmonary disease reduces hospital use and is safe. Internal Medicine Journal. 38(5)(pp 334-340), May 2008.</p>	<p>Background: Despite recent advances in the management of patients with chronic obstructive pulmonary disease (COPD), interventions to reduce hospitalization have had only modest success. The aim of this study was to report the outcomes of a novel, nurse-led 24-h telephone support line (hotline) for patients with COPD.</p> <p>Methods: Observational study of patients' use of hotline between September 2002 and November 2004. All patients with COPD referred to a Respiratory Ambulatory Care programme over this period (n = 458) were given access to the hotline. The number and time of calls to the hotline, outcomes of hotline calls and safety of hotline, were assessed. The characteristics of hotline callers and non-callers were compared using an unpaired Student's t-test for normally distributed variables, a chi<sup>2</sup> test for categorical variables and a Mann-Whitney test for non-normally distributed variables.</p> <p>Results: Over the period studied, 675 calls were made to the hotline by 118 patients and 56% of calls were made after hours. For 78 calls (12%), advice and interventions given by hotline staff averted potential 000 calls by patients/carers. Specific advice about interventions for acute exacerbations of COPD (AECOPD) was given in a further 117 calls (17%). Callers had more severe COPD than non-callers (worse lung function, lower exercise capacity and higher prescription of home oxygen, all P &lt; 0.05). No adverse events related to use of the hotline were documented. Conclusion: A nurse-led 24-h hotline for patients with COPD is safe, is used by patients and carers and, when used, reduces hospital presentations with AECOPD.</p>
<p>Roberts N.J. Partridge M.R. Telephone consultations in secondary care. Respiratory Medicine.</p>	<p>Objective: To determine the role of telephone consultations in respiratory medicine. Design: An observational study. Setting: Respiratory outpatients department in an inner London teaching hospital.</p> <p>Participants: Five-hundred sequential patients attending three different outpatient respiratory clinics. Intervention: Substitution of the next intended consultation with a telephone consultation.</p>

<p>101(8)(pp 1665-1669), Aug 2007.</p>	<p>Outcome measures: Proportion of patients suitable for telephone consultation, their availability when telephoned, length of consultation and patient satisfaction.</p> <p>Conclusions: Telephone consultations are an effective alternative to traditional consultations in a third of respiratory patients attending for hospital follow-up. This style of consultation allows the option of not attending the hospital for a consultation and 23.9% had their consultation at their place of work.</p>
<p>Schofield I, Knussen C, Tolson D. International Journal of Nursing Studies. 43(4):465-76, 2006 May A mixed method study to compare use and experience of hospital care and a nurse-led acute respiratory assessment service offering home care to people with an acute exacerbation of chronic obstructive pulmonary disease.</p>	<p>BACKGROUND: Over the past 10 years hospital at home schemes for the treatment of an acute exacerbation of Chronic Obstructive Pulmonary Disease have proliferated throughout developed countries. For selected patients treatment at home is no less advantageous in terms of readmission rates and length of stay than treatment in hospital. Although care at home might seem to be a more desirable option than admission to hospital, little is known about care preferences and how people exercise service choice. OBJECTIVES: 1. to determine patients' recent use of and satisfaction with health care services during exacerbations of Chronic Obstructive Pulmonary Disease. 2. To determine and compare patients' and families' perceived future care preferences. 3. To complete an in-depth exploration of care experiences and preferences with a subset of respondents and their families.</p> <p>DESIGN: A mixed method design was used consisting of a postal survey and in-depth qualitative interviews with a subset of questionnaire respondents. SETTING: An outreach service provided by a large university hospital within Scotland, UK. PARTICIPANTS: One hundred and four out-patients registered with the Acute Respiratory Assessment Service and who had experienced hospital inpatient care during the past year, and their families. A subset of respondents was invited to take part in qualitative interviews.</p> <p>RESULTS: The majority of respondents indicated a preference for the home care service, and this was positively associated with high coping skills. There was a strong relationship between personal and family preferences. There was no linear relationship between a clinical measure of severity of lung disease and service use or care preferences. Results from the qualitative interviews endorsed and explained these findings.</p> <p>CONCLUSIONS: A range of factors combined to influence service use at a particular point in time, implying a need for increased self-management support from nurses and increased service provision.</p>
<p>Shin IH. Lee JH. Kim HC. Ubiquitous monitoring</p>	<p>The Purpose of this paper is to report a code division multiple access (CDMA) based wireless device that is able to measure pulse oxygen saturation(SpO2) and Electrocardiogram(ECG) during chronic obstructive pulmonary disease and heart disease patients' daily life at home. Global Positioning System (GPS) and a specific database system are also included in this device to</p>

<p>system for chronic obstructive pulmonary disease and heart disease patients. Conference Proceedings: ... Annual International Conference of the IEEE Engineering in Medicine &amp; Biology Society. 2007:3689-92, 2007.</p>	<p>trace patient's location. Unlike the pre-reported devices using wireless network like Bluetooth or Zigbee which has a limited connection area, the developed system enables the literally ubiquitous service in reporting the patient's data to their doctors at any time and any place using the CDMA-based cellular phone network.</p>
<p>Trappenburg JC. Niesink A. de Weert-van Oene GH. van der Zeijden H. van Snippenburg R. Peters A. Effects of telemonitoring in patients with chronic obstructive pulmonary disease. Telemedicine Journal &amp; E-Health. 14(2):138-46, 2008 Mar.</p>	<p>The objective of this study was to determine the effects of a homebased telemonitoring device, The Health Buddy (HB), on health consumption and health-related quality of life (HRQoL) in patients with moderate to severe chronic obstructive pulmonary disease (COPD). The HB provides daily symptomsurveillance by a case manager and education to enhance disease knowledge and self-management. A nonrandomized controlled multicenter study was established comparing the effectiveness of telemonitoring as an add-on to care as usual with a follow-up of 6 months. Four hospitals took part in the experimental group and 2 hospitals formed an equivalent control group with 59 and 56 patients, respectively. HRQoL was measured by the Clinical COPD Questionnaire. Healthcare consumption was assessed using medical records in the 6 months preceding study entry and during the study. Compared with the control group, the HB group showed a significant decrease in hospital admission rates (HB - 0.11 +/- 1.16 vs. control +0.27 +/- 1.0, p = 0.02) and in the total number of exacerbations (HB -0.35 +/- 1.4 vs. control +0.32 +/- 1.2, p = 0.004). There was a tendency toward decreased hospital days and outpatient visits. No significant changes in HRQoL were observed at follow-up between both study groups. Despite inherent limitations of the study, these findings suggest that adopting telemonitoring in everyday clinical practice is feasible and can substantially improve care and decrease healthcare utilization of patients with moderate to severe COPD.</p>
<p>Vitacca M, Assoni G, Pizzocaro P, Guerra A, Marchina L, Scalvini S, Glisenti F, Spanevello A, Bianchi</p>	<p>We assessed the feasibility of telemedicine for home monitoring of 45 patients with chronic respiratory failure (CRF) discharged from hospital. The patients transmitted pulsed arterial saturation (pSat) data via a telephone modem to a receiving station where a nurse was available for a teleconsultation. A respiratory physician was also available. Scheduled and ad hoc appointments were conducted. Thirtyfive patients were on home mechanical ventilation, 13 with invasive and 22 with non-invasive devices. The main diagnosis was chronic obstructive pulmonary disease (COPD). The follow-up period was 176 days</p>

<p>L, Barbano L, Giordano A, Balbi B. A pilot study of nurse-led, home monitoring for patients with chronic respiratory failure and with mechanical ventilation assistance. Journal of Telemedicine &amp; Telecare. 12(7):337-42, 2006</p>	<p>(SD 69). In all, 376 calls for scheduled consultations were received and 83 ad hoc consultations were requested by the patients. The actions taken were: 55 therapy modifications, 19 hospitalizations in a respiratory department for decompensated CRF, three hospitalizations in an intensive care unit (ICU), 22 requests for further investigations, 25 contacts with the general practitioner (GP), 66 demands for respiratory consultations and 10 calls for the emergency department. The mean time recorded for the 459 calls was 16 min/patient/week. In 82% of calls, a pSat recording was received successfully. The nurse time required to train the users in the operation of the pSat instrument was high (mean time 30 min). However, the results showed that home monitoring was feasible, and useful for titration of oxygen, mechanical ventilation setting and stabilization of relapses.</p>
<p>Vontetsianos T. Giovas P. Katsaras T. Rigopoulou A. Mpirmpa G. Giaboudakis P. Koyrelea S. Telemedicine-assisted home support for patients with advanced chronic obstructive pulmonary disease: preliminary results after nine-month follow-up. Journal of Telemedicine &amp; Telecare. 11 Suppl 1:86-8, 2005.</p>	<p>Eighteen well motivated patients with advanced chronic obstructive pulmonary disease, who had had at least four hospitalizations during the previous two years, were included in a home-based telemedicine study. A visiting nurse was equipped with a case containing a laptop computer and a number of medical devices, including an electrocardiogram recorder, spirometer, oximeter and blood pressure monitor. It also contained a videoconference camera, for realtime audiovisual connection with the hospital using the patient's TV set. A single ISDN line (128 kbit/s) was installed in each house before the study began. After nine months, there was a decrease in hospitalizations, emergency department visits and use of health services. The patient's disease knowledge and self-management also improved. It seems likely that adopting telemedicine in everyday clinical practice could substantially improve the care of chronically ill patients.</p>

<p>White P. Wong W. Fleming T. Gray B. Primary care spirometry: test quality and the feasibility and usefulness of specialist reporting. British Journal of General Practice. 57(542):701-5, 2007 Sep.</p>	<p>BACKGROUND: Provision of spirometry for chronic obstructive pulmonary disease (COPD) is a new requirement in primary care. Effective spirometry requires that tests and interpretations meet international criteria. AIM: To assess the feasibility and usefulness of remote specialist reporting of primary care spirometry.</p> <p>DESIGN OF STUDY: Comparison of reporting by primary care clinicians and respiratory specialists of consecutive primary care spirometry tests.</p> <p>SETTING: South London primary care teams with patient lists &gt; or =6000.</p> <p>METHOD: Feasibility of remote reporting of spirometry was assessed by the frequency of electronic mailing of tests. Usefulness of remote reporting was defined by the frequency that specialist reports made a clinically significant addition. Usefulness was assessed by measuring agreement (kappa) between primary care reports and those of specialists. Clinically significant disagreements were analysed with respect to test quality, diagnosis, and severity.</p> <p>RESULTS: Six practices emailed 312 tests over 3 months. Forty-nine tests sent without indices or curves (flow volume and time volume) were excluded. Mean age of patients tested was 65 years and 52% were female. Mean predicted forced expiratory volume in the first second (FEV1) was 69%. Clinically significant disagreements were identified in the interpretation of acceptability (quality) of 67/212 (32%) tests (kappa = 0.07; 95% confidence interval [CI] = 0 to 0.24), of diagnosis in 49/168 (29%) tests (kappa = 0.39; 95% CI = 0.25 to 0.55), and of severity in 62/191 (32%) tests (kappa = 0.53; 95% CI = 0.43 to 0.63).</p> <p>CONCLUSION: Remote reporting of primary care spirometry was feasible. Its usefulness was confirmed by the high rate of additional clinically significant information to the reports of primary care clinicians. The quality of primary care spirometry was so unsatisfactory that remote reporting of tests may be a means of establishing adequate spirometry.</p>
<p>Whitten P. Mickus M. Home telecare for COPD/CHF patients: outcomes and perceptions. Journal of Telemedicine</p>	<p>We evaluated the use of home telehealth for patients with chronic obstructive pulmonary disease (COPD) and/or congestive heart failure (CHF). Patients diagnosed with COPD and/or CHF who were prescribed home health-care services were randomly assigned to an experimental group where they received home health care through a combination of traditional face-to-face and telemedicine visits (n = 83), and a control group where only conventional home care was employed (n = 78). Data</p>

<p>&amp; Telecare. 13(2):69-73, 2007.</p>	<p>were collected via the Short Form 36 (SF-36), Outcome and Assessment Information Set (OASIS) and patient charts. In the experimental group, patient perceptions of the home telecare services were collected via telephone interviews. Overall, the addition of telehealth to COPD/CHF patient care was not a significant predictor of health and wellbeing, either positively or negatively. Although those receiving telehealth had worse ratings on the SF-36 general health subscale after the intervention, this measure was only significant when controlling for a number of key variables in the model. In regard to patient perceptions of home telecare, patients were satisfied with the technology and the way that care was delivered via this modality.</p>
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