

## Telehealthcare for long term conditions

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Cite this as: *BMJ* 2011;342:d120  
doi: 10.1136/bmj.d120

Telehealthcare is the provision of personalised healthcare over a distance.<sup>1</sup> It has the three following essential components<sup>2 w1</sup>:

- The patient provides data such as a voice recording, video, electrocardiography, or oxygen saturation that gives information about the illness.
- Information is transferred electronically to a healthcare professional at a second location.
- The healthcare professional uses clinical skills and judgment to provide personalised feedback tailored to the individual.

Telehealthcare can be delivered by both synchronous and asynchronous (such as store and forward) technologies (fig 1). For example, telephone and video conferencing enable consultations in real time. An example of asynchronous communication would be storing two weeks' of spirometry

### SOURCES AND SELECTION CRITERIA

We identified systematic reviews and original research studies on telehealthcare and long term conditions. We used searches from our ongoing Cochrane systematic reviews to find randomised controlled trials for telehealthcare interventions for asthma and chronic obstructive pulmonary disease. Search terms were telehealth, tele-health, telemedicine, tele-medicine, internet, computer, web, interactive, telecommunication, telephone, phone, SMS, tele-monitor, telemonitor, telemanagement, tele-management, teleconsultation, tele-consultation, telecare, tele-care, telematic, telepharmacy, and tele-pharmacy. We searched PubMed (1948 to March 2010) using search terms telehealthcare, telehealth, telecare, telemedicine, systematic review or randomised controlled trial, and selected relevant studies from these.

We searched the internet for so called grey literature, including legal and strategic documents, and official government healthcare websites. We also used our private libraries of research papers and completed and ongoing work on telehealthcare.

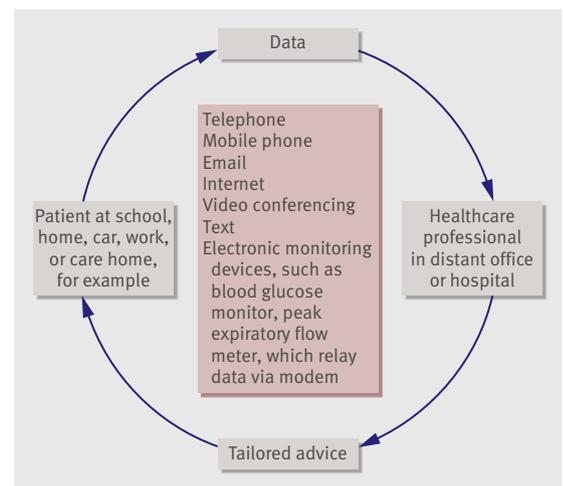


Fig 1 | Key elements of telehealthcare

results in a batch and forwarding these on to a healthcare provider, who responds by email or telephone.

Telehealthcare is related to, but distinct from telemedicine, where technology is used to share information over a distance between healthcare providers.<sup>2</sup>

### Why is interest in telehealthcare increasing?

Healthcare systems globally are facing major challenges such as ageing populations, increasing numbers of people living with long term conditions, patients in remote areas or with limited mobility, and increasing expectations for patient centred healthcare.<sup>w2 w3</sup> Telehealthcare offers potential solutions to these challenges (see box 1),<sup>3</sup> but the acceptability and effectiveness, and the safety considerations associated with its adoption need careful consideration.

### Acceptability to professionals and patients

#### Professionals

Telehealthcare can greatly alter the healthcare encounter. In the United States there was some resistance to adopting telehealthcare until state insurers (such as Medicare) recognised it as a reimbursable medical act. A similar reimbursement related barrier has been seen in parts of the European Union.<sup>w4</sup> In fact, in countries with insurance based health systems, collocation of patient and practitioner was sometimes a requirement for reimbursement.<sup>w4</sup> However, the European Commission now regards telehealthcare as a legitimate medical act, drawing attention to the points listed in box 2.<sup>w5</sup>

### SUMMARY POINTS

Telehealthcare is personalised healthcare delivered over a distance; data are transferred from the patient to the professional, who then provides feedback

In patients with severe long term conditions, such as problematic asthma and diabetes, telehealthcare can reduce hospital admissions without increasing mortality

Potential pitfalls include user interface problems, technical problems, and safety concerns such as data loss and confidentiality

Telehealthcare can alter the doctor-patient relationship so try to humanise the interaction

Consider workflows, to minimise unintended disruptions to normal routines

Careful assessment of effectiveness, cost effectiveness, and safety considerations is needed before introduction

**Box 1 | How might telehealthcare systems benefit patients?<sup>3</sup>**

Allows patients to be cared for in their preferred location, typically at home  
 Provides patient education and support for preventive care in, for example, those trying to lose weight  
 Videophone or web based clinical consultations, such as those for asthma or chronic obstructive pulmonary disease, or diabetes annual reviews, can replace routine visits such as face to face annual reviews  
 Improves adherence to drugs and other treatments  
 Proactive education and support, such as via web forums, may facilitate self management and help with coping (for example, in people with chronic back pain) or prevent exacerbations of conditions such as asthma  
 Use of monitoring techniques can enable earlier detection of disease exacerbations, thereby facilitating timely management and support  
 Allows greater opportunities for continuity of care with the same clinician and more frequent assessments  
 Reduces costs to patients by obviating the need for time off school or work and for travel

**Box 2 | Summary of the European Economic and Social Committee's opinion on telehealthcare<sup>w5</sup>**

Telehealthcare cannot and should not replace conventional medicine. It is a complementary technique, limited by the absence of clinical examinations.  
 The status of the health practitioner should be clearly indicated  
 The patient must benefit from the latest medical knowledge  
 The patient must be able to give his or her free consent  
 Medical confidentiality must be ensured  
 Resulting documents must be secure and recorded in the medical file  
 Continuity of care must be ensured  
 The medical act must be of at least equivalent quality to a traditional act

**Box 3 | An example of a successful telehealthcare intervention in type 2 diabetes<sup>13 14</sup>**

The IDEATel trial (<http://clinicaltrials.gov/ct2/show/NCT00271739>) found that when people monitored their blood glucose and blood pressure with telehealthcare input from specialist nurses and endocrinologists, their glycated haemoglobin decreased, as did their blood pressure, and low density lipoprotein-cholesterol. All cause mortality was similar in the intervention and control arms of the trial. The study was not powered to find differences in mortality from cardiovascular disease.

Further analysis showed that improvement in self efficacy in older ethnically diverse patients with diabetes resulted in an improvement in glycaemic control. The telehealthcare intervention had a direct effect and an indirect effect—mediated by a change in self-efficacy—on glycaemic control. Blood pressure and low density lipoprotein-cholesterol improved, but this effect was not mediated by a change in self efficacy.

**Patients**

Patients' attitudes to telehealthcare have been extensively studied. A 2007 systematic review of patients with a range of long term conditions found that most patients saw telehealthcare as a positive development.<sup>3</sup> Telehealthcare improves access to care, which increases patients' understanding of their condition and can lead to a greater sense of empowerment and willingness to engage with self care.<sup>3 4</sup>

Telehealthcare is not just suited to the technologically literate. A 1998 study of people with little experience of technology using a new asthma telehealthcare system daily for three weeks found that 88% of them felt safer while being monitored by the system; 94% were interested in using the same system in the future.<sup>5</sup>

Descriptive studies provide only limited data on patients' and carers' perspectives on these new models of care. A 2000 systematic review found that despite a large body of literature on patients' satisfaction with telehealthcare, the research lacked depth. The authors urged caution when

interpreting the largely positive findings reported in many studies.<sup>6</sup>

Qualitative approaches can generate a more rounded, nuanced appreciation of patients' experiences and expectations. A 2009 study convened a so called citizens' panel to help understand patients' perspectives on telehealthcare.<sup>7</sup> The panel discussions generated important insights. Although the policy discourse on telehealthcare is full of positive references to a shift in the patient's role from passive to active—becoming “informed,” “expert,” and “self managing”—the panel thought that existing power relationships were often reinforced, with passive patients being monitored by a now distant medical professional. They also concluded that telehealthcare could not take the place of face to face interaction and that a combination of face to face and telehealthcare consultations was optimal. The panel emphasised the need for increased discourse with the public regarding the boundaries for these technologies, because of a concern that telehealthcare could take attention away from personal care needs. However, the panel recognised that such interventions could potentially make a valuable contribution to modern healthcare provision so long as the patient still had the option of face to face care, if required.

Other qualitative studies have identified similar concerns. The subjects in a 2008 study registered some annoyance with their partner or informal carer for being “too concerned” during a period of telehealthcare in the home. Interviews with the partners showed that they felt “forced to take responsibility,” despite feeling insecure and worried because they lacked confidence in the technology.<sup>w6</sup> More positively, patients also described feeling secure with telehealthcare and described being “looked after” at home. They also experienced “freedom” in contrast to being “under surveillance” while in hospital.

Age and cognitive function are relevant when considering the acceptability of telehealthcare to different populations. Incipient dementia or mental health problems can affect patients' ability to use the technology. As vision, hearing, and dexterity change with age, even mentally competent older people may struggle with the technology. Further, setting up systems that increase the social isolation of this group of vulnerable people is a concern. Each individual's suitability for telehealthcare interventions needs to be carefully considered.<sup>w7 w8</sup>

**Effectiveness and cost effectiveness****Effectiveness**

The effectiveness of telehealthcare is often assumed by industry and policymakers.<sup>8</sup> However, effectiveness depends on the context of the introduction of a specific system. The aim of introducing telehealthcare must be clear from the start.<sup>9</sup> Such aims might be to widen access, improve clinical end points, aid the early detection of disease exacerbations, reduce the risk of hospital admissions, reduce mortality, or reduce the degree of dependency in old age. Agreement on why telehealthcare has been introduced, followed by focused implementation and evaluation to see if the specific need has been dealt with, helps determine when and if aims have been realised.

Several examples of clinically successful telehealthcare projects exist (see box 3 for an example in patients with



**Fig 2 | Telehealthcare with video conferencing for a patient with chronic obstructive pulmonary disease**

diabetes). In chronic obstructive pulmonary disease, interventions with a dedicated chronic obstructive pulmonary disease case manager have reduced the numbers of exacerbations and related admissions to hospital.<sup>10-12</sup> For example, in one trial, case managers provided an enhanced service during working hours, monitoring patients with increased frequency using media including video conferencing (see fig 2). In a 2003 trial of patients with chronic obstructive pulmonary disease related respiratory failure requiring long term oxygen therapy or mechanical ventilation, or both, case managers alternated physical visits to the patient's home with virtual home visits via telehealthcare to conduct reviews and reduce the need for admission.<sup>10</sup>

Our systematic review identified several telehealthcare trials in asthma with similar findings.<sup>15</sup> It found little evidence of improvements in measures of disease specific quality of life in most patients with mild or moderate disease, but hospital admissions were reduced in carefully selected patients who had severe asthma or had recently been admitted to hospital (or both) and are consequently at high risk of readmission.<sup>15</sup>

A 2009 systematic review found that telehealthcare for people with diabetes can help improve glycaemic control.<sup>16</sup> The number of admissions to hospital and the length of stay associated with admission were reduced. People with more severe problems benefitted most from the regular tailored feedback.<sup>6</sup> The data suggested that outcomes were more likely to improve if these contacts helped establish and maintain the continuity of a close therapeutic relationship. Patients were likely to become better at self management and increase their self efficacy so that, over time, they depended less on feedback.<sup>13-16</sup> Conversely, patients with high baseline self efficacy may be less likely to benefit from a management regimen that involves frequent testing and reporting.

Overall, the evidence shows that telehealthcare based initiatives may be particularly helpful for people with accessibility problems, or where a need for careful monitoring and regular feedback has been identified, or both. These newer models of care seem to be less effective in people with relatively mild disease and those in whom control is already considered optimal.<sup>13-15-17</sup>

#### Cost effectiveness

Evidence suggests that only some classes of low cost telehealthcare interventions in certain contexts (such

#### Box 4 | Remote prescribing guidance from the UK General Medical Council<sup>w14</sup>

In all circumstances, ensure that you have an appropriate dialogue with the patient to:

- Establish the patient's history and current medical conditions and current or recent use of drugs, including non-prescription ones
- Carry out an adequate assessment of the patient's condition
- Identify the likely cause of the patient's condition
- Ensure that there is sufficient justification to prescribe the drugs or treatment proposed. Where appropriate discuss other treatment options with the patient
- Ensure that the treatment or drug(s) are not contraindicated for the patient
- Make a clear, accurate, and legible record of all drugs prescribed

as telephone follow-up to improve attendance or text messaging reminders for monitoring) are likely both to improve outcomes and reduce costs.<sup>18</sup> Overall, the evidence for cost effectiveness is limited. Where studies have been conducted, they were often short term or did not consider the full range of perspectives (those of the patient, healthcare provider, and society). There are only a limited number of more detailed analyses, such as cost-utility analysis or estimations of opportunity costs.<sup>14 w9-w11</sup>

#### Safe implementation

##### Protocols and procedures

Professionals and their respective bodies have been hesitant to introduce telehealthcare partly because of safety concerns. The worry is that specialist emergency care might be precluded for an ill patient managed outside of the hospital environment—as in the case of a patient experiencing an exacerbation of chronic obstructive pulmonary disease, for example—should an unpredictable acute deterioration occur. However, in most cases acute deterioration can be anticipated, and the death rates of patients managed in the community are, so far as has been demonstrated in trials, not higher than those managed in hospital.<sup>19-20</sup> This concern helps to explain the increased intensity of monitoring when telehealthcare systems are introduced into people's homes. Frequency of contact is often necessary to gain the confidence of both patients and healthcare professionals using the technologies. However, to tackle these concerns more research with full reporting of adverse events is needed.

Access to healthcare professionals via telephone, email, and the internet or other networked interventions may lead to breaches of confidentiality or loss of electronic data (or both), as has been illustrated by several recent high profile cases.<sup>w12 w13</sup> Appropriate encryption software should be used and secure data transfer built into systems. Doctors should follow the advice from national professional regulatory bodies on telephone and email consulting, such as the General Medical Council's advice for UK practitioners (box 4).<sup>w14</sup>

More fundamentally, doctors need to consider whether a remote consultation is appropriate in the first place. Most defence unions emphasise that no email, text message, or telephone consultation is a substitute for a standard face to face consultation and examination.<sup>21 w15 w16</sup> In the UK, general practices are contractually obliged

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- ▶ Preventing exacerbations in chronic obstructive pulmonary disease (*BMJ* 2011;342:c7207)
- ▶ Islet transplantation in type 1 diabetes (*BMJ* 2011;342:d217)
- ▶ Diagnosis and management of hereditary haemochromatosis (*BMJ* 2011;342:c7251)
- ▶ Diagnosis and management of soft tissue sarcoma (*BMJ* 2010;341:c7170)

to offer patients a physical examination if considered appropriate.

### Workflow changes

The potential for disruption to existing workflow patterns should not be underestimated and is a major factor in the failure of many IT based service redesigns.<sup>22 23</sup> Healthcare professionals need to have protected time and resources to respond to the work generated by telehealthcare. More broadly, a theoretical framework such as normalisation process theory can help identify the barriers to change in this type of situation.<sup>w17</sup>

For example, consider the implications of a trial of a telehealthcare intervention in patients with chronic heart failure in which patients monitored their own weight and blood pressure and recorded their own electrocardiogram to transmit to a hospital based specialist nurse. The nurse, in consultation with a cardiologist, provided tailored advice to the patient over the telephone on managing the illness.<sup>w18</sup>

- Several important workflow points were highlighted:
- The role and responsibility of the nurse has changed; nurses are increasingly involved in decision making, which requires further training.
  - The general practitioner is somewhat marginalised, because patients with increasingly complex management regimens default to a trusted specialist relationship.
  - There is a need to maintain accountability; this can be achieved by protocols and guidelines for case managers, describing how much they can undertake themselves and when to involve a senior medical practitioner, though such protocols and guidelines may prove burdensome.

### Training of staff and patients

The integration of telehealthcare into health service workflows often means adding to the roles and responsibilities of healthcare professionals. This was the case in the Columba telehealthcare initiative,<sup>w19</sup> where extensive protected training opportunities had to be provided for staff. During these sessions, staff learnt how to use



**Fig 3** | Once confident with using the technology, patients can continue to operate it independently

### ADDITIONAL EDUCATIONAL RESOURCES

- McLean S, Chandler D, Nurmatov U, Liu J, Pagliari C, Car J, et al. Telehealthcare for asthma. *Cochrane Database Syst Rev* 2010;10:CD007717.
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the technologies and in turn contributed ideas for the adaptation and integration of the technologies into existing workflow patterns.

Patients may also need training. Ideally, to help establish trust and confidence, the first interaction of a telehealthcare system should be face to face. Training should be tailored to patients' baseline familiarity with technology. Once confident with using the technology, patients can continue to operate it independently (see fig 3).

Looking ahead, future research should seek to understand how best to humanise the remote relationship and find ways of maintaining and, if possible, enhancing the all important therapeutic relationship.<sup>w5</sup>

### Conclusions

Telehealthcare based interventions are proliferating rapidly and are underpinned by variable quality of evidence. To implement telehealthcare effectively and safely, the aims of introducing telehealthcare to a care process must be clear. Such aims might be to improve access, increase satisfaction, avoid emergency admissions, or reduce costs. Less complex interventions, such as those based on the telephone, have a more robust evidence base, but even with such established technologies healthcare providers must remain vigilant to the dangers of compromising safety in the absence of a face to face consultation.<sup>24</sup> Contextual factors such as type of illness, type of technology, age, and ability of the patients to interface with technology must be considered. Robust cost-benefit evaluations must be performed before making these technologies mainstream, to avoid increased cost and widespread disappointments.<sup>25 w20</sup>

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**Contributors:** AS conceived the idea for this paper. SMCL drafted the paper, which was commented on by DP and revised by AS. SMCL and AS are guarantors.

**Competing interests:** All authors have completed the Unified Competing Interest form at [www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) (available on request from the corresponding author) and declare that this work was supported by grants from NHS Connecting for Health Evaluation Programme (NHS CFHEP 001) and an Academic Fellowship for General Practice funded by NHS Education for Scotland; support was also received from the Chief Scientist's Office of the Scottish Government; the authors have no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

**Provenance and peer review:** Commissioned; externally peer reviewed.

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Accepted: 29 December 2010

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**STATISTICAL QUESTION**

**Meta-analyses V**

Statements *b* and *d* are true, whereas *a* and *c* are false.

**ON EXAMINATION QUIZ**

**Glasgow coma scale**

**Patient 1** Score of 10 (eye opening to pain: 2; speaking, but incomprehensible: 3; localises to pain: 5)

**Patient 2** Score of 3 (no responses for eye opening, speech, or pain: 1 each (3))

**Patient 3** Score of 13 (eye opening when asked: 3; confused speech: 4; normal movements: 6)

**CASE REPORT**

**Neck lump in a young woman**

- 1 Local symptoms such as voice changes, a nodule in a child, cervical lymphadenopathy, rapid enlargement, or stridor should prompt urgent referral.
- 2 In a young euthyroid patient, a neoplastic thyroid lesion should be excluded first. Other differential diagnoses include lumps of non-thyroid origin (branchial cyst, cystic hygroma, parotid tumour, laryngocele, carotid body tumour) and thyroid origin (toxic goitre and non-toxic goitre, both of which are unlikely in this euthyroid patient).
- 3 Fine needle aspiration is the investigation of choice for a definitive histological diagnosis.
- 4 Ultrasound of the neck will help localise the anatomical origin, and measurement of serum calcium and 24 hour urinary catecholamines might help rule out hyperparathyroidism and pheochromocytoma, respectively.
- 5 Medullary thyroid cancer was confirmed by fine needle aspiration. If this is suspected, look for symptoms and signs of local invasion (dysphagia), metastasis, and the systemic effects of concurrent calcitonin and peptide secretion (frequent loose stools and vasomotor flushing). Medullary thyroid cancer may be sporadic, familial, or as part of the multiple endocrine neoplasia syndromes (MEN2A and MEN2B) so multiple endocrine neoplasia needs to be excluded too. Patients with established medullary thyroid cancer should undergo a total thyroidectomy and local neck dissection. Prognosis is good, with a 92% survival rate at 10 years.