Telemedicine in healthcare 1: exploring its uses, benefits and disadvantages

An outline of the various applications for telemedicine in healthcare, and an examination of the advantages and disadvantages of using this technology

INTRODUCTION
Telecommunication technologies can be used to facilitate the delivery of healthcare to patients living in remote areas and enable information exchange between healthcare professionals (Maheu et al, 2001).

In the UK, a growing and ageing population, along with more sophisticated clinical interventions, means there are demands for an increasing focus on quality and efficiency to maintain ready access to effective healthcare.

Stanberry (1998) warned that headlong investment in technology for its own sake was misguided. He advocated maintaining patient safety, consumer focused relations between professionals and patients, and identifiable service improvement as significant considerations for investment in telemedicine.

The Department of Health developed the National Programme for IT (NPfIT) to move the NHS in England towards a single, centrally mandated electronic care record for patients. This connects GPs to hospitals, providing secure and audited access to records for authorised healthcare professionals (House of Commons Committee of Public Accounts, 2007).

The programme aims to improve patient care by enabling clinicians and other staff to increase efficiency by giving them easy, safe and secure access to patient information. The DH agency NHS Connecting for Health (NHS CiH) is responsible for delivering it.

There are also plans for patients to have access to their records online through a service called HealthSpace. NPfIT is said to be “the world’s biggest civil information technology programme” (House of Commons Committee of Public Accounts, 2007).

DEFINITION OF TELEMEDICINE
Most definitions of telemedicine focus on improved access to healthcare services through the use of telecommunications technology. Logan (1998) defined telemedicine as: “Simply a tool that permitted more equitable distribution of comprehensive specialty and sub-specialty healthcare services to remote populations.”

Other definitions include using and accessing remote medical expertise to seek or give advice on patient care.

Telemedicine is therefore a diverse and comprehensive concept that incorporates transfer and exchange of medical information using telecommunication technologies.

Beyond the key concept of single patient/practitioner interface, Craig and Patterson (2006) outlined natural extensions that could include electronic links between multicentre care facilities locally, nationally or internationally, heralding the notions of “telehealth” and “telecare”.

However, technological advances should not be seen as a new form of medicine, but merely as a new location (Bashshur et al, 2005) that will not in itself provide a cure or replace healthcare professionals (Craig and Patterson, 2006).

Other terms used when discussing technology in healthcare include telehealth, which refers to the delivery of health-related services and information via telecommunications technologies. Telehealth delivery could be as simple as two healthcare professionals discussing a case over the telephone, or as sophisticated as the use of videoconferencing by providers at facilities in two countries, or even as complex as robotic technology.

Telehealth is an expansion of telemedicine, but unlike telemedicine (which more narrowly focuses on the curative aspect), encompasses preventive, promotive and curative aspects (Maheu et al, 2001). Although originally used to describe administrative or educational functions related to telemedicine, telehealth is now used to describe a myriad of technology solutions. For example, doctors use email to communicate with patients, order drug prescriptions and provide other health services (Field, 1996).

E-health is a term introduced relatively recently to describe healthcare practice supported by electronic processes and communication. The term is inconsistently used: some would argue it is interchangeable with healthcare informatics and a subset of health informatics, while others use it in the narrower sense of healthcare practice using the internet (Field, 1996).

The term telecare refers to the continuous, automatic and remote monitoring of real-time emergencies and lifestyle changes over time to manage the risks associated with independent living (Telecare Aware, 2009).

In the UK, the NHS set targets for implementing e-health:
- 2001 – to have up to 90% of GP practices and 25% of hospitals connected to NHSmail;
- 2002 – to have desktop connections for all NHS clinical, staff linking them to basic emails, browsing and directory services;
- 2003 – to have completed migration to national standards for all email, internet browsing and office systems in the NHS and all NHS staff to have desktop access;

PRACTICE POINTS
- Telemedicine has several applications and nurses need to understand the full range of possible uses.
- Using telemedicine technology in healthcare has several advantages and disadvantages.

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This first in a two part series on telemedicine in healthcare outlines the background and context for using this technology. It discusses the levels of telemedicine and its possible applications in healthcare, and examines its advantages and disadvantages.
2004 – to have access to electronic patient records (EPRs) and electronic transfer of prescriptions (ETP);
2005 – to have all appointments bookable electronically. There will be local telemedicine facilities and all GP practices and hospitals will be able to use EPRs and ETP (House of Commons Committee of Public Accounts, 2007).

**LEVELS AND TYPES OF INTERVENTION**

Craig and Patterson (2006) said that all telemedicine interventions were based on patients or professionals obtaining an opinion on treatment or care from someone who is more experienced or an expert in a particular field.

Accordingly, telemedicine interventions could be classified on the basis of the type of interaction and information transmitted between patients and professionals.

According to Maheu et al (2001), such intervention could be categorised into four levels (Box 1).

Table 1 outlines the clinical applications of telemedicine.

**Ranges of application**

Clough (1999) said that telemedicine and telecare already encompassed a wide range of applications with varying degrees of sophistication, from standard telephone equipment to complex scanners and communication satellites.

Some systems are live or interactive, using videoconferencing or a telephone, while others adopt a “store and forward” method.

Telemedicine can be used to access expert advice. It is already used in areas such as: cardiology; dermatology; endoscopy; home monitoring; information for patients and carers; community nursing; ophthalmology; pathology; radiology and imaging; and psychiatry.

**RATIONALITY**

McClellan et al (2008) said that the Organization for Economic Cooperation and Development provided evidence that high quality and cost effective healthcare interventions are not being used effectively at local, national and global levels. This results in misuse of resources, long waiting lists and variations in standards of care across hospitals (Heinzelmann et al, 2006).

Bashshur (2001) argued that telemedicine would significantly help reduce barriers in information sharing among healthcare professionals. This way, constraints in accessing care for large numbers of patients across wide areas would be reduced. Equally, rises in global costs of healthcare and considerable variation in standards of care would be more controlled (Heinzelmann et al, 2006). Telemedicine therefore provides an option for contemporary quality control and future resource allocation and planning.

**ROLE**

Telemedicine can be used when healthcare professionals and patients are unable to meet face to face due to geographical distances, convenience or practicality. Eng and Gustafson (1999) identified a number of functions that telemedicine can provide:

- Individualised health information;
- Enhancing decision making in clinical management;
- Facilitating communication between healthcare professionals;
- Health promotion/changing health behaviours and lifestyle to adopt and maintain good health;
- Offering support;
- Educating patients, carers and relatives on managing health problems by facilitating remote monitoring and information delivery.

There is scope for telemedicine to improve healthcare outcomes, in terms of reducing secondary complications, enhancing communication and centralising data sources to allow information sharing. Craig and Patterson (2006) said that telemedicine could contribute to improving equity in accessing care by enhancing communication between healthcare professionals.

**BENEFITS**

Telemedicine can be used to monitor patients’ health from a distance, offer advice and manage healthcare needs.

Hui et al (2001) conducted a pilot study on the feasibility of telemedicine in providing geriatric services and whether this method of care delivery might increase productivity and cut costs. Two hundred residents were recruited from a local nursing home. Teleconferencing was used to replace face to face outreach services over one year. The feasibility of telemedicine was evaluated by participating specialists (medical staff, nurses, psychologists, physiotherapists and occupational therapists), who tested productivity gains, use of hospital services and user satisfaction.

The findings suggested that telemedicine

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**TABLE 1. CATEGORIES AND EXAMPLES OF TELEMEDICINE APPLICATIONS**

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Patient care</td>
<td>Radiology consultations; post-surgical monitoring; triage of emergency patients</td>
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<tr>
<td>Professional education</td>
<td>Continuing medical education programmes; online information and education resources; individual mentoring and instruction</td>
</tr>
<tr>
<td>Patient education</td>
<td>Online help service for patients with long term conditions</td>
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<tr>
<td>Research</td>
<td>Aggregation of data from multiple sites; conducting and coordinating research at multiple sites</td>
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<tr>
<td>Public health</td>
<td>Access to care for disadvantaged groups; poison control centres; reporting</td>
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<tr>
<td>Healthcare administration</td>
<td>Video conferences for managers of integrated health systems; quality monitoring</td>
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**BOX 1. FOUR TELEMEDICINE LEVELS**

- **Level 1** – using emails or faxes to transfer medical data over telephone lines.
- **Level 2** – transmitting still images or “store and forward” information such as electrocardiogram strips, pathology slides and/or X-rays.
- **Level 3** – transmitting synchronous, interactive, audio-visual communications. This requires satellite, telephone and microwave or internet technology.
- **Level 4** – in the US this is limited to research conducted at the Department of Defence. The technology was designed for remote palpation and guided robotic surgery.

Source: Maheu et al (2001)
was an adequate means of service delivery in up to 99% of cases, in that follow-up intervals were cut, follow-up care via teleconferencing was cheaper than face to face outreach or clinic activities and, importantly, patients accepted telemedicine as a valid form of continuity with healthcare professionals. A 9% reduction in visits to accident and emergency units and 11% fewer admissions to acute hospital wards shows more tangible economic savings. Hui et al (2001) concluded that telemedicine was a feasible way of delivering multidisciplinary care to frail nursing home residents and might result in increased productivity and significant savings.

Pain et al (2007) conducted a randomised controlled trial in three centres over two years to evaluate the effectiveness of using internet-based video link technology. The study was for patients in the first six months post discharge from spinal rehabilitation centres. Standardised assessments took place before allocating participants to intervention or control groups. Both groups received standard post-discharge support, but the intervention group also had regular videoconferencing sessions. Participants underwent assessment at two months and six months post discharge. The results (from 77 participants) revealed significant differences between the two groups when quality of life intra-subject score differences between discharge and month six were compared (p=0.025). Other findings indicated that the video link was accepted by the intervention group.

Pain et al (2007) suggested regular expert consultation after discharge via video link technology improved participants’ quality of life. Participants suggested tele rehabilitation should be targeted at people assessed as having continuing health or rehabilitation needs. This supports earlier points on the efficacy of telemedicine as a malleable tool for acute care and follow-up and preventive healthcare (Maheu et al, 2001).

Other benefits include educational opportunities for healthcare professionals. Similar considerations of ease of access, travel constraints and costs, applicable to patient care, also apply here (Hjelm, 2006).

**Home care**

Elford et al (2000) stressed that the most important potential benefit of telemedicine was access to quality healthcare for rural communities. This means patients no longer need to travel in order to consult medical specialists.

**Telemedicine** is playing a major role in home care collaboration and partnership working between primary and acute care professionals. The driving forces for these are patients being discharged earlier from hospital with additional care needs at home; treating patients at home is cheaper than in hospital and many prefer to stay in their homes rather than moving to nursing homes or hospices (Elford et al, 2000).

Advocates of telemedicine argue that it offers effective advice and enhanced communication between healthcare professionals and relatives. Guest et al (2005) examined its use in helping neurologically impaired children at home. One family was recruited as a pilot study to assess the feasibility of telemedicine.

The findings suggested the family did not feel isolated from expert help and advice since the technology was simple to use and they found teleconsultations as reassuring as face to face consultations. The child was able to spend more time with family in a familiar setting instead of hospital. The family indicated significantly improved independence (Guest et al, 2005).

Soopramanien et al (2005) examined telemedicine in providing post-discharge support for patients with spinal cord injury, with a sample of 12 patients recruited from a spinal centre in the UK. Preliminary results indicated telemedicine enabled healthcare professionals to have better understanding of family interactions, which facilitated more effective care. The study concluded that telemedicine offered an additional means of support for outpatients with spinal cord injury.

**Referral**

Telemedicine also provides the opportunity to refer patients directly to specialist consultants for advice on managing their conditions. Magjarevic et al (2003) considered the acceptability and usability of information technology as a means of psychosocial rehabilitation for patients with spinal cord injury in Croatia.

Findings indicated that most participants accepted telemedicine support in psychosocial rehabilitation.

So far, the literature indicates that telemedicine can reduce healthcare costs by providing care to patients at home, reducing their need to travel to specialist centres. In addition, duplication of test results and other information can be reduced (Badshur, 2001).

There is a need for large scale trials to examine the cost effectiveness of telemedicine as there is little quantitative information about potential savings (Hjelm, 2006; Magjarevic et al, 2003).

**DISADVANTAGES**

One possible consequence of using teleconsultations or video link is a breakdown in the patient/healthcare professional relationship. Arguably, communication breakdown could result from poor interpersonal skills as well as poor mastery of telemedicine technology.

Nonetheless, depersonalisation due to physical and mental factors, new and different processes of consultation, inability to perform the whole consultation due to technical difficulties and patients’ reduced confidence in healthcare professionals are all potential negative aspects of telemedicine.

Hjelm (2006) argued that relationship breakdown has not been explored to any great extent. She suggested that highly skilled healthcare professionals may perceive their autonomy is threatened by telemedicine, and feel they become no more than information technology technicians relegated to operating computers and transforming information electronically.

Maheu et al (2001) identified several barriers to using telemedicine in healthcare (Box 2).

Stanberry (2006) illustrated the complexity of managing change in healthcare and pointed to obstacles related to telemedicine:

- Lack of evidence about cost effectiveness and efficiency of telemedicine applications;
- Potential/perceived threat to healthcare professionals’ role and status;
- Possibly increasing workload;
Fear that telemedicine is “market driven” rather than “user driven”;
Lack of technological knowledge and skills;
Cultural and linguistic differences among healthcare professionals and patients;
Lack of agreed standards about its use.
Hjelm (2006) argued many of these points could be incorporated into risk assessments as specific evaluation criteria when considering telemedicine. To date the evolution of protocols and guidance has been piecemeal.
Since most professionals are not familiar with telemedicine, research is needed into how best to achieve competency and efficiency of the system and the staff within it, while maintaining safeguards for patients.
There is scant evidence on the reliability of telemedicine for diagnostic or therapeutic intervention.

CASE STUDY
Using “store and forward” technology for pressure ulcer assessment in patients with spinal cord injury
Accurate assessment of pressure ulcers in spinal cord injury is critical in planning therapeutic management to maintain adequate healing and prevent complications. However, several factors may inhibit wound assessment in community settings, such as a lack of time and patient transport, and a lack of staff knowledge about assessment and treatment.
Tracy Geddis, a senior staff nurse in the spinal outpatient department at the National Spinal Injuries Centre at Stoke Mandeville Hospital, was involved in the “storing and forwarding” of digital images and assessed the application of telemedicine in meeting patients’ needs in the community.
Community nurses, patients and carers were encouraged to send digital images of pressure ulcers for assessment and advice on treatment. Telephone consultation between sender and receiver occurred simultaneously at the time of image transmission.
Nurses said using telemedicine in the community could reduce costs for patients and health services, allow expert consultation with specialist distant centres and promote learning among practitioners.
They identified some problems while assessing the digital images:
● Time;
● Extra paperwork;
● Resources;
● Access to photos;
● Quality of picture;
● Understanding of tools used;
● No measuring guide to scale and depth;
● Could not see or smell exudate.
They gave positive feedback from using digital images:
● Patients can be treated at home without travelling to clinics;
● Nurses can monitor progress/deterioration and discuss treatment via telephone and liaise with other team members;

Cuts down clinic lists;
Saves time and effort and is therefore cost effective.
Nurses also gave some negative feedback:
● Quality of picture;
● Not knowing the exact location of the wound;
● Unable to assess the cause, for example, mattress, toilet seat, shower chair, transfers;
● Unable to assess home environment;
● No networking (meeting district nurse).
Nurses at the spinal outpatient department said there was a place for technology to develop further in wound assessment. However, they needed training, resources and information to improve the service for practitioners and patients.

CONCLUSION
Telemedicine covers the application of a variety of electronic and communication techniques in providing healthcare. The techniques have already been applied in the context of teletriage, telediagnosis, telefollow-up and telemonitoring.
Telemedicine has a variety of applications in patient care, education, research, administration and public health. It has the potential to deliver benefits to patients, clinicians and the NHS as a whole.

Part 2 of this series, to be published in next week’s issue, examines the legal and ethical aspects of telemedicine.

REFERENCES