

Telemedicine in the National Health Service

Richard Wootton PhD DSc

J R Soc Med 1998;91:614-621

TELEMEDICINE FORUM, 23 SEPTEMBER 1998

The UK Government has lately declared that, where there is evidence that the techniques are cost-effective, telemedicine will be introduced into the National Health Service (NHS). In late September 1998 the Royal Society of Medicine's Telemedicine Forum held a meeting to discuss a strategy whereby telemedicine might be implemented. This report summarizes the recommendations that emerged, and also incorporates some guidance notes based on the collective experience of those present (see Acknowledgment).

WHAT IS TELEMEDICINE?

Telemedicine for diagnosis and management can be real-time long-distance videoconferencing, in which the patient consults a specialist located at a remote site; or it can be the transmission of either real-time or prerecorded images and data to a remote expert, as in teleradiology or telepathology. The common thread is a client of some kind obtaining an expert opinion when the two are separated in space, in time or in both. Telemedicine episodes can therefore be classified on the basis of the *interaction* between client and expert (prerecorded or real-time) and on the *information content* of that interaction (text, still images or video) (Figure 1).

Telemedicine is more than simply diagnosis at a distance, and encompasses the whole spectrum of medical and nursing activities. Telemedicine is medicine practised at a distance and as such is a *technique* and not a technology. Unfortunately the subject of telemedicine, like information technology generally, has been bedevilled by inexact terminology, jargon and loose language. Similar terms are used in confusing ways—for example, telehealth, telecare, telenursing, telematics. The Greek prefix *tele-* refers to distance. Thus, telemedicine is the generic term signifying any medical activity involving distance, and covers diagnosis and clinical management, treatment, and education (for both health care workers and patients). Note that this general definition has nothing to do with the use of telecommunications. Telemedicine was practised hundreds of years before telecommunications were developed¹. For example, patients in 18th century London used to consult

their doctors by letter: the doctors would prescribe treatment by return of post. The general definition of telemedicine given above encompasses activities such as public health measures (e.g. education of patients who are not ill) and nursing activities, whenever there is a distance element.

BACKGROUND TO TELEMEDICINE IN THE NHS

Much of the early work in telemedicine was done in Scandinavia, where governments were committed to equal access to health care for the whole population but geographical barriers made this difficult to achieve. In recent years there has also been an upsurge of interest in Australia and in particular the USA, where telemedicine is now a major commercial activity. The UK is a late entrant and much of the work is still at the experimental stage. The potential to improve health care in the UK by this method is, however, increasingly being recognized. To date this has mostly been because of the vision of a small number of interested parties (medical, nursing or other); but now information technology, and telemedicine in particular, is to be an important part of the modernization of the NHS. The Government's intentions were clarified in a parliamentary Written Answer to Lord Swinfen, who asked:

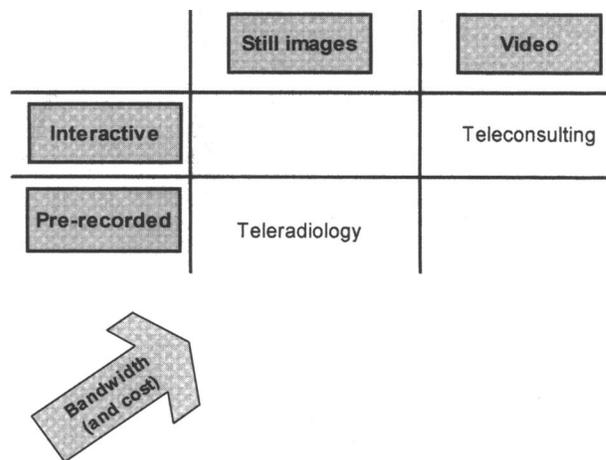


Figure 1 Telemedicine episodes classified according to nature and information content (still or moving images). The data transmission rate, and therefore the cost, rises from bottom left to top right

Whether, if significant introduction of telemedicine (that is remote diagnosis using information and readings supplied on-line or by telephone) is planned for the National Health Service, the fundamental principle of evidence-based medicine will be preserved; and whether: (a) telemedicine applications will only be introduced on the basis of identifiable clinical need supported by evidence of cost-effectiveness; and (b) external commercial pressures to introduce telemedicine will be resisted until evidence of cost-effectiveness has been obtained by scientific research trials in the National Health Service.

Lady Hayman, Parliamentary Under-Secretary of State, Department of Health, replied:

The Government is committed to modernising the NHS including introducing telemedicine applications where this is appropriate. These will only be widely introduced where there is clinical need and evidence from research and evaluation indicates that it is appropriate to do so².

The Government is therefore pledged to introduce telemedicine as a means of delivering health care, but only where it has been shown to be effective and efficient. A strategy by which this should be best done is further explored.

Expected impact

In broad terms, telemedicine can be expected to improve the efficiency of a national health service by enhancing communication up and down the health care pyramid. Widespread adoption of telemedicine would permit decentralization: work previously done in the higher strata of the primary care sector could be carried out in the community; and work which had been the domain of the secondary care sector could be done by those in primary care. For the specialist hospitals at the top it would offer opportunities to export their skills for money (Figure 2).

Telemedicine has obvious advantages in remote or rural areas where there are few specialist doctors. It can improve access to health care, reducing the need for patients or doctors to travel. Even in urban areas, however, the

introduction of telemedicine can speed up the referral process, reduce unnecessary referrals, and improve the consistency and quality of health care³. Enhanced contact between professional staff has resulted in educational benefits and a reduction in professional isolation⁴.

Barriers to introduction

The technology now exists to fulfil most telemedical requirements. The obstacles are mainly non-technical—for example, personal and organizational issues related to the changes required to take advantage of the technology. Technology is only as effective as the ability of users to adopt and apply it. Equipment must be user-friendly and adequate training must be provided. Clinical and technical support mechanisms should be in place in case of breakdown or network failure. Since health care takes place within an organization, there must be a firm commitment from managers to adopt telemedicine. Efficient and smooth administration of a telemedicine service demands scrupulous organization. Prearranged clinics and scheduled appointments are likely to be important to ensure that telemedicine, like normal health care, is a managed process. Ideally a single person should be responsible for coordinating telemedicine within an organization.

Though successful telemedicine requires enthusiastic practitioners, no-one should pretend that distance medicine is equivalent to the face-to-face model. The art of successful telemedicine lies in identifying the circumstances in which its disadvantages are outweighed by the benefits. Fear of malpractice suits and litigation may prevent some people from implementing telemedicine. However, clinical risk management is designed to reduce these threats. Health care providers must adopt clinical standards and protocols agreed by practitioners and suitable indemnity cover for potential failures (e.g. misdiagnosis) should be arranged.

A NATIONAL STRATEGY

Telemedicine in the UK is currently being developed largely by individuals exploring their own specific area of interest. However, a more coordinated approach might permit faster realization of its potential. One way might be the development of a national strategy. Against this there is concern that the ‘dead hand of central government’ would stifle innovation and progress. Any strategy must therefore consist not of grand immutable statements based on some notion, probably misconceived, of where telemedicine will ultimately fit into the wider picture of health service delivery. Likewise a strategy placing premature emphasis on such aspects as technical and data standards before the subject has even been allowed to mature—or even worse the enforcement by central bodies of formal and restrictive

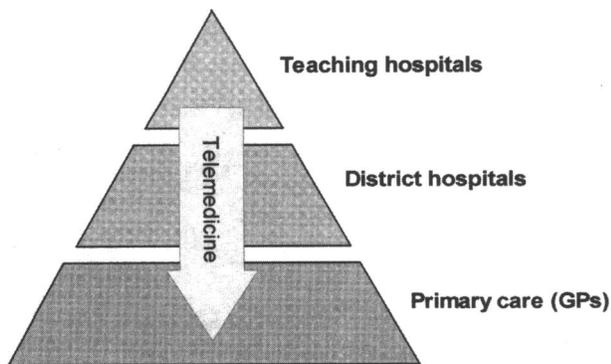


Figure 2 Telemedicine as a technique for decentralization, improving communication down the health care pyramid

evaluative approaches—will not only stifle the development of telemedicine but possibly even marginalize the 'telemedicine champions' on whom progress depends. Instead a national strategy for telemedicine must be flexible enough to reflect the ever-expanding pool of knowledge. Its core activities should be to promote telemedicine, support the evaluation of telemedicine applications through high-quality research, and eventually assist with its implementation. For this to be achieved the strategy must not be 'stand alone' but part of a fourfold commitment by government—to encourage and provide funding for telemedicine research; to develop a plan for implementation (once clinical and cost effectiveness have been demonstrated); to assess the major structural changes required within organizations to incorporate this method of delivering health care; and to develop a process for training, formulation of practice guidelines, quality control and continuing audit.

RECOMMENDATIONS

1. Educational programmes should be set up to improve public and professional understanding

As more health care professionals become interested in the potential of telemedicine there is an increasing need for educational programmes targeted at different groups. Such programmes, which should demonstrate what telemedicine can do, are required not only for healthcare professionals (doctors, nurses, managers) but also for patients and their representative bodies. Most programmes initially would be introductory and aimed at multidisciplinary groups. To deliver educational programmes effectively, specially equipped lecture halls are necessary—at present few and far between.

2. Telemedicine training is required for some telemedicine applications

With the passage of time, specialist applications of telemedicine will increase. Most telemedicine currently takes the form of simple verbal interactions (e.g. for patient consultations in primary care^{5,6} or for hospital outpatient follow-up⁷) and this is straightforward. More technical applications in which visual information is also required (such as teledermatology or teleradiology) demand special training. It is only by this approach that national and international quality standards can be developed. The award of nationally recognized certificates could be an incentive. A national telemedicine centre, with assistance from other relevant bodies, could provide such training.

3. Telemedicine research should be encouraged and adequately funded

The Government rightly requires scientific evidence of effectiveness before widespread introduction of telemedicine. Even if this were not so, the techniques might not be accepted by health professionals in the absence of evidence from rigorously conducted trials. Thus, areas of research should include how to do a telemedicine trial and how to evaluate existing telemedicine applications in the UK.

4. Funding should be provided at national, health authority and trust level to encourage pilot trials and definitive studies

If telemedicine is to be developed effectively, attention is needed to training, research and clinical service. Funding is required at national level, at health authority level and at trust level, to encourage pilot trials and definitive studies. The NHS R&D Programme should actively commission telemedicine projects. However, the areas to be studied should continue to be determined largely by those who actually deal with patients. Overall the projects should aim to establish the benefits to patients, measure the reduction of costs and/or quantify the improvements to standards of health care.

International

European research funding is an excellent way to encourage collaboration between nations for the ultimate benefit of all. In practice, however, it is far from easy to obtain. Applications are complex and time-consuming (and some say that awards are influenced more by political than by scientific considerations). If the UK is to receive its fair share of research funds from Europe, initial government funding will be needed to allow individuals the time to develop proposals of high quality.

National

Since the national requirements differ, each country requires its own programme for telemedicine research. National funding programmes should be based on a needs assessment, with funds made available for both large and small scale projects. It is important that the initiatives are focused; and the NHS R&D programme could be a strong influence. In Europe, Italy already has a centrally funded programme⁸.

Local

There are times when the most appropriate source of funding is local—for example, because the region has specific requirements for pilot trials. Health care trusts should make budgetary provisions for such studies.

5. Telemedicine 'champions' should be identified and encouraged

Telemedicine systems are often set up by enthusiastic and strongly motivated individuals, usually clinicians, commonly known as 'drivers' or 'champions'. In recent years there has been a tendency for telemedicine systems to be driven instead by central bureaucracies, and this is perceived as a major threat to successful development⁹. Telemedicine champions up to now have been the visionaries who have identified a specific deficiency in the delivery of care in their particular setting which telemedicine might be able to correct. Through their work they have been promoting telemedicine, and they should be encouraged to continue.

Centres of excellence for telemedicine for each specialty could be an alternative approach, although they too benefit from the input of champions. These centres could be linked and provide the basis for an evaluation group or task force (*see below*).

6. A multidisciplinary research group ('task force') is required to report on the differences between home monitoring and hospital monitoring

Physiological monitoring at home has several advantages over data collection in hospital¹⁰. A multidisciplinary task force should evaluate the place of home monitoring.

7. People undertaking telemedicine work should publish their experience

Case histories and other reports should be published—even if negative—for the benefit of others. Peer-reviewed journals are to be preferred.

8. Standards should be developed when the time is right

Ultimately, as telemedicine matures, standards will be required for the technology, staff training and protocols for use. However, such formalities may not yet be required. Overemphasis on technical and data standards, or formal and restrictive evaluation approaches, could be counter-productive in the long term, providing ammunition for the doubters or foot-draggers and possibly leading to over-ambitious and technologically driven initiatives. The NHS has a very poor record in implementation of information technology.

9. Guidance should be published for those contemplating telemedicine work

Those present at the meeting emphasized the dearth of good-quality published information about various aspects of telemedicine, and specifically requested guidance (*see below*).

GUIDANCE

What follows is based on the collective experience of the speakers at the meeting and the committee members of the Telemedicine Forum.

Advantages of telemedicine

Telemedicine can improve the delivery of health care by:

- Increasing access to services, i.e. bringing specialist expertise to the patient. For example, teleradiology can be used to provide radiology services to peripheral hospitals that do not have a local radiologist
- Speeding up referrals, with earlier diagnosis and treatment. Travel and waiting times between the initial consultation with the patient's own GP and referral to a specialist can be reduced. The number of unkept appointments may also be lessened with savings in cost
- Improving communication between primary and secondary care. Ordinarily, when a GP refers a patient for specialist treatment, patient records are forwarded so that the specialist has access to the medical history. The specialist, in turn, sends a reply back to the GP with the outcome of the consultation. The GP then has to sift through these records to ensure that any suggested treatment or review is carried out. When telemedicine is used, the patient's GP can be present at the specialist consultation so that a rapid specialist opinion is available to all parties and paperwork is reduced
- Extending treatment and management into the primary care sector. Diagnoses can be made reliably at primary care level, with a reduction in hospital attendances for specialist examination, procedures or treatment
- Improving professional education and reducing isolation. For example, a GP can apply the knowledge obtained from being present at a specialist consultation to treat similar cases in the future
- Reducing health care delivery costs. Telemedicine can decrease the duplication of services, equipment and specialists. For instance, one pathologist can provide services to several locations using telepathology
- Meeting expectations of a consumer-led health service. Studies repeatedly show that patients like telemedicine^{7,11,12}

This impressive list consists largely of *potential* advantages¹³. A survey of the published work reveals little quantitative evidence at present.

Disadvantages

Potential drawbacks of telemedicine include:

- Change in doctor-patient relationship. The relationship is undoubtedly changed, but this does not seem

troublesome in practice; having a local healthcare worker with the patient when a real-time teleconsultation is taking place with a remote specialist may actually be better than conventional practice

- No touch. For palpation and auscultation, the remote specialist usually has to rely on an amanuensis. Again this does not usually seem to cause problems
- Lack of privacy. There is the potential for invasion of privacy, particularly where telemedicine to the home is concerned, but trials in other parts of the world have not encountered major difficulties in this respect; nor have the preliminary experiments in the UK
- Economic disadvantages. There is a dearth of quantitative data about the economics of telemedicine in the UK. However, on existing evidence many telemedicine applications offer substantial savings for patients (who do not need to travel so far or take so much time off work), with savings for health authorities less impressive
- Uncertain medicolegal position. The medicolegal position of telemedicine is not thought to raise new issues of principle¹⁴

Sources of information

Since 1990 there has been a large increase in publications on telemedicine. However, there is an important difference between the availability of data and the gaining of information, and sources of information are of variable quality. The newcomer requires guidance from objective sources.

Internet

Searching the Internet for data on telemedicine is easy. A brief search produces thousands of publications but the strong North American flavour does not always relate well to the situation in the UK.

Textbooks

Again, much of the work emanates from North America and this can be confusing, especially with regard to the legal aspects. A larger obstacle is expense: because of limited sales, textbooks on telemedicine are costly and unlikely to be purchased by the novice. For example, the 18-page NHS guidance note on telemedicine¹⁵ sells at £60.

Peer-reviewed journals

At present there are only two peer-reviewed journals dedicated to telemedicine (*Journal of Telemedicine and Telecare* and *Telemedicine Journal*).

Non-peer-reviewed publications

The articles in non-peer-reviewed periodicals are usually easy to read and are addressed to a more general audience.

Some, for example in *Telemedicine Today*, are very useful sources of information. Others seem to depend heavily on advertising and may not be unbiased.

Computerized databases

These are increasing in number and can be useful (e.g. <http://tie.telemed.org>), but training is necessary for best results.

Conferences and seminars

Conferences and seminars are often where the most up-to-date material is to be found. For example, the RSM Telemedicine Forum (open) organizes annual international telemedicine conferences.

Equipment manufacturers and consultants

These sources of information are unlikely to be objective.

A national advisory service?

There is a strong case for establishing a national advisory service where interested individuals can obtain objective information on telemedicine. Such an advisory service could be organized on a regional basis.

Defining the need for a telemedicine service

Before any telemedicine pilot trial begins, the problem to be addressed has to be determined accurately so that the solution can be well focused. This process will usually have begun with the observation that there is a clinical or economic need to investigate other ways of providing care to a particular patient cohort in a particular setting. Telemedicine should not be viewed in isolation, but as a new way of delivering health care.

After assessment of the local desire to implement change, the aims of any planned alterations to the current method of healthcare delivery should be established. The possibility of meeting these by organizational or other simple alternatives should then be explored. If these seem unlikely to bring about the desired ends, then and only then should novel alternatives such as telemedicine be explored. In other words, telemedicine research should be needs-driven, planned within the context of other possibilities, and not the result either of commercial pressures or of the simple desire to try new equipment.

Implementation of telemedicine applications

Before any telemedicine application becomes an accepted method for delivering health care in a particular setting it should have come through a substantial period of evaluation. After identification of an area of clinical or economic need the next stage will be formal assessment of the intervention by: definition of the requirements to perform the intervention; estimation of the safety and

diagnostic accuracy of the telemedicine intervention in that setting; estimation of the feasibility of introducing the intervention; assessment of the clinical effectiveness of the intervention; and economic evaluation of the intervention. The results of these trials should then be disseminated widely—preferably in a peer-reviewed journal—so that future researchers have access to the findings. If research shows that the intervention works, substantial organizational change may be required before a new telemedicine service can be integrated into routine health care. Finally, continuing monitoring will be required.

Evaluation of a telemedicine service

A randomized controlled trial is not necessarily the ideal method of evaluation since patients are offered not different treatment interventions but rather different methods of health care. Questions to be asked when designing a telemedicine trial include: Can medicine be practised remotely without compromising patient care? Do remote clinical decisions differ greatly from those made face-to-face? Is telemedicine cost-effective? It is the principle of distance medicine that is being assessed; technology is merely the means to an end and should be viewed as the servant, not the master.

A feasibility study is the first step to evaluation. Clinicians need to be able to continue their normal work, whether it be viewing an X-ray or examining a patient. Feasibility studies should highlight the areas that require modification of normal clinical practice, identifying the strengths and weaknesses of distance medicine and indicating whether it is possible or not for individual specialties.

The next stage is to determine whether telemedicine is a cost-effective alternative to conventional care, and a randomized controlled trial is one option. With drugs or surgical procedures the endpoints are usually clinical; but telemedicine randomized controlled trials tend to be more complex¹⁶ and very few have been done to date. In theory comparison of two types of health care delivery is straightforward; in practice it is difficult. Long waiting lists for non-urgent consultation appointments in traditional health care render follow-ups impossible within a reasonable time frame. Clinicians and patients cannot be blinded to the allocation group. We need to advance cautiously, from the initial feasibility studies indicating that distance medicine has potential, through clarification of details of the new approach, to assessment of efficacy, safety and costs in comparison with conventional care.

A simple design will suffice for the feasibility study. A clinician compares the accuracy and effectiveness of a distant diagnosis and clinical management plan with one made conventionally. As always, efforts must be made to control extraneous variables; thus ideally the same clinician

participates in both types of consultation. If a second clinician is involved, we must then assess whether differences are due to the system or due to differences between clinicians¹⁷. Shortcomings of distance medicine are quickly recognized when the same personnel are involved in both parts, and may then be rectified and reassessed.

Feasibility trials do not have to be large so long as the clinician is confident that a representative sample of the normal clinical workload has been evaluated both remotely and conventionally. The clinician must have access to all the information necessary for a decision about the care of the patient, irrespective of location. If the normal consultative process has to be amended then these changes are integrated into the telemedicine consultation and subsequently assessed. By contrast, randomized controlled trials must have large samples to allow proper analysis.

Economic evaluation comes in various forms such as cost-minimization analysis, cost-effectiveness analysis, cost-utility analysis and cost-benefit analysis. The type selected depends on the information that is required from the trial (if in doubt consult a health economist). Where randomized double-blind controlled trials are feasible, the study protocol should closely reflect normal clinical practice so that costing data are accurate. Before beginning a randomized controlled trial assessing the economics of distance medicine, users should be sufficiently comfortable with the procedure to avoid difficulties due to inexperience rather than deficiencies in the technology.

The opinions of the users should be heard. Both clinicians and patients should be afforded the opportunity to express views on a telemedicine service.

Difficulties encountered in telemedicine trials

Apart from the practical obstacles to randomized controlled trials, why else has evaluation been difficult? One reason is the continually changing technology. For this reason it is important to evaluate the *principles*, not the technology itself (which will have changed by the time any trial can be completed). Others are the difficulty of establishing observable links between telemedicine and patient outcome, the limitations of conventional techniques of economic evaluation, the failure to quantify non-health benefits such as improvements in the process of care, the fact that trials tend to involve enthusiastic 'early adopters' (rather than reactionaries or Luddites¹⁸), and training effects whereby telemedicine alters the pattern of use and increases the number of cases that can be handled locally without a telemedicine referral. It is also difficult to quantify the educational benefits gained by contact with the experts.

Key issues in any evaluation include:

- Diagnostic accuracy. This requires a comparison between results obtained via telemedicine and the

results obtained via traditional practice. Most of the work to date has concerned teleradiology and little is known about the diagnostic accuracy of other telemedicine applications. There is also surprisingly little information about the accuracy of conventional medical practice

- Management advice. Where teleconsulting is being used primarily to provide management advice, rather than to reach a formal diagnosis, the quality of that advice should likewise be assessed in comparison with conventional consultation. There is almost no published work to date
- Economics. The costs of telemedicine should be compared with the costs of traditional practice. Estimating these is not straightforward and it is important to make clear what costs are included. The goal in assessing a telemedicine system is a clear statement of who it is cheaper for^{19,20}—e.g. the patient, the healthcare system, the state

Evaluation is clearly important, but some have argued that it is overemphasized. Techniques such as telephone and fax have never been formally evaluated for health service use, and have simply become accepted as indispensable.

Medicolegal issues

Clinicians and health care organizations owe a duty of care to the patient irrespective of the systems they use to deliver health care. In the case of telemedicine, normal standards of care and skill apply. In the UK, the legal duty is the same as for those offering advice or opinions by telephone, fax or e-mail. Many of the medicolegal implications of telemedicine will be determined by litigation as they arise²¹. Legal issues concerning within-trust telemedicine are simpler than those between trusts. Contracts must specify the legal arrangements.

What are the possible repercussions? Like other varieties of medical care telemedicine involves risks, and users of telemedicine should be aware of the limitations²². For example, mistakes can be made and a wrong diagnosis given over a videolink just as in a conventional face-to-face consultation. A mistake made via telemedicine could result in both the referring doctor and the consultant being sued.

One possible risk is that the consultant believes he or she can advise as fully as if present with the patient. This may or may not be so. A point to note is that, in some circumstances, it can be unethical *not* to use telemedicine if it is available.

Confidentiality and data security

Breaches of confidentiality and security may be overrated hazards. Confidentiality of a telemedicine system should be

no worse than that of conventional systems, most of which are based on paper records. Hospitals and health centres are not impregnable fortresses and a determined person can gain access to patient records. Paper records are stored in secure places and personnel sign a confidentiality agreement about access. Both conditions can be implemented in a telemedicine system. In practical terms the confidentiality of a telemedicine episode is less likely to be breached by a 'hacker' than by an unauthorized person eavesdropping during a consultation.

Re-engineering

If telemedicine is to be developed to its full potential then the structure of organizations will have to alter. Currently very few job descriptions in the UK refer to the delivery of health care by telemedicine. In future an increasing number of health care professionals will spend part of their week in such activities—some perhaps working from home. Before discussions begin on introduction of change, the attitude of the medical staff must be considered carefully. Some may believe that improvement of healthcare delivery is a matter of funding, not telemedicine. The structure and number of new buildings may also have to change. There is an ever-increasing demand for secondary care services and some outpatient sessions might be delivered to the primary care setting, reducing the requirement for patient or specialist to travel. As the network of telemedicine stations in the primary care setting increases there will be the potential for these to become multipurpose—e.g. usable for continuing medical education, outpatient appointments and management meetings. Telemedicine rooms could be used for several purposes in a single day, sometimes outside normal working hours.

CONCLUSION

Telemedicine has great potential for decentralizing health care. Existing knowledge indicates clear benefits in some, if not many, circumstances. There is little formal evidence as yet, particularly in the UK. Having become technically and economically feasible, telemedicine deserves investigation by well-conducted research, adequately funded.

Acknowledgment Telemedicine Forum committee members were Dr John Brebner, Aberdeen University; Dr Liam Gray, Southampton University; Dr Paul Johnson, John Radcliffe Hospital, Oxford; Dr Paul McLaren, UMDS Guy's Hospital, London; Dr Demetrios Papakostopoulos, Bristol Eye Hospital; Mr Sapal Tachakra, Central Middlesex Hospital, London; and Professor Richard Wootton. Other contributors to this report were Dr Tony Cornford, London School of Economics; Dr John Craig, Institute of Telemedicine, Queen's University, Belfast; Dr Nigel

Edwards, London University; Professor Richard Edwards, Department of Health, Wales; Mr Ian Jardine, Institute of Health Service Managers, London; Ms Maria Loane, Institute of Telemedicine, Belfast; Dr Frances Mair, Liverpool University; Dr Akber Mohamedali, Grove Medical Centre, London; Mr Ben Stanberry, University of Wales.

REFERENCES

- 1 Wootton R. Telemedicine. In: Lock S, Dunea G, Pearn J, eds. *Oxford Illustrated Companion to Medicine*. Oxford: Oxford University Press (in press)
- 2 *Hansard* 593 (201) 5 October 1998: WA 68–69
- 3 Darkins A, Dearden CH, Rocke LG, Martin JB, Sibson L, Wootton R. An evaluation of telemedical support for a minor treatment centre. *J Telemed Telecare* 1996;2:93–9
- 4 Jennett PA, Hall WG, Morin JE, Watanabe M. Evaluation of a distance consulting service based on interactive video and integrated computerized technology. *J Telemed Telecare* 1995;1:69–78
- 5 Nagle JP, McMahon K, Barbour M, Allen D. Evaluation of the use and usefulness of telephone consultations in one general practice. *B J Gen Pract* 1992;42:190–3
- 6 Gallagher M, Huddart T, Henderson B. Telephone triage of acute illness by a practice nurse in general practice: outcomes of care. *B J Gen Pract* 1998;48:1141–5
- 7 Pal B. Evaluation of a telephone follow-up clinic for rheumatology outpatients. *J Telemed Telecare* 1998;4(suppl 1):106
- 8 Pisanelli DM, Ricci FL, Maceratini R. A survey of telemedicine in Italy. *J Telemed Telecare* 1995;1:125–30
- 9 Yellowlees P. Successful development of telemedicine systems—seven core principles. *J Telemed Telecare* 1997;3:215–22
- 10 Johnson P, Andrews DC. Remote continuous physiological monitoring in the home. *J Telemed Telecare* 1996;2:107–13
- 11 Loane MA, Bloomer SE, Corbett R, et al. Patient satisfaction with realtime teledermatology in Northern Ireland. *J Telemed Telecare* 1998;4:36–40
- 12 Harrison RM, Clayton W, Wallace P. Is there a role for telemedicine in an urban environment? *J Telemed Telecare* 1997;3(suppl 1):15–17
- 13 Anon. Telemedicine; fad or future? *Lancet* 1995;345:73–4
- 14 Stanberry BA. *The Legal and Ethical Aspects of Telemedicine*. London: RSM Press, 1998
- 15 NHS Estates. *Telemedicine: Health Guidance Note*. London: Stationery Office, 1997
- 16 Field MJ, ed. *Telemedicine. A Guide to Assessing Telecommunications in Health Care*. Washington: Institute of Medicine, 1996
- 17 Loane MA, Corbett R, Bloomer SE, et al. Diagnostic accuracy and clinical management by realtime teledermatology. Results from the Northern Ireland arms of the UK Multicentre Teledermatology Trial. *J Telemed Telecare* 1998;4:95–100
- 18 Wootton R. Telemedicine: a cautious welcome. *BMJ* 1996;313:1375–7
- 19 Lobley D. The economics of telemedicine. *J Telemed Telecare* 1997;3:117–25
- 20 McIntosh E, Cairns J. A framework for the economic evaluation of telemedicine. *J Telemed Telecare* 1997;3:132–9
- 21 Brahams D. The medicolegal implications of teleconsulting in the UK. *J Telemed Telecare* 1995;1:196–201
- 22 Darkins A. The management of clinical risk in telemedicine applications. *J Telemed Telecare* 1996;2:179–84