Prioritisation of telemedicine services for large scale implementation in Norway

Jan Norum*†, Steinar Pedersen†‡, Jan Størmer§, Markus Rumpsfeld**, Anders Stormo††, Nina Jamissen‡‡, Harald Sunde§§, Tor Ingebrigtsen*** and Mai-Liss Larsen†††

*Department of Oncology, University Hospital of North Norway; †Faculty of Medicine, University of Tromsø; ‡Norwegian Centre for Telemedicine; §Department of Radiology, University Hospital of North Norway; **Section of Nephrology, Department of Internal Medicine, University Hospital of North Norway, Tromsø; ††Health Care Centre, Evenes; ‡‡Department of Obstetrics, Nordland Hospital Bodø; §§Health Care Centre, Kirkenes; ***Northern Norway Regional Health Authority, Bodø; †††Price Waterhouse Coopers, Tromsø, Norway

Summary

In late 2005, the Northern Norway Regional Health Authority requested an evaluation of all tested telemedicine services in northern Norway to clarify which were suitable for large scale implementation. A total of 282 reports from the Norwegian Centre for Telemedicine, the University Hospital of North Norway and the University of Tromsø were included in the study. Projects not focusing on secondary health care were excluded and 46 studies representing 21 topics entered the final analysis. They were analysed with a self-developed scoring tool focusing on five items. Eleven topics were concluded as being candidates for large scale implementation and grouped according to priority. The first priority topics were teleradiology, digital communication/integration of patient records and education. The second priority topics were teledialysis, pre-hospital thrombolysis, telepsychiatry and teledermatology. The third priority topics were paediatrics, district medical centres, tele-ophthalmology and tele-otorhinolaryngology. No priority was suggested for the projects in cardiology, endocrinology, geriatrics, gynaecology/obstetrics, pathology and nursing/care. User support, training, research ability, financial incentives and interaction between clinicians and ICT-personnel were considered as important factors in motivating health-care personnel to use telemedicine.

Introduction

The Norwegian Centre for Telemedicine (NST) was established in 1992. The Northern Norway Regional Health Authority (NNRHA) has directed significant resources to the NST, aiming to achieve high quality and cost-effective health care in the region. The NST has developed and implemented a number of telemedicine services. There have been successes and failures.

Pressure on the limited health-care resources has been steadily growing in Norway. Resources spent in one area of medicine have continually to be considered for allocation to other areas to achieve maximum value for money. In this setting, studies documenting the cost-effectiveness of telemedicine have been requested by health-care administrators and a priority ranking list has been called for. In late November 2005, the NNRHA initiated a review to clarify which telemedicine services, in the specialist health-care sector, should be escalated into large scale usage.[1]

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Correspondence: Jan Norum, Department of Oncology, University Hospital of North Norway, PO Box 13, N-9038 Tromsø, Norway (*Fax: +47 776 26779; Email: jan.norum@unn.no*)

Methods

The mandate was to perform a systematic review of all tested telemedicine services in northern Norway and clarify which were suitable for large scale implementation. The review focused on clinicians' requests, health economics, functionality, operability,

training and how to motivate health-care personnel. A review group of clinicians was established fulfilling the following criteria: all counties of northern Norway and specific specialities (primary health care, laboratory medicine, surgery, internal medicine, gynaecology/obstetrics, telemedicine and oncology) had to be represented.

The reports included in the review process represented the whole portfolio at the NST. All clinicians and researchers at the University Hospital of North Norway (UNN) and the University of Tromsø were asked by email to report any project which included telemedicine. A total of 282 reports were identified. To select reports for the final review, we employed the following exclusion criteria: telemedicine services not tested in Norway and/or not including the secondary (specialists/hospitals) health-care sector. Two clinicians screened all reports. Discrepancies were revealed in 13 cases. They were all discussed by the screeners and an agreement was reached. A total of 178 reports were excluded. The remaining 104 reports represented 54 studies for further analysis by the review group. This group excluded eight further studies which were preliminary reports, too little data to draw any conclusions or outside the focus of secondary health care. The 46 remaining studies covered 21 subjects (Table 1). When overlapping between groups occurred, the one representing the article's main focus was employed. The evaluation form (Appendix 1) focused on five items, which were equally weighted (0–5 scale). The five items were: overall score, quality of care, personnel resources, communication and health economics. Each item was scored by the group (0 = no need/disadvantage, 1 = equal to alternatives, 2 = there may be minor benefits, 3 = there are some benefits, 4 = there are clearly benefits, 5 = there are major benefits). The health economics score was measured as the number of 'yes' responses.

Senior doctors at departments employing telemedicine services were consulted. There were eight such departments at the UNN (dermatology, ophthalmology, cardiology, plastic surgery, orthopaedics, paediatrics, pathology and psychiatry) and three at the Nordland Hospital (anaesthesia, pathology and obstetrics/gynaecology).

Table 1 The 46 studies represented 21 different areas

Area	No of studies
Emergency medicine	1
Cardiology	2
Endocrinology	1
Geriatrics	3
Dermatology	4
Communication	5
Nephrology	1
Neurosurgery	1
Nuclear medicine	0
Obstetrics/gynaecology	1
Ophthalmology	2
Oncology	4
Orthopaedics	1
Pathology	2
Paediatrics	3
Nursery/care	0
Primary health care (DMC)	2
Psychiatry	2
Radiology	2
Education	6
Otolaryngology	3

Results

Studies reviewed

Emergency medicine

The study on pre-hospital thrombolysis in acute myocardial infarction (AMI)[2] was concluded to be a candidate for further escalation. In this study, electrocardiograms (ECGs) and clinical information were communicated by mobile phone from ambulances to the department of cardiology and thrombolytic therapy was initiated when an AMI was diagnosed.

Cardiology

Two studies in telecardiology were analysed.[3,4] Tele-echocardiography[3] (tele-echo) had been tested ten years previously and it had been documented that cardiologists could guide a remote located clinician via videoconferencing. Since then, five hospitals in our region had obtained their own cardiologists. Thus the need for tele-echo consultations was almost non-existent.

The second study focused on the digital interpretation of heart murmurs transmitted from primary health care to a specialist.[4] This service was concluded to be of limited value as the cardiologists considered that echocardiography represented the 'gold standard'.

Endocrinology

Research in this field was focused on diabetes.[5] Automatic measurement of blood glucose and digital communication of the results to family members or health-care personnel was of interest, but the service was mainly outside the frame of specialist health care.

Geriatrics

Three studies in the field were analysed.[6–8] The first was a videoconference based school for relatives of patients suffering from senile dementia.[6] The education was offered from Oslo to groups of relatives in Norway. Relatives highly appreciated this service. The second report[7] was a theoretical study on the possibilities of telemedicine in the care of geriatric patients. The third report[8] was an education service for geriatricians employing telephone meetings and PowerPoint presentations communicated by email. Only limited results were available from the last two projects. The education programme[8] may be implemented in a general focus on education.

Dermatology

There were four studies in teledermatology.[9–12] In teledermatology, still images are of limited value if the service is operated independently from the hospitals' and general practitioners' (GPs') electronic patient record (EPR) systems. When integrated into EPR systems, it should be reconsidered.

Real-time teledermatology via videoconferencing[10,12] has been found to be superior to store-and-forward teledermatology based on still images. There were educational benefits to the participating GPs in the early stages.

Digital communication and integration of patient-data

Five studies had focused on digital communication and integration of patient-data in the health-care system.[13–17] Digital referrals and reports were daily routine activities in the communication between GPs and hospital departments. In the future, a digital 'common multimedia envelope' (including laboratory data, patient records, referrals, reports, messages, still images, videos, sounds and ECGs) is desirable.

The number of digital referrals for radiological examinations had increased from 1600 in 2001 to nearly 22,000 in 2005.[13] The goal is to have all radiological referrals digitised. An email consultation service had also been tested between two hospitals.[17] The service was in addition to present systems and did not obtain sufficient traffic.

Nephrology

Teledialysis has been a success in northern Norway[18] and other areas in southern Norway have since begun teledialysis. The patients appreciate the service, a high quality of treatment can be preserved and the service has been widely implemented. The investment cost for a teledialysis unit is steadily dropping.

Neurosurgery

A study by Stormo *et al*. has shown the benefits of a coordinating teleneurosurgical service in an emergency setting.[19] In this survey neurosurgeons on duty considered digitally communicated MRIs and CT scans together with clinical data from distant located hospitals. Patient transportations were avoided (34%), local treatment plans altered (42%) and the service was concluded to be beneficial in most cases (93%). This service may be seen in the context of teleradiology.

Nuclear medicine

There is close integration between the departments of radiology and nuclear medicine in our region. Knowing the plans for a PET-CT scan and the future need for communication of images and reports, the group suggested this service be run in close co-operation between the department of nuclear medicine and the department of radiology. They employ a common platform for digital communication of images and reports.

Obstetrics and gynaecology

The tele-obstetric service which had been tested had not reached a significant volume and there was a high threshold for using it.[20] Except for the regular videoconference based meetings and a suggested integration of cardiotocograms (CTG) into the digital patient record folder, this service has limited potential.

Oncology

There were four studies in medical oncology and radiotherapy[17,21–23] A videoconference based common platform for the training/upgrading of medical oncologists and radiotherapists had been a success.[17] Another study[21] explored the benefits of exchanging radiographs and dose plans between institutions for second opinions and discussions. The service was crucial for communication between a satellite unit and its mother institution and may be incorporated in the escalation of teleradiology.

The Website of the department of oncology (http://www.unn.no/kreft) was accessed frequently. Because of the high number of patients' requests in this setting[22] and Websites acting as show cases,[23] the potential of Websites should be further investigated.

Orthopaedics

One pilot study in tele-orthopaedics had been conducted.[24,25] This was a videoconference-based education programme for oral surgeons and doctors in Tromsø who followed an education programme at the University of Oslo. Tele-orthopaedics may be implemented as part of a general plan for education and teleradiology.

Pathology

Two studies[26,27] in telepathology were reviewed. In one project, a network for Norwegian pathologists was evaluated.[26] The network was little used. The other service was based on still images and used for second opinions.[27] Whereas this could be an instrument for the communication and discussion of challenging cases, the tool employed in daily practice was the hospital email system. The distant pathology diagnostic service, based on specimens placed under a remote located microscope, was no longer in use. The centralisation of cancer surgery to the major hospitals had made this service redundant. A general focus on education and communication may be beneficial.

Paediatrics

The study called 'the eczema school'[28] offered children and their parents an Internet based education focusing on therapy, prophylaxis and follow-up. The other eczema study[29–31] bypassed primary health care, as children and their parents communicated still images directly to paediatricians. This was highly debated in the review group as the GPs are supposed to act as 'gatekeepers' in the Norwegian health-care system. Data expected from a phase III study may elucidate this question in the near future.

The study on transmission of heart murmurs from GPs to paediatricians[32,33] was of interest in a training setting, but it reached a low volume.

Nursery/care

No studies in this field were available.

Primary health care – District medical centres (DMC)

There were two studies in this field.[34,35] DMCs have been considered as a means of obtaining a substantial volume of patients for a telemedicine service in remote areas of Norway.[34] However, the group did not find any quantitative data indicating the implementation of DMCs being superior to a general upgrade of local GP centres.

Internet communication between patients and doctors[35] is of interest, but further studies are need before escalation may be performed.

Psychiatry

A study on the use of interactive media in the follow-up of drug abusers[36] was of interest, but one in eight of the participating health-care personnel considered the resulting connection to the patients as representing a heavy workload. This should be further investigated.

Most institutions in psychiatric health care had access to videoconferencing. The equipment was frequently used for professional purposes (education, training, guidance, second opinions) and for administrative meetings. The service was reported as saving time and economic resources,[37] but the use in direct patient communication was limited.

Radiology

In 2005, there were more than 20,000 teleradiology examinations at the UNN. The teleradiology network has been essential for the regional services offered in neurosurgery,[19], trauma work, orthopaedics, vascular surgery, coronary heart surgery, medical oncology and radiotherapy, but little has been described in scientific papers. Based on present experience,[19,20] teleradiology is clearly of great importance.

Education

Telemedicine was used for the education and training of remote health-care personnel in a wide range of medical specialities.[38–43] Annually about 13,000 participants used the various educational services offered.

Otorhinolaryngology

Three tele-ENT studies were reviewed.[44–46] The system for referrals with still images attached has been available since 1992, but the service has a very low volume. The study on Internet-based control and adjustment of hearing aids concluded that the service was not cost-effective, mainly due to high costs related to videoconferencing.[44] This service has a potential for a high volume and should be reconsidered in a non-videoconferencing setting.

The equipment needed for satisfactory still images in otorhinolaryngology is costly and present equipment is in limited use.

Ophthalmology

The group reviewed one publication,[47] one article in press[48] and consulted the head of a Department of ophthalmology. The numbers of patients screened for retinal diabetic changes using tele-ophthalmology were 130 and 230 in 2004 and 2005, respectively. The service is of interest, but the optimum conditions have not been clarified. When the potential of replacing nurses with professional photographers has been explored, the service should be reconsidered.

Priority ranking for large scale implementation

All telemedicine services were valued based on the scoring tool (Appendix 1). The ranking is shown in Table 2.

Priority group 1

- *Teleradiology*: Teleradiology is a high volume service and is an important basis for the regional service of several areas of medicine. This gave teleradiology the top priority in the review project.
- *Digital communication and integration of patient-data:* This topic has a large volume and includes the whole health-care system. The need for an improved common platform for digital communication gave this issue top priority.
- *Education*: Education of health-care personnel is one of the main topics of Norwegian hospitals.

Priority group 2

- *Teledialysis*: Teledialysis is a service with great potential and the investment costs are dropping.
- *Pre-hospital thrombolysis*: This service has a large volume. There are currently two different services operating. They should be compared and the best one chosen for further escalation.
- *Telepsychiatry*: Psychiatry has been characterised by a lack of specialists. It is an area given priority by the national health authority and has a large volume of patients. Videoconferencing should be employed more.
- *Teledermatology:* The volume is dropping, but the videoconference and the still image based service offer significant benefits.

Priority group 3

- *Paediatrics:* The review group concluded that transmission of heart murmurs and the 'eczema service' only reached a low volume of patients. The service could benefit from improved digital communication and integration of patient-data.
- *District medical centres:* DMCs have been the focus of the regional health authority, but they obtained a low ranking based on the data mentioned earlier.
- *Tele-ophthalmology and tele-otolaryngology:* There are several aspects concerning these services that require clarification.

No priority

No priority was suggested for the projects in cardiology, endocrinology, geriatrics, gynaecology/obstetrics, pathology and nursing/care. However, these areas will benefit from general improvements in digital communication and integration of patient records and ICT-based training/education.

Bringing the services into action

How can health-care personnel be motivated to bring the new services into action? Technical support and

Table 2 Subjects for large scale implementation according to their level of priority

	Alt	Qual	Pers	Comm	Cost-utility	Total points
Teleradiology	4	5	3	5	5	22
Communication	4	4	2	5	5	20
Education	3	3	4	4	5	19
Teledialysis	3	4	2	3	4	16
Pre-hospital thrombolysis	3	4	0	4	4	15
Telepsychiatry	3	3	2	3	4	15
Teledermatology	3	3	0	3	5	14
Paediatrics	3	2	1	3	3	12
DMC	2	2	1	3	2	11
Tele-ophthalmology	1	3	2	3	2	11
Tele-otolaryngology	1	3	1	3	2	10

Alt=The value of the telemedicine service against the alternative (maximum score 5); Qual=The quality of the telemedicine service versus the alternative (maximum score 5); Pers=The telemedicine service's ability to compensate for lack of qualified personnel (maximum score 5); Comm=The telemedicine service's ability to improve communication within the health service (maximum score 5); Total points=sum of scores Alt, Qual, Pers, Comm, Cost-utility (maximum 25)

experienced users ('super-users') available for support, within short range and with minimal delay were considered crucial. Sufficient training and user-participation when administrative decisions are made are also important. Contracts should guarantee that services are continuously available (i.e. a high level of up-time). Equipment should be user friendly. There should be a plan for upgrading equipment and keeping it up to date. Patients frequently want to access their records. This access should be easy, minimising the need for assistance. Clinicians want to take part in industrial development projects and clinical research. This should be kept in mind when large scale projects are introduced. Tariffs compensating for the investment and encouraging the use of telemedicine services are of utmost importance.

Discussion

The review study suggested the priority ranking for large scale implementation of telemedicine services in northern Norway based on publications and clinicians' experience. We did not include the international experience in the review. This was partly due to the limitations of the original mandate and partly because we wanted to have the safety and effectiveness of new medical interventions demonstrated in our region before they were approved for regular professional and consumer use.

There are two main types of evaluation research in health care.[49] The first is concerned with testing efficacy, effectiveness and safety. The second is the assessment of health programme performance and achievement in terms of stated goals and objectives. As shown in our review study, health programme evaluation is complex. We are usually left with a large number of programmes widely distributed, but very few of them have the resources or long-term support needed for robust clinical trials. The projects that attempted to collect uniform datasets across several sites have usually yet to publish definitive results. The most useful technique in summative evaluation is a cost-benefit or alternatively a cost-effectiveness analysis.[49] In the present study we did not have the resources or the detailed information available to conduct a health economic study. Estimation based on patient volume, investments needed, alternative costs and savings and the quality of the telemedicine service was employed. A qualified guess by clinicians experienced in telemedicine and health economics may appear to be a simple substitute for a large health economic analysis. However, the cost-effectiveness of telemedicine has been difficult to document even in large trials. A systematic review of more than 1000 articles evaluating the cost-effectiveness of telemedicine revealed only a few controlled trials.[50] Several review studies have concluded that there is no solid evidence that telemedicine is (or is not) a cost effective means of delivering health care.[50,51] Is telemedicine technology worth advancing and how does society decide? Making priority lists based on administrators' and clinicians' experience and suggestions may be a way forward.

Teleradiology has been shown to be effective across all other specialities.[52] This was also illustrated in our survey. Furthermore we did not discover any previously published 'ranking studies'. In our survey, we employed a simple tool for prioritising. This instrument could have been made more sophisticated to distinguish between services of equal priority level. However, a simple instrument trying to structure and document the clinicians 'qualified guess' was preferred. In future, an upgraded instrument for prioritising should be developed.

Whereas our study focused on the secondary health-care service in our region, we believe it may also act as a guideline for other regions and countries planning implementation or escalation of their own telemedicine services. But, variations in infrastructure, experience and geography between countries have to be accounted for. For example, we did not discover any teleneurology service in our region and telepaediatrics achieved a low ranking. Looking to Australia,[53,54] these services seem to be much more focused, at least in their research projects.

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Appendix 1 Evaluation of telemedicine projects

Type of project

Category
- ☐ Diagnostic/treatment
- ☐ Education
- ☐ Administration
- ☐ Others

Stage
- ☐ Test
- ☐ Pilot
- ☐ Implementation

Is the project a candidate for review? ☐ Yes ☐ No*
(Implemented/tested/run in Norway?)

Main focus
- ☐ Primary health care – Specialist health care
- ☐ Specialist health care – Specialist health care
- ☐ Patient – Primary health care
- ☐ Patient – Specialist health care
- ☐ Other

Need for the service?	0*	1	2	3	4	5
Overall score for need	☐	☐	☐	☐	☐	☐
Improving quality	☐	☐	☐	☐	☐	☐
Personnel resources	☐	☐	☐	☐	☐	☐
Improved communication	☐	☐	☐	☐	☐	☐

(0=no need/disadvantage, 1=equal to alternatives, 2=there may be minor benefits, 3=there are some benefits, 4=there are clearly benefits, 5=there are major benefits

Health economics?
- Sufficient volume?…….. ☐ Yes ☐ No
- Limited investments needed?…….. ☐ Yes ☐ No
- Alternative costs – savings by telemedicine?…….. ☐ Yes ☐ No
- Is the quality of the telemedicine service good?…… ☐ Yes ☐ No
- In total: Is the service cost-effective?..... ☐ Yes ☐ No*

(The score was measured according to the number of 'yes' responses)

Demands/conditions
Functionality?
User-friendly?
Training?

Total ranking ☐☐

*The evaluation was stopped if this option was chosen