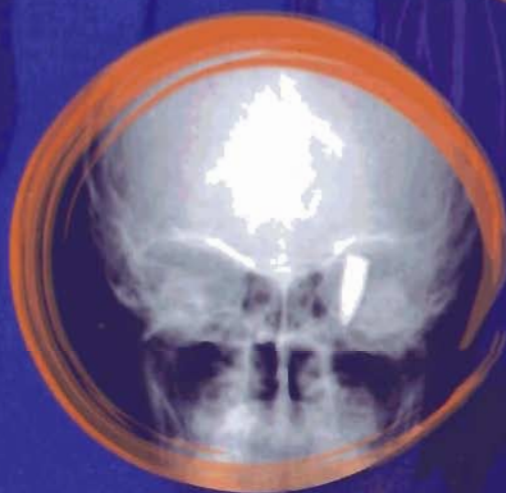
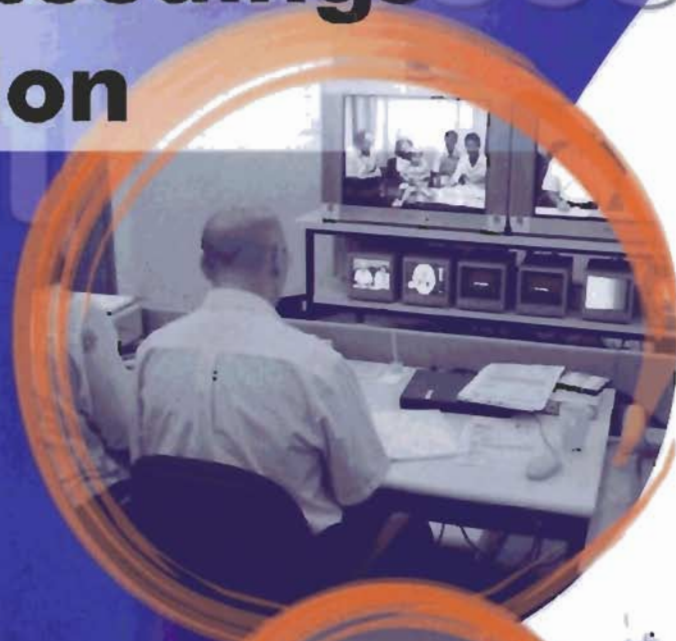


Conference Proceedings Delegates' Edition

SFT-5

Brisbane,
Queensland,
Australia



5th International Conference on Successes and Failures in Telehealth

4th - 5th August 2005

Major Sponsors:

INLINE
SYSTEMS



Queensland Government
Queensland Health



THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA



Royal Children's
Hospital Foundation

Conference Proceedings
Delegates' edition

Successes and Failures in Telehealth-5

4-5 August, 2005

Editor: R Wootton

Centre for Online Health
University of Queensland

Acknowledgements

The organisers are grateful to many individuals and organisations, including the sponsors and exhibitors.

Conference Proceedings
Delegates' edition

These Proceedings will be published as a Supplement to the *Journal of Telemedicine and Telecare*. To reserve a copy, complete and return the slip below. (The publishers, Royal Society of Medicine Press, will advise the price in due course).

----- ✂ -----

To:

Publications Subscription Department
Royal Society of Medicine Press Ltd
1 Wimpole Street
London W1A 0ZA
UK

Please reserve a copy of the Conference Proceedings for *Successes and Failures in Telehealth-5* for:

Name

Address

CONTENTS

FOREWORD	1
<i>Alan Isles</i>	
PAPERS	2
Delivery of child development services by videoconferencing: a review of four years' experience in Queensland.....	3
<i>Maggie A Bailey, Anthony C Smith, Antoinette Fitzgerald and Eileen Taylor</i>	
The iPath telemedicine platform	8
<i>Kurt Brauchli and Martin Oberholzer</i>	
The Telemedicine Information Exchange: ten years experience.....	16
<i>Nancy A Brown</i>	
Success and failures in web-based medical collaboration.....	23
<i>Tatjana M Burkow and Line L Nilsen</i>	
Telemedical treatment at home of diabetic foot ulcers	27
<i>Jane Clemensen, Simon B Larsen and Niels Ejsskjaer</i>	
Transmission of online digital documents for the health assessment component of e-visa applications.....	31
<i>Anthony MacDermott and Bernard Crowe</i>	
Development of a pilot telemedicine network for paediatric oncology in Brazil	35
<i>André Nebel de Mello, Adilson Yuuji Hira, Regis Rossi Alves Faria, Marcelo Knörich Zuffo and Vicente Odone Filho</i>	
Establishment of the Brazilian telehealth network for paediatric oncology.....	41
<i>Adilson Yuuji Hira, Thiago Tognoli Lopes, André Nebel de Mello, Vicente Odone Filho, Marcelo Knörich Zuffo and Roseli de Deus Lopes</i>	
Web-based patient records and treatment guidelines in paediatric oncology	45
<i>Adilson Yuuji Hira, Thiago Tognoli Lopes, André Nebel de Mello, Vicente Odone Filho, Marcelo Knörich Zuffo and Roseli de Deus Lopes</i>	
Attitude to telemedicine, and willingness to use it, in audiology patients	49
<i>Robert H Eikelboom and Marcus Atlas</i>	
The clinical champion role in the development of a successful telehealth wound care project for remote Australia	57
<i>Isabelle Ellis</i>	
Challenges for implementing wireless handheld technology in healthcare: views from selected Queensland nurses.....	62
<i>Raj Gururajan and Clint Moloney</i>	
Achievements and challenges on policies for allied health professionals who use telehealth in the Canadian Arctic	65
<i>D Hailey, V Foerster, B Nakagawa, TM Wapshall, JA Murtagh, J Smitten, JA Sieblecki and G Wong</i>	
Lifeshirt system for wireless patient monitoring in the operating room	70
<i>Nina Halin, Mika Junttila, Pekka Loula and Pertti Aarnio</i>	
Telemedicine by email in remote Cambodia.....	75
<i>Paul J Heinzelmann, Gary Jacques and Joseph C Kvedar</i>	
Difficulties in moving routine medical checks from the specialist level to the General Practitioner level, supported by electronic message exchange	81
<i>Eva Henriksen, Monika Johansen, Trygve Deraas and Eli Arild</i>	
Information governance standards for managing e-health information	89
<i>Janis L Huston</i>	
Instant wireless transmission of radiological images using a personal digital assistant phone for emergency teleconsultation.....	94
<i>Dong-Keun Kim, Sun K Yoo and Sun H Kim</i>	

Attitudes of breast cancer professionals to conventional and telemedicine-delivered multidisciplinary breast meetings	100
<i>RG Fielding, M Macnab, S Swann, IH Kunkler, J Brebner, RJR Prescott, JR Maclean, U Chetty, G Nkuries, A Walls, A Bowman, JM Dixon, T Gardner, M Smith, MJ Lee and RJ Lee</i>	
A tele-ultrasound needs analysis in Queensland.....	111
<i>Chris Lewis</i>	
Electronic patient record systems and the GP: an evaluation study.....	117
<i>K Mäkelä, I Virjo, J Aho, P Kalliola, A-M Koivukoski, H Kurunmäki, M Kähärä, L Uusitalo, M Valli, V Vuotari and S Ylinen</i>	
Twenty years' experience of a telehealth service in the UK.....	121
<i>Peter Mansfield</i>	
Auto TeleCare – understanding the failures and successes of small business in telehealth	125
<i>David McMahon</i>	
Case management and adherence to an online disease management system.....	129
<i>Lucy Robertson, Michael Smith and Dennis Tannenbaum</i>	
Telemedicine for rural and remote child and youth mental health services	134
<i>Ven-nice Ryan, Stephen Stathis, Anthony C Smith, Denisse Best and Richard Wootton</i>	
Striving for evidence in e-health evaluation: lessons from health technology assessment	139
<i>Marie-Pierre Gagnon and Richard E Scott</i>	
An e-health needs assessment of medical residents in Cameroon	145
<i>Richard E Scott, Peter Ndumbe and Richard Wootton</i>	
Real-time telemedicine for paediatric ENT pre-admission screening	151
<i>Anthony C Smith, Judy Williams, Julie Agnew, Stephen Sinclair, Karen Youngberry and Richard Wootton</i>	
Wireless telemedicine for the delivery of specialist paediatric services to the bedside... 159	
<i>Anthony C Smith, Mark Coulthard, Ron Clark, Nigel Armfield, Shauna Taylor, Robyn Goffe, Ian Motterelly, Karen Youngberry, Alan Isles and Richard Wootton</i>	
A survey of e-mentoring amongst New Zealand midwives.....	169
<i>Sarah Stewart and Richard Wootton</i>	
User acceptance of integrated web-based RIS/PACS distribution of radiology services in regional and remote centres of Western Australia	175
<i>Peter Tually, Chris Stavrianou and John Walker</i>	
Supporting community carers via telehealth.....	180
<i>Penny Van Ast</i>	
Successes and failures: what are we measuring?	183
<i>Sue Whetton</i>	
Referral patterns for a global store-and-forward telemedicine system	188
<i>R Wootton, K Youngberry, R Swinfen and P Swinfen</i>	
Evaluation of the Western Australian Department of Health telehealth project.....	197
<i>Eric Dillon, Jozef Loermans, Dale Davis and Cathy Xu</i>	
Work practice changes caused by the introduction of a Picture Archiving and Communication System (PACS)	205
<i>Ping Yu and Paul Hilton</i>	
POSTERS	212
Real-time video in the neonatal intensive care nursery	213
<i>Nigel Armfield, Tim Donovan and Richard Wootton</i>	
A global telemedicine and teaching network for children in underserved areas	214
<i>Frank Brady</i>	
A Web-based system for collaborative diagnosis in pediatric oncology	215
<i>Thiago Tognoli Lopes, André Luiz M da Rosa, Adilson Yuiji Hira, André Nebel deMello and Marcelo Knörich Zulfo</i>	

Assessing acquired neurogenic language disorders online: a telerehabilitation application	216
<i>Anne Hill, Deborah Theodoros, Trevor Russell and Liz Ward</i>	
Diagnostic value of a written referral and/or images for skin lesions	218
<i>Amanda M M Oakley, Felicity Reeves, Jane Bennett and Stephen H Holmes</i>	
Pilot implementation of an online disease management system for depression in Australia	219
<i>Lucy Robertson, Michael Smith, Dennis Tannenbaum and Holly Exeter-Kent</i>	
Expanding the sphere of influence of e-health to determinants of health	221
<i>Richard E Scott</i>	
Technology and innovation to support healthy ageing and aged care.....	222
<i>J Soar and R Gururajan</i>	
Responses of clinicians and families to a telepaediatric diabetic retinopathy screening programme in Queensland	223
<i>Jill Stillman, Glen Gole and Richard Wootton</i>	
Low-cost telemedicine in Iraq: an analysis of referrals in the first 15 months	225
<i>P Swinfen, R Swinfen, K Youngberry and R Wootton</i>	
Accuracy and utility of real-time paediatric echocardiographic transmission via telemedicine	226
<i>Mark Lewin, Cathy Xu, Mary Jordan, Heidi Borchers, Catherine Henson, Dennis Wilbert and Sanford Meizer</i>	
INDEX.....	228

FOREWORD

Alan Isles

Correspondence:

Dr A Isles
Royal Children's Hospital
Herston 4029
AUSTRALIA
(Fax: +61 7 3636 7215; Email: IslesA@health.qld.gov.au)

This is now the fifth telehealth conference about Successes and Failures, sponsored by the Centre for Online Health of the University of Queensland in partnership with the Royal Children's Hospital.

Again, it is interesting to see the diversity of papers and the growing experience in the use of telehealth in its various forms. This mirrors the growth of the telepaediatric service within our hospital.

One hopes that, with the continued sharing of experiences in such a forum, there will in the future be more successes than failures in telehealth around the world.

PAPERS

Delivery of child development services by videoconferencing: a review of four years' experience in Queensland

Maggie A Bailey¹, Anthony C Smith², Antoinette Fitzgerald¹ and Eileen Taylor¹

1 Child Development Unit, Community Child Health Service, Royal Children's Hospital and Health Service District, Brisbane, Australia

2 Centre for Online Health, University of Queensland, Brisbane, Australia

Correspondence:

Maggie Bailey
Child Development Unit
PO Box 277, Everton Park
Queensland 4053
AUSTRALIA
(Fax: +61 7 3354 7548; Email: Maggie_Bailey@health.qld.gov.au)

Summary

In 2001 the Child Development Unit (CDU) in Brisbane piloted a series of monthly multidisciplinary case discussions via videoconference in the area of child development. During 2001 there were two sessions provided; during 2004 there were 40. The substantial growth in 2004 was due to the expansion of child development services to include special interest group meetings and multipoint case conference meetings. In 2004, a total of 49 hours of videoconferencing was conducted. The average session length was 75 minutes. Education and training sessions were delivered to 32 hospitals and health centres in Queensland and northern New South Wales. The maximum number of sites involved during a single videoconference was 25. The average number of attendees for each videoconference was five per site, including allied health staff, nurses and paediatricians. The delivery of child development services via videoconference has been shown to be useful in Queensland, especially for allied health staff working in regional and remote areas. The growth of the programme indicates its acceptance as a mainstream child development service in Queensland.

Introduction

The Child Development Unit (CDU) is a community-based service of the Royal Children's Hospital (RCH) in Brisbane. The services offered by the CDU represent a multidisciplinary model of practice in the area of understanding and management of developmental and learning disorders.[1] Since 2001 we have been using videoconferencing for the delivery of child development services to rural and remote areas. This developed from a pilot study of the Child Development Unit.[2] The educational support programme for professionals was unique in providing a service at a multidisciplinary team level and addressing the topic of developmental disorders and learning difficulties, as opposed to mental

health topics [3]. The service has been well received as participants continue to provide positive feedback with regards to its high value and a continuing need.

Videoconferencing

The CDU staff organized and facilitated the videoconference sessions from Brisbane. A regular meeting schedule was planned 12 months in advance to ensure room and staff availability. Advertisements for each session's topic and registration forms were distributed via email to child development services in Queensland approximately three weeks in advance.

Each meeting generally consisted of an attendance check, a welcome and introduction by the chairperson, either a case presentation or educational seminar, and an interactive discussion between sites. Each session was transmitted via videoconference using digital lines (ISDN) at a bandwidth of 128 kbit/s. Commercial videoconferencing equipment was used (Sony, Polycom). Various peripherals were also available at the central site, such as a document camera (VID-P110, Sony), laptop computer, PC scan converter and video-recorder.

Methods

We conducted a review of our experience in using videoconferencing for the delivery of clinical teaching sessions related to child development. Telepaediatric service records were reviewed to determine the type and frequency of services provided during the four year period from November 2001 to December 2004.

Results

There was a substantial growth in the number and type of services provided via videoconference during the study period. The programme expanded to include a broad range of child development telehealth services, and the demand from remote sites continued to grow, with the number of sites wanting to participate far exceeding the number of videoconference bridge ports available.

Videoconference activity

During 2001 there were two sessions provided; during 2004 there were 40 (Figure 1). The substantial growth in 2004 was due to the expansion of child development services to include special interest group meetings and multipoint case conference meetings. In 2004, a total of 49 hours of videoconferencing was conducted. The allocated time for each session was 90 minutes, with an average session length of 75 minutes.

Scope of service delivery

Education and training sessions were delivered to 32 hospitals and health centres in Queensland and northern New South Wales (see Table 1). Sites furthest away from Brisbane included Thursday Island (2650 km), Mt Isa (1800 km) and Cairns (1700 km).

Table 1. Participating regional sites and their approximate distance from Brisbane

<250 km	250-500 km	501-1000 km	1001-1500 km	>1500 km
Nambour	Roma	St George	Mackay	Cairns
Gold Coast	Bundaberg	Rockhampton	Townsville	Mt Isa
Kingaroy	Hervey Bay	Charleville	Longreach	Thursday Island
Logan	Gayndah	Gladstone	Barcaldine	Mareeba
Toowoomba	Chinchilla	Biloela	Moranbah	Richmond
Caboolture	Maryborough		Proserpine	
	Goondiwindi		Clermont	
			Ayr	
			Blue Mountains	

Attendance

The average number of sites attending the special interest group meetings was five (SD 1.3) and the average number of sites attending the monthly education sessions was 13 (SD 5.3). The maximum number of sites involved during a single videoconference was 25. The average number of attendees for each videoconference was five per site, including allied health staff, nurses and paediatricians. Most of the CDU team, which comprised seven clinical staff, attended routinely (Figure 2). Additional staff from the RCH and the Queensland Education Department attended sessions on an occasional basis.

Presentation topics

Although the CDU organized and facilitated the sessions, the number of presentations provided by invited guest speakers increased during the study period. Topics ranged from specific developmental disorders, associated conditions and clinical processes, to much broader issues of the future directions for allied health professionals in Queensland's paediatric services. Videoconferencing became an essential tool in providing multidisciplinary support and mentoring for allied health professionals. This was particularly useful for the support of staff in regional centres. As many of the participating child development centres were embarking on reviewing and restructuring of their own service delivery models, we were also able to provide the required guidance.

Discussion

Despite the growing emphasis on multidisciplinary care in child development services, opportunities for more integrated support of allied health teams are limited.[4,5] Our project has been one of few which have addressed this issue, especially in relation to ensuring that educational services are available for allied health staff working in non-metropolitan areas. In our initial evaluation we were able to demonstrate that videoconferencing was useful for allied health professionals in rural areas by improving access to professional support services available through the CDU team. We also identified the importance of creating networking opportunities amongst regional sites in Queensland.[2]

The use of videoconferencing for the delivery of education and group meetings is common in the Queensland health department which has a total of about 300 videoconferencing systems throughout the state. Videoconferencing is also used in a weekly grand rounds education programme for doctors working in regional and remote hospitals.[6] Multipoint videoconferencing allows access for audiences across the state, including remote areas.

The benefits for participants of the CDU programme included improved knowledge in developmental disabilities and learning difficulties, and enhancement of clinical processes, which have been demonstrated in the evaluation of the initial project [1]. The provision of a mentorship programme for regional staff via videoconference was developed as part of a professional enhancement project. This programme is facilitated by the CDU team and participating regional sites undergoing the review and restructuring of services. Although the CDU is a relatively small Brisbane based community service, it has gained recognition for the provision of statewide clinical and educational services throughout Queensland.

The delivery of child development services via videoconference has been shown to be useful in Queensland, especially for allied health staff working in regional and remote areas. The growth of the programme indicates its acceptance as a mainstream child development service in Queensland.

Acknowledgements

We are grateful to all members of the CDU team, including Kerri Webb, Karin Klepper and Jordana Rigby, for their contributions. We also thank the Health Advisory Unit who funded the Professional Enhancement Project in Child Development.

References

- 1 McDowell M, Klepper K. A 'chronic disorder' health-care model for children with complex developmental disorders. *J Paediatr Child Health* 2000; **36**: 563-8
- 2 Fitzgerald A, Bailey M, Smith AC, *et al.* Child development services: a multidisciplinary approach to professional education via videoconference. *J Telemed Telecare* 2002; **8** (suppl. 3): 19-21
- 3 Mitchell, JG., Robinson, PJ., McEvoy, M *et al.* Telemedicine for the delivery of professional development for health, education and welfare

professionals in two remote mining towns. *J Telemed Telecare* 2001; 7:174-180

- 4 Hall P, Weaver L. Interdisciplinary education and teamwork: a long and winding road. *Med Educ* 2001; 35:867-75
- 5 Skeil DA. Individual and staff professional development in a multidisciplinary team: some needs and solutions. *Clin Rehabil* 1995; 9: 28-33
- 6 McCrossin R. Successes and failures with grand rounds via videoconferencing at the Royal Children's Hospital in Brisbane. *J Telemed Telecare* 2001; 7 (suppl. 2): 25-8

Figure 1. Videoconference activity (2001-2004)

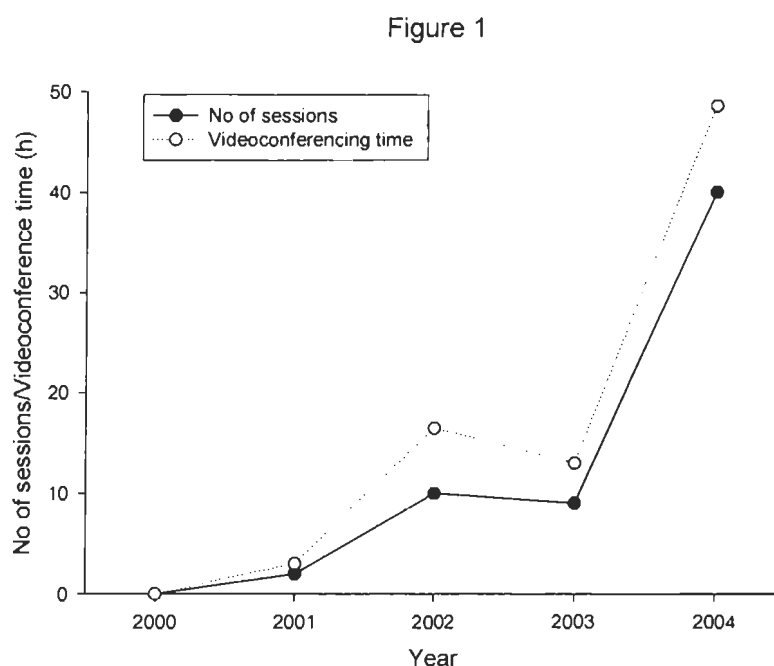


Figure 2. Multipoint videoconference presented by the CDU team



The iPath telemedicine platform

Kurt Brauchli and Martin Oberholzer

Department of Pathology, University of Basel, Switzerland

Correspondence:

Kurt Brauchli
Department of Pathology
University of Basel
Schöbeinstrasse 40
CH-4003 Basel
SWITZERLAND
(Fax: +41 61 265 31 94; Email: kurt.brauchli@unibas.ch)

Summary

An early, point-to-point telepathology system at the University of Basel developed into an open source, Internet-based platform for telemedicine in 2001. The Internet Pathology Suite (iPath) is a web-based telepathology platform that allows real-time teler microscopy across firewalls. It also permits the online presentation and discussion of cases within user groups. After four years, the telepathology network has over 1400 users. More than 6300 cases with a total of about 39,000 images have been diagnosed. The diagnostic workload of all these cases is not exclusively handled by the Department of Pathology in Basel, but by a growing number of independent groups who also use the server simply as a case repository. What started as a small project for hospitals in Switzerland has become a global network.

Introduction

The only major hospital in the Solomon Islands is the National Referral Hospital (NRH) in Honiara on the central island of Guadalcanal. It is staffed by about 20 doctors. There is one radiologist, but no pathologist, ophthalmologist or dermatologist. Consequently, tissue samples for histological examination have to be sent to the nearest pathology service by airmail, which is in Brisbane, Australia. With the decline in tourism after the period of civil disorder in 1999, transport to the Solomon Islands has become even more limited. It is common for the doctors at the NRH to wait for 3-6 weeks before a histological diagnosis is available from Brisbane.

In September 2001, a small histology laboratory was established at the NRH, allowing specimens to be prepared on site. Microscope images of these slides are taken in Honiara with a conventional digital camera (CoolPix 990, Nikon) and a standard microscope (OptiPhot, Nikon). These images are then sent by email to the telepathology network of the University of Basel[1], Switzerland, where they are reviewed by a group of experienced pathologists. Since September 2001 over 400 cases have been diagnosed in this manner and the average turn-around time

for a diagnosis is now approximately 8 hours after submission of the images.[2] At the time of writing, the NRH has also started to process cytology slides. Cervical cancer has a relatively high prevalence in the pacific region and an early diagnosis would be very valuable.

Telepathology at Basel

The telepathology project at the University of Basel began in the early 1990s, where an early real-time telemicroscopy application had been developed to allow intra-operative frozen section diagnosis between the regional hospital in Samedan and the Department of Pathology at the University Hospital in Basel.[3] In 2000, iPath - the "Internet Pathology Suite" - was developed, a web-based telepathology platform that allows real-time telemicroscopy across firewalls. It also permits the online presentation and discussion of cases within user groups.[4]

The original system was based on ISDN connections and specialized software was required for remote control of the microscope. Its application was thus limited to a few, specially installed workstations and it was useful only for point-to-point connections. The change to an Internet-based platform means that only a web browser is required.

In 2001, the telepathology group at the University of Basel was approached by a Swiss surgeon who had been working in the Solomon Islands for many years. He had heard about the telepathology project in Switzerland and wondered about its application in the Solomon Islands. A few months later, a small histology laboratory was opened at the NRH and in October 2002, a virtual institute of pathology with a defined duty plan for the routine diagnostic work for Solomon Islands was formed with pathologists from Germany, Switzerland and South Africa.

An open source, Internet-based platform for telemedicine

The new telepathology system was developed from the point-to-point model and organized into a telemedicine network. The telemedicine software allows users to interact and share knowledge and information. The major challenge with a general-purpose telemedicine system is to allow its use for different types of applications and for users who have different preferences for accessing information. While the pathologists in Switzerland may prefer a website where they can login and read about all their cases, this did not suit the surgeons from the Solomon Islands. Access to the Internet is so slow that that they prefer doing their consultations by email.

The iPath system allows different methods of working. A case from Solomon Islands submitted by email can be imported into the database through the email interface (Figure 1). A pathologist in Germany can access this case and write a diagnosis using the web-interface. In addition, a regional hospital in Switzerland can use a special microscope-interface to connect their remote-controlled microscope to the server, allowing a pathologist to operate the microscope with a web browser.

Basically, iPath is a combination of a discussion forum and an electronic patient record. All users are organized into closed working groups. Every working group

has an administrator who can grant access to other users. Cases can be presented inside such a group. iPath will control user access to the groups and will allow users with appropriate permission to present cases and to view and to comment on cases submitted by other users in the same group. Figure 2 illustrates a case presentation in iPath. A case consists of a clinical description and of a set of images or other attachments (e.g. ultrasound video clips). At the end of the case, other users can add comments.

Besides these basic publication and discussion functions, iPath offers a range of specially designed management functions to improve the workflow of teleconsultations. A group of specialists providing diagnostic services can form an "expert group" or a "virtual institute". This is a special discussion group which is combined with a duty roster and an automatic email notification module. At any time, one of the group members is the expert on call and automatically receives an email about any new case arriving in a discussion group which is linked to the expert group. If it is not a complicated consultation the expert on call can simply write the diagnosis and sign out the case. However, if he or she wishes, the case can also be presented to the whole expert panel for a preliminary discussion, which can optionally be hidden from the sender of the case. Based on their opinions the expert will finally sign out the case with a summary of the joint diagnosis of the whole group. This form of organization has proven very helpful in routine work. In the project with the Solomon Islands, the median response time dropped from 28 h to 8.5 h after the introduction of the virtual institute.[2]

In addition to the consultations, iPath can also be used to make case presentations for educational purposes and for tumour board meetings. Finally, the system can be used for clinical documentation in multi-institutional tumour studies. For this purpose a special module to incorporate custom HTML forms has been developed. This module allows data to be captured in a standardized way and every member of the study group can export the full set of data, for example to analyse it on their PC.

Beyond pathology and the Solomon Islands

Four years after its inception, the telepathology network of the University of Basel has over 1400 users. More than 6300 cases with a total of about 39,000 images have been diagnosed (Figure 3). The diagnostic workload of all these cases is not exclusively handled by the Department of Pathology in Basel, but by a growing number of independent groups who also use the server simply as a case repository. In India, the telepathology network has more than 200 users. In addition, there are many pathologists, some of whom are retired, who are willing to offer some of their time and expertise to colleagues in developing countries and who participate voluntarily in one of the many discussion and expert groups within the telepathology network. As the workflow of an image-based consultation is not very different between pathology and other medical specialties, it is not surprising that iPath is also used for radiology and dermatology consultations.

Besides the diagnostic applications, a collaborative tool like iPath has turned out to be useful for other applications. The regional Hospital of Lörrach in Germany has started to document all tumour board meeting using iPath. In preparation for the meeting the clinicians open the case with the essential clinical data and the questions to be discussed. The pathologist and radiologist then document their

findings with the crucial images and sometimes even add information from a textbook illustrating the basic processes or changes that they observe. During the meeting, all relevant material is then readily available and the discussion notes can be added in the form of comments. After the meeting, every participant has access from their office to the whole set of material and can review the discussions. It is also possible to invite external specialists to "virtually" participate in the meeting. After two years, over 360 cases have been documented in this way which represents a very useful educational resource.

The iPath software that was developed for the telepathology network at the University of Basel has been released as an open source project. One of the main reasons for releasing the system under a free licence was to allow health care providers in developing countries to utilize iPath for regional telemedicine networks. In the initial phase, most users were happy using the main server at University of Basel. However, sending medical information out of a country for the sake of a consultation is not necessarily the best approach. Often there are experts available within the country so it is preferable to first collaborate with these.

Conclusion

What started as a small project for hospitals in Switzerland has become a global network. While the telemedicine platform of the Department of Pathology in Basel alone has 1500 users worldwide, there is a growing number of projects using iPath or customized versions for regional telemedicine networks (Figure 4). These include a dermatology network in South Africa, a Central Asian telepathology network, a perinatal health network and a trauma consultation network in Ukraine, and a general purpose telemedicine network for consultations and distance training for public hospitals in the province of Buenos Aires.[5]

References

- 1 Telepathology Service. Department of Pathology, University of Basel. See <http://telepath.patho.unibas.ch>. Last checked 11 July 2005
- 2 Brauchli K, Jagilly R, Oberli H, *et al.* Telepathology on the Solomon Islands. *J Telemed Telecare* 2004; **10** (suppl. 1): 14-7
- 3 Oberholzer M, Fischer HR, Christen H, *et al.* Telepathology with an integrated services digital network - a new tool for image transfer in surgical pathology: a preliminary report. *Hum Pathol* 1993; **24**: 1078-85
- 4 Brauchli K, Christen H, Haroske G, Meyer W, Kunze KD, Oberholzer M. Telemicroscopy by the Internet revisited. *J Pathol* 2002; **196**: 238-43
- 5 The iPath project. See <http://ipath.ch>. Last checked 12 July 2005

Figure 1. Architecture of the iPath system. At its centre is a telemedicine database that stores all information about users and cases. The database can be accessed through different interfaces – most frequently used is the web access, but there is an interface for email access and also a special interface for remote controlled telemicroscopy.

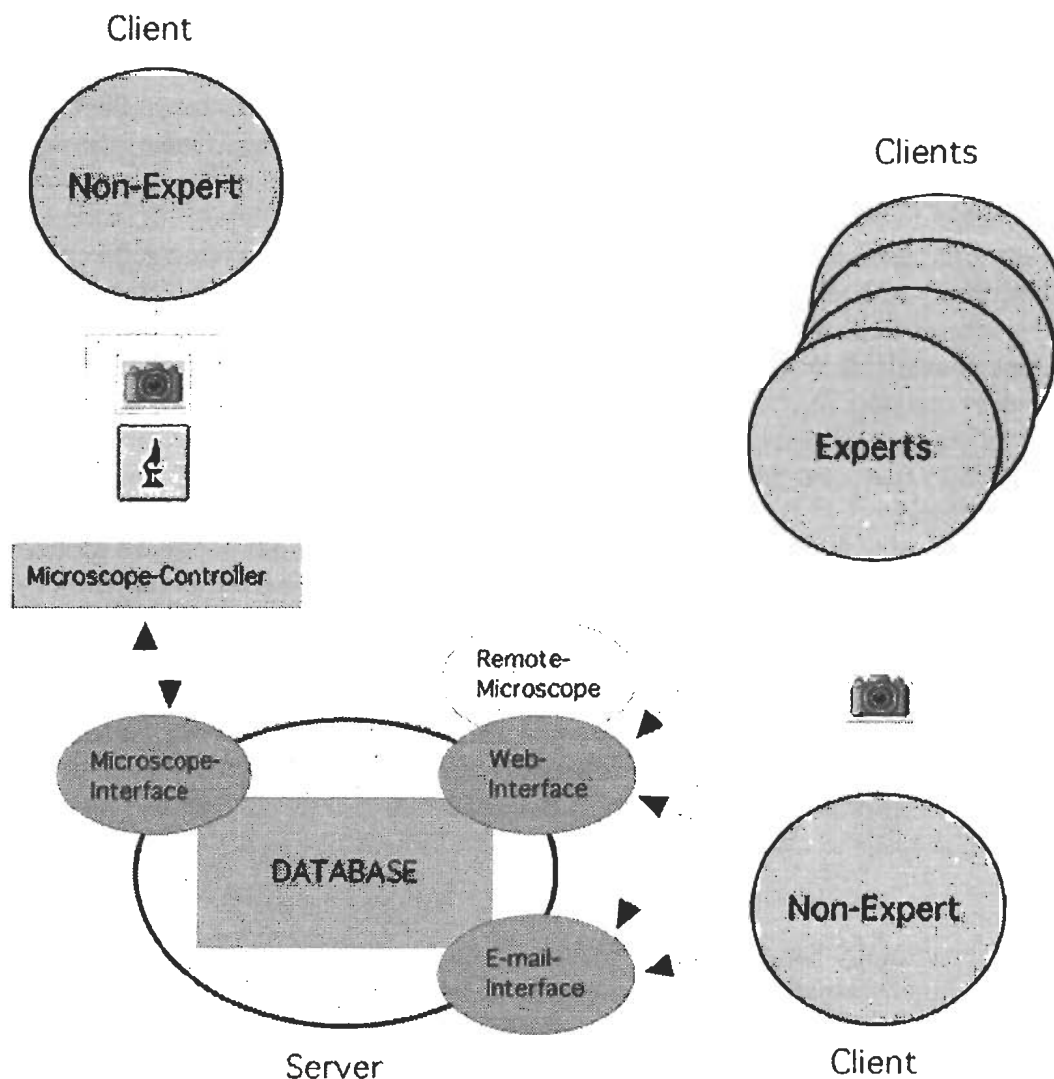


Figure 2. A typical case presentation in iPath. At the top of the case is a header with information about the sender and the time of submission. Below the clinical description is the gallery of images which can be enlarged by clicking on the image. At the bottom are the comments of other users. (This case was part of the Ukrainian Swiss perinatal health programme.)

Congenital anomaly (6922)
previous :: next

top
list new find
reference export
chat slide show


6922
Congenital anomaly
Type
treatment
advice
Sender
Eugene
2005-04-04
08:33:24
group:
Ukrainian Swiss Perinatal Health
Programme

Description
17 years old pregnant woman applied to maternity clinic for the first time.
Ultra Sound Examination: term of pregnancy - 32-33 weeks. Fruit one. Heart beating(+) - 146 per min.
Congenital anomaly - occipital encephalocele.
Delay of intrauterine development, opalescence of amniotic fluid, medium hydramnion, degeneration of
placenta.

Dear friends! We'll be grateful, if You will try to suggest us something concerning this very special
case, thank You much.

Last modified: 2005-04-04 08:32:41

Images (2)


encephalocele 002.JPG[1] encephalocele 001.JPG[3]

Comments I add comment (new window) I

Sender	Comment
Oleksiy (2005-04-06 19:34)	Prognosis of cephalocele depends on: 1) brain insertion inside; 2) hydrocephaly; 3) microcephaly. In case of cephalocele mortality is up to 45%. In this case normal intellect is registered just in 9% of children. In case of hydro- and micro-cephalia presence or any additional malformations a prognosis is even more unpleasant. Ob tactics (conservative or operative) depends on defect size, brain tissue part inside cephalocele, additional malformations presence. Anyway doctors have to inform family real prognosis.
vodtmo (2005-04-07 11:48)	In this case we agree with this diagnosis. Such children can be surgically treated, probably there will be necessity of ventriculo-peritoneum shunting. When next pregnancy planning the woman must address to family planning center. It is recommended to use folic acid before pregnancy in such cases, TORCH-infection and inheritance pathology examination.

Figure 3. Monthly case submission to the iPath server at the University of Basel. The solid symbols represent the total number of cases submitted per month. The open symbols represent cases submitted from developing countries, most of which come from Cambodia, the Solomon Islands, Bangladesh, Iran and Laos (and more recently from Ukraine and India).

Figure 3

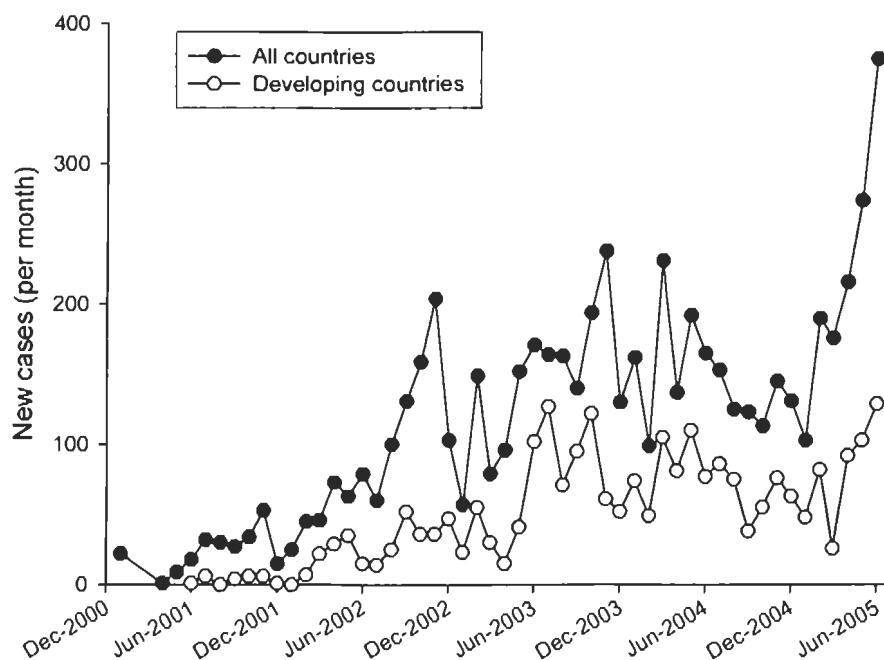
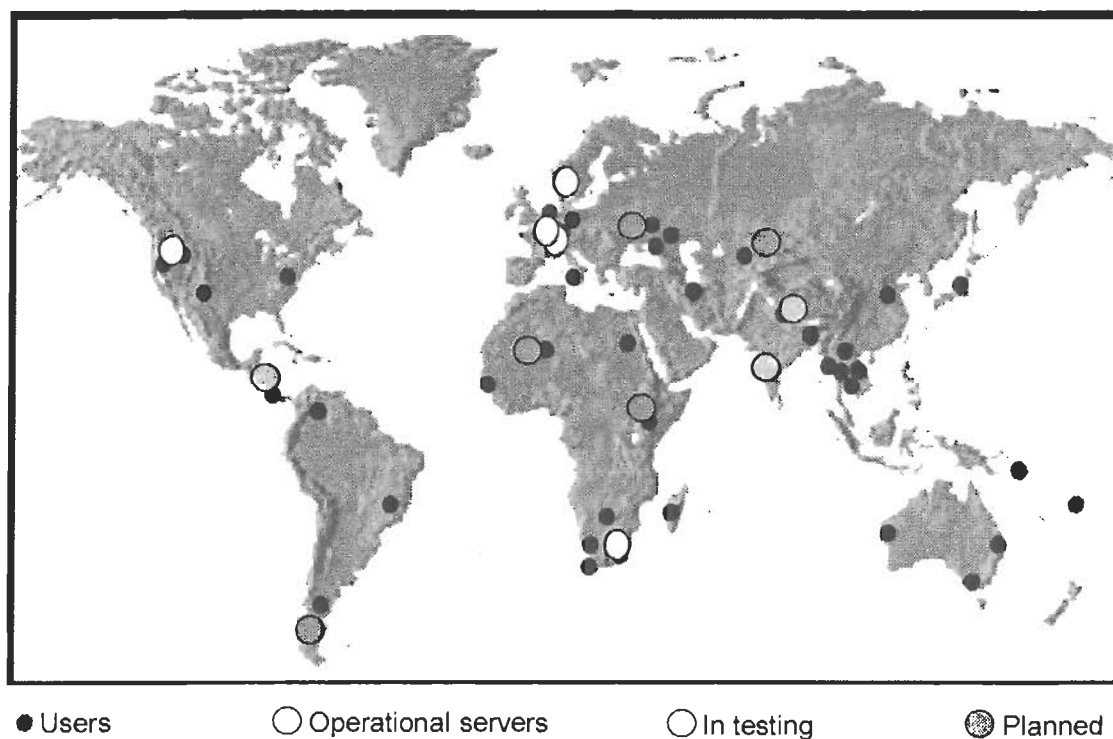


Figure 4. Telemedicine network based on the iPath platform. The most heavily used sector is the telepathology network of the University of Basel which has over 1200 logins per month. There are smaller networks in South Africa, north west USA and West Africa (using a server in Norway).



The Telemedicine Information Exchange: ten years experience

Nancy A Brown

Telemedicine Research Center, Portland, USA

Correspondence:

Nancy A Brown
2121 SW Broadway, Suite 130
Portland
OR 97201
USA
(Fax: +1 503 223-7581; Email: brownnancy@hotmail.com)

Summary

The Telemedicine Information Exchange (TIE) Web site has provided information on telemedicine since 1995. The site could be considered successful from its longevity alone; however, it can also be considered a success using other measures. The usage of the site has grown steadily over the years, to more than 20,000 visitors per month by 2005. The Bibliographic database has over 16,000 telemedicine-related citations, more than found anywhere else, and is the most visited section of the Web site. The second most visited database, Active Telemedicine Programs, is the result of ten years of tracking activity and growth using a voluntary online survey. This continuous monitoring of telemedicine literature and activity has allowed TIE research staff to anticipate user needs and interests. For instance, a Home Telehealth section was initiated after it became apparent that interest in the subject was increasing. Longevity also provides a perspective about the best ways of maintaining a content-heavy online resource. Efforts to augment federal funding (the TIE's sole source of support) by selling packaged information products have taught us that online users will not pay for information.

Introduction

In 1994, staff at the Telemedicine Research Center decided that telemedicine would probably find a permanent niche in the delivery of health care services, despite barriers to its full acceptance and use. At the time, there was almost frenetic activity in telemedicine. There were several US-based and international associations which were holding annual conferences, two peer-reviewed journals and several trade magazines and newsletters. Millions of dollars of federal funds were being spent on new telemedicine programmes in the US. Thus we found ourselves at the confluence of: (1) a resurgence of interest in telemedicine, which had been used in various forms since the 1960s; (2) the availability of less expensive technology; and (3) the first appearance of the World Wide Web. We assumed that, given its "high-tech" and somewhat novel approach to health care, the practice of telemedicine would generate questions from health care

professionals and researchers about its use and applications, and we realized that new Internet techniques such as the Web would be a perfect environment for information on interactive methods of health care. In 1995 we created the TIE Web site (<http://tie.telemed.org>) to display staff-generated information and information collected from other resources, and to facilitate the user exchange of information about telemedicine. Our original mission statement was:

The TIE will provide an online, unbiased, all-inclusive platform for information on telemedicine and telehealth. It is aimed at health professionals and those interested in telemedicine worldwide who are directly or peripherally involved in a wide variety of healthcare delivery services, and who have an interest in the practice of telemedicine.

Figure 1 shows the first home page developed in 1995, and Figure 2 the current home page (2005).

Since 1997, major support from the National Library of Medicine (NLM) has allowed continued development of this online library and has given TIE staff the opportunity to create a unique resource.

TIE development

We began the development of the TIE by determining the telemedicine-related subject areas which would be most useful to health professionals worldwide. These included: a bibliographic database of the literature; an active programmes section (i.e. who is practising telemedicine and how); information about legal, legislative and reimbursement issues affecting its practice; conferences; funding opportunities; vendors of equipment and services; and a 'What's New' column. Other related subject areas were added later, but the above sections still remain the core of the TIE. Although all databases are updated regularly, the Bibliographic database is updated daily, and with over 16,000 citations (i.e. bibliographic records) it represents the largest searchable database of telemedicine information. The number of bibliographic citations in the database has grown steadily at a rate of approximately 1500 per year, Figure 3. The Active Programs database has stayed fairly stable at approximately 150 programmes listed – more if archived programmes that have not been updated are included. In the Meetings database, the numbers vary according to numbers of conferences and meetings submitted each year. The Vendors database, made up of voluntarily submitted records, currently lists about 300 vendors worldwide.

The TIE's path over ten years since its inception has mirrored developments in Web technology and programming. For instance, in 1995 we uploaded new information on the TIE using various Microsoft Word documents and commercial software; this could only be done by programming staff. We now have bespoke software and Web-based administrative tools, so that information can be input and uploaded immediately by appropriate staff members. This not only saves staff time and allows for rapid updates to the site, but it also allows programming staff to fine-tune and upgrade TIE databases and search functions.

TIE usage

The first five years of the TIE's existence saw a steady growth in its use, as interest in telemedicine increased. Our annual report for 1997-1998 showed approximately 5000 visitors per month (as opposed to 'visits' per month, a much higher number), which steadily increased through 1998-1999. By late 2000 that number had doubled to 10,000, with an increase to 20,000 per month in 2004, Figure 4. Web statistics are imprecise at best, and our figures represent the result of employing a variety of statistical methods and software. We also filter out hits from search engines such as Google, which 'spider' the TIE regularly and can greatly skew usage statistics.

The Bibliographic database has continually been the most frequently used, based on page views per quarter, far and above the second most visited, the Active Programs section. TIE-Europe has been the third most visited, an indication of the amount of interest in non-US telemedicine.

Lessons learned

It is immediately obvious when one is on a Web site that is cumbersome to use, or obviously not kept current. Our years of experience have provided us with a good perspective on what makes an online resource successful and useful. The lessons we have learned include the following.

Currency and attribution. One rule we have followed strictly is to continuously update the site. The Internet contains many examples of sites that have been created and abandoned, and it is often difficult to tell whether the information on them is current. As obvious as this might seem, it is still not unusual to find academic or professional Web sites without page dates. We also credit any source that is not in-house, and if possible provide a link to the source. The Health on the Net Foundation (HON) has established a Code of Practice for medical and health Web sites.[1] The TIE has followed those principles since 1998.

Information exchange. We created several opportunities for users to share information with colleagues. While these features have not been used as much as we hoped, there are a number of users who do submit information. There are online submission forms for all searchable databases. For instance, the Vendors database is voluntary (we do not solicit listings) and contains information for over 300 vendors worldwide who provide telemedicine equipment and services. Many users also submit information on forthcoming conferences. The option for authors to submit details of their publications to the Bibliographic database, however, is rarely used.

Anticipate user needs. Based on careful monitoring of telemedicine trends, as well as observations of how our Web site is used, we try to anticipate the information needs of our users. For instance, the Bibliographic database provides a significant number of citations from telemedicine journals and publications that are not available from most medical libraries. In 1999 we initiated a fee-based document delivery service so that users could obtain full-text documents, and the service now provides access to over 5000 documents. Demand for this service waxes and

wanes, but we average about 4-5 requests per month. The articles most requested are those published in the *Journal of Telemedicine and Telecare*. In 2002 we redesigned our Bibliographic search engine to allow more refined searching techniques. Much like the NLM's PubMed database, users can limit their searches by language, non-US, peer-reviewed and date of publication. When it became obvious that home telehealth was a topic of great interest, we developed a special section for that subject.

Academic resource. The TIE was designed to be an academic, research-based Web site. In the early years of the Web, it was common for other sites to have multiple graphics, banners and other distracting advertisements that (particularly before wider use of broadband connections) made downloading information a slow process. Even though the idea of potential advertising income was appealing for the TIE, we knew that most researchers would want to search the site and download information without the distraction of advertisements.

International audience. Although the TIE is US-based and centred, we have always included international information, since telemedicine has no geographical boundaries. A request for international collaborative partners was made during a presentation at Telemed '99 conference in London,[2] and we found interested partners in the UK. We developed a TIE-Europe (TIE-EU) Web site in 2000 (<http://www.tieurope.org>) using the TIE as a model. New non-US information added to the TIE is automatically posted to the TIE-EU Web site. Information is also sent to the TIE by staff at the TIE-EU operation. The partnership currently suffers from a lack of sponsorship for staff time. However, thanks to the early efforts of Ms Lynda Sibson, particularly in developing 'Tool Kits' for certain specialties, the TIE-EU site contains some additional European-focused information that is not present on the main TIE site.

Responsive to users. We receive numerous email messages and telephone calls each week from users with questions or requests for additional information. We respond to all requests within 24 hours, and encourage suggestions for content and improvements in service.

Conclusion

It is ironic to discuss the success of the TIE Web site over the past ten years, while simultaneously reporting its demise. The NLM has decided not to continue its financial support of the TIE. It will be updated and remain on the Web at least until November 2005, but at the time of writing (mid-2005) its final disposition is unknown. That the TIE received ten years of federal funding is little short of a miracle. That our luck should run out is not unexpected, given the vagaries of Congressional appropriations, a Republican administration, the changing priorities of the granting agency, and a year-to-year contract. It is certain that the NLM would not have continued to fund us if we had not adhered to the above practices and produced a worthwhile product. Our determination to provide a free service may also have led to our downfall. While we have tried intermittently over the past ten years to sell enhanced information products (e.g. in-depth research, newsfeeds) it became apparent that Web users are not predisposed to buying

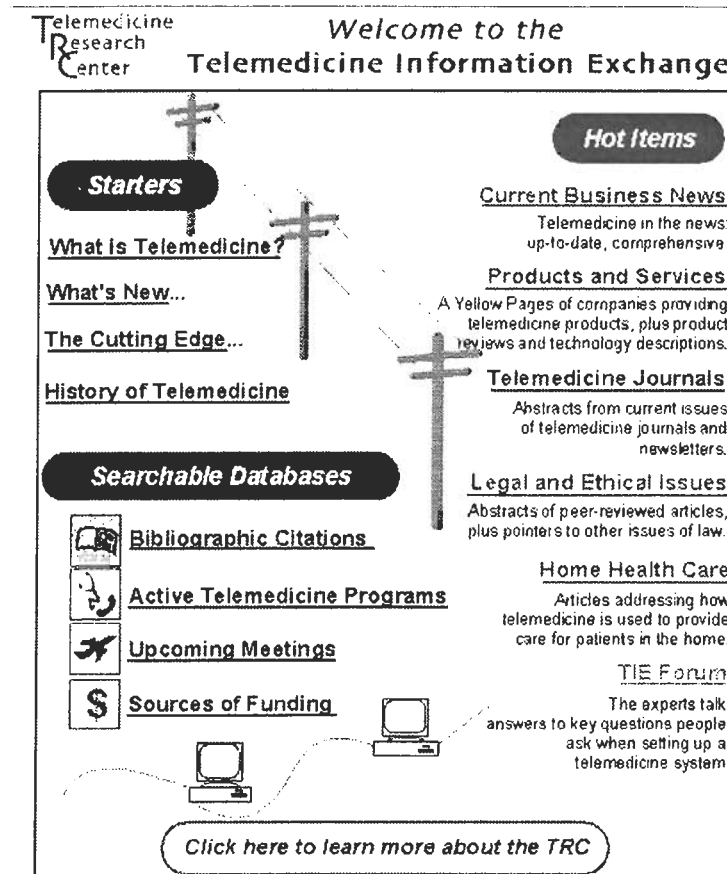
information on any subject, let alone telemedicine, when they think they can find it somewhere on the Internet for free.

One is reminded of the old line, 'the operation was successful but the patient died.' Our *raison d'être* for the past ten years has been the provision of credible, up to date information, and our reward has been positive feedback from thousands of TIE users.

References

- 1 *HON Code of Conduct (HONcode) for medical and health Web sites.*
<http://www.hon.ch/HONcode/Conduct.html>. Last checked 10 June 2005
- 2 Brown N. Five years' experience with the Telemedicine Information Exchange.
J Telemed Telecare 2000; **6** (suppl 1.): 110-2

Figure 1. The first TIE home page, designed in 1995.



Copyright 1995,1996,1997 Telemedicine Research Center
All rights reserved

These pages maintained by neadron@telemed.org

Figure 2. The fourth redesign of the TIE home page (2005).

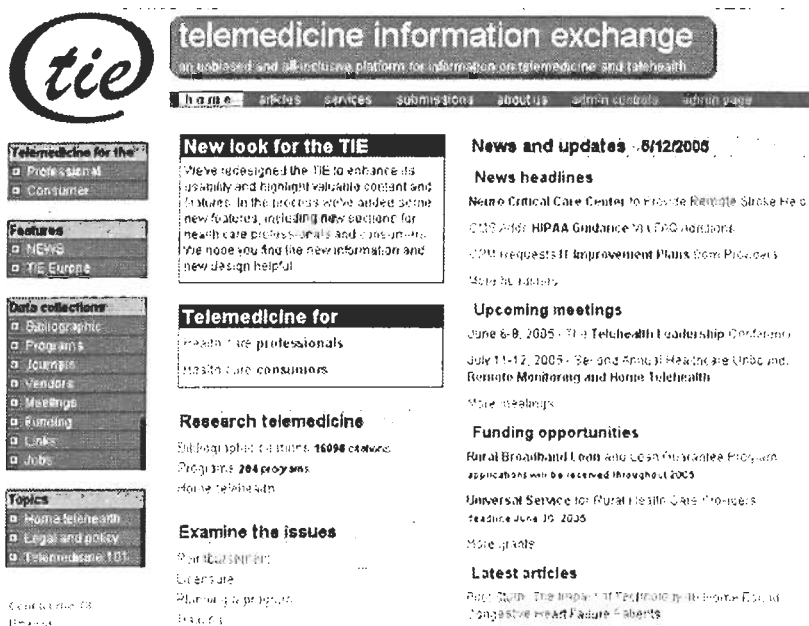


Figure 3. The increase in the number of bibliographic records since 1994.

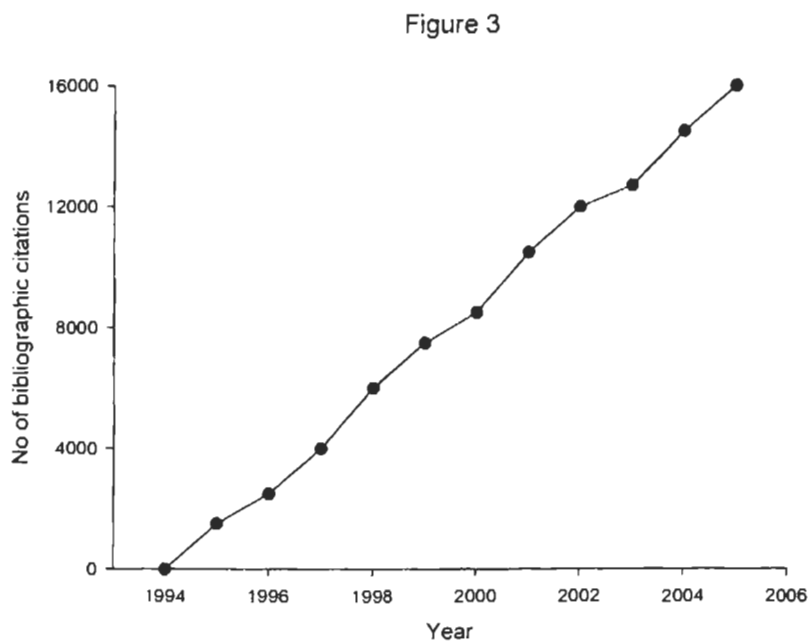
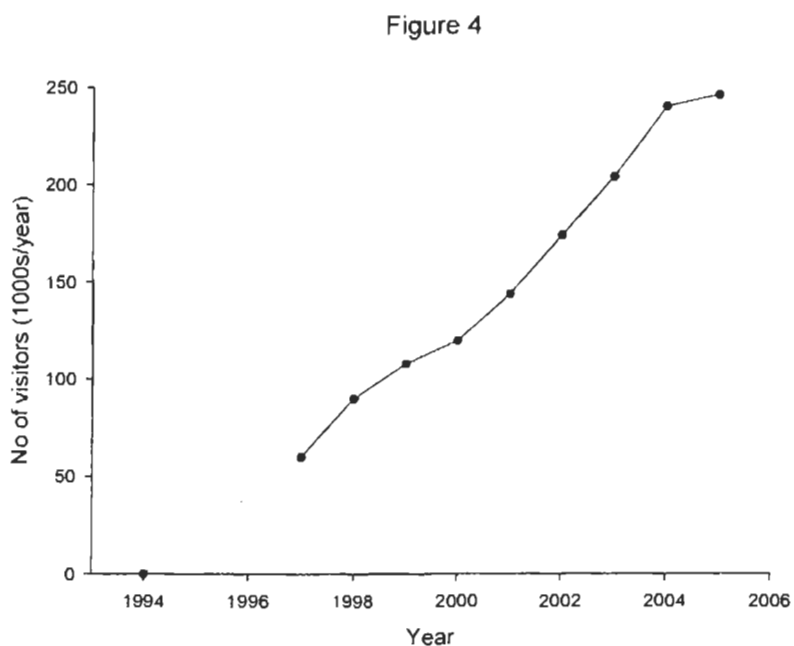


Figure 4. Number of visitors to the TIE Web site from 1997-2005



Success and failures in web-based medical collaboration

Tatjana M Burkow and Line L Nilsen

Norwegian Centre for Telemedicine, University Hospital of North Norway,
Tromsø, Norway

Correspondence:

Tatjana M Burkow
Norwegian Centre for Telemedicine
University Hospital of North Norway
PO Box 35
9038 Tromsø
NORWAY
(Fax: +47 77 754 098; Email: tatjana.m.burkow@telemed.no)

Summary

We developed a web-based collaboration tool for ophthalmologists, Øyenet. A feasibility study was performed in 2000. The system was ready to use in 2001, but the usage of the system was disappointing, compared to the enthusiasm expressed in the feasibility study. In order to identify facilitators and barriers for usage of the system, we performed a qualitative study. Nineteen ophthalmologists from different parts of Norway, who had been using the system but to a varying degree, were interviewed. The study revealed that one common solution is not appropriate for the ophthalmology community as a whole. It also revealed that colleagues from abroad should be allowed to use the system, in order for it to act as a tool for collaboration and seeking advice in complex medical problem solving.

Introduction

In 2001 members of the Norwegian Ophthalmology Association (NOF) were offered access to a web-based medical collaboration tool called Øyenet. The system was tailored to specific ophthalmology needs and included a web-based image processing tool allowing annotation, support for second opinion with the possibility of including images, and a historical case archive. The case archive could be used as storage for interesting case files. It could also be used for motivating purposes, for example for contests such as a monthly case published, and where a winner is chosen from the correct answers received. It was a true web application, accessible with a standard web browser. In order to use the system a user account and a password was required. Figure 1 shows what an example second opinion consultation made with the system looks like.

Øyenet was implemented after a feasibility study in the year 2000. A questionnaire was sent to all 368 ophthalmologists in Norway, both private

practitioners and hospital specialists. The quantitative feasibility study revealed a major interest in a web-based collaboration tool. The response rate was 67% (114 answers) for hospital specialists and 43% (85 answers) for private practitioners respectively. Of those working in hospitals, close to 90% thought they would benefit from a web-based collaboration system, while 77% of the specialists in private clinics thought they would.[2]

Øyenet was made available for the members of the NOF from 2001. However the usage of the system was disappointingly low and far from what was expected on the basis of the enthusiasm expressed in the feasibility study. In order to identify possible barriers and facilitators for take-up amongst professionals, a qualitative study was performed in 2003.

Methods

Ophthalmologists from different parts of Norway were interviewed, using in-depth interviews lasting up to two hours. The results were analysed using qualitative methods.[3] The Norwegian ophthalmology community consists of ophthalmologists working in hospitals, in private clinics or both places. There are approximately 21 ophthalmology departments in Norway, and about 150-200 staff working in private clinics. In total there were at the time of the study about 300 members of the NOF, and in November 2002 there were 138 registered users of the web-based collaboration system. A criterion to become a part of the study was that the ophthalmologists were registered as users of the system. In order to be able to answer what would facilitate the use of a system, the users need knowledge about how to log into it and the functions included in it. Therefore, the 138 registered users constituted the whole population of the study. All of the registered users were contacted by email (the email address registered in the Øyenet system). Those who responded during a certain period of time were interviewed (n=19), and this included both ophthalmologists working in private clinics, in hospitals and those working in both types of organisation.

In the study all categories of users were represented, both less experienced users of the system (only logged into the system and “looked around”) and those who had been using the functionality in case archive or the second opinion to make consultations or answer to consultations. In the period of March to April 2003 in total 19 ophthalmologists, located from north to south in Norway, were interviewed. Some of them by telephone and others face to face at their workplace. The interviews lasted up to two hours.

The interviews were semi-structured, which implies that the interviews consisted of open ended questions.[4] In order to be able to compare the answers, some of the questions were formulated in advance, and all the informants were asked these questions. We also used triggers based on knowledge and assumptions from the feasibility study.[2] Open ended questions allowed the informants to present topics that *they* regarded as important. The interview guide was organised around the following subjects: access to the system, the ophthalmology discipline, the functionality and the use of the system. The interviewed were recorded and then transcribed.

Results

The results showed that a single common web-based solution is not appropriate for the ophthalmology community as a whole. The different subspecialties in the ophthalmologist community differ too much, even though they are all specialists in the same medical discipline. Some of the specialists, regardless of working in private clinics or not, are sub specialists and others are general specialists. The degree of specialization depends on factors such as how large or small the hospital in question is. In a small hospital, the possibility to specialize is less compared to a larger hospital. The needs between the different subspecialties also vary, and particularly the use of images in second opinion consultations.

The study also showed that a collaboration system including only members from one country does not support the needs of the specialist, who need to seek international expertise in order to solve their complicated medical problems. As one of the informants expressed it:

“The problem in question is to determine who I contact for advice. If someone in Norway knows something about it I contact them. Otherwise I send the request to the USA”

This is just one example of consultations with colleagues abroad. Other countries mentioned in the interviews included Sweden and Denmark, and several of the informants were already using email to send second opinion request to colleagues abroad.

Discussion

The different subspecialties in the ophthalmology community differ so much that one common web-based solution is not appropriate for the community as a whole. They would need “virtual rooms” or “meeting places” inside a common system, with functionality specially tailored for the medical problems they need to solve.

The Øyenet system was originally intended for members of the NOF only. But the study revealed that a collaboration system including only members from one country does not support the needs of specialists who need to seek international expertise in their medical problem solving. The decision to include members from abroad or not, as members of the system, will depend on what the intentions of the system are. It could be used as an information channel for the NOF, which means that colleagues abroad do not have to be given access to the system. But if the intention is that it should be a collaboration tool to support complex medical problem solving, colleagues abroad have to be given access. In order to fulfill both needs, there could be one part with information about the NOF, which is reserved only for NOF members. In addition there could be virtual rooms or meeting places for the different subspecialties including the general specialist, with functionality tailored to their needs, and where also colleagues from abroad are allowed to enter.

Acknowledgements

We thank all the informants who participated in the study.

References

- 1 Burkow TM, Fossen K, Lundvoll Nilsen L, Strandenæs T, Fiskaa SA, Bakkevoll PA. A web-based collaboration system for geographically distributed medical professionals. *IADIS International Conference, WWW/Internet 2003*. Portugal: 531-7, 2003
- 2 Burkow TM., Fossen K, Strandenæs T, Fiskaa SA, Bakkevoll PA. A web-based infrastructure for medical professionals. *Proceedings of MIE, Medical Informatics Europe*. St Malo, France: 2003
- 3 Kvale S. *Interviews : an Introduction to Qualitative Research Interviewing*. Thousand Oaks, CA: Sage, 1996
- 4 Holstein JA, Gubrium JF. *The Active Interview. (Qualitative Research Methods, Volume 37)*. Thousand Oaks, CA: Sage, 1995

Figure 1. An example second opinion consultation [1]

NORSK ØFTALMOLOGISK FORENING
NORSK ØYELÆGEFORENING
SPESIALFORENING I ØSKEN NORSKE ØYELÆGERFORENING

Form

Arbeid
Send
Draft
Deleted
Case suggestion
Case reply
Multiple cases
Retina cases

Form

Send
Open as draft
Add to queue
Subject response(s)
Outline
My profile
Logout

Form

To:

Subject:

History

67 ys old woman. No prior medical history.
Tumour in left fundus found on routine exam.

Visual acuity: Right Left

Correction: Right Left

Pressure (mmHg): Right Left

Examination

Greyish tumour, white drusen. Shallow serous detachment over the tumour.
FA shows late leakage.
ICG shows tortuous vessels at margin of tumour.
B-scan: 1,07/1,47mm tumourheight
General exam incl. blood, ultrasound abdomen

Images

Retina image

(194 kb)

Angiography

(170 kb)

(182 kb)

(147 kb)

(12 kb)

(14 kb)

Telemedical treatment at home of diabetic foot ulcers

Jane Clemensen¹, Simon B Larsen¹ and Niels Ejksjaer²

1 Centre for Pervasive Healthcare, Aarhus N, Denmark

2 Department of Endocrinology M, Aarhus University Hospital, Aarhus C, Denmark

Correspondence:

Jane Clemensen
Centre for Pervasive Healthcare
Aabogade 34
DK8200 Aarhus N
DENMARK
(Fax: +45 8942 5750; Email: janec@daimi.au.dk)

Summary

The treatment of diabetic foot ulcers may not always be well organised and not all patients have access to expert evaluation. We investigated the use of telemedicine to enable a visiting nurse (in the patient's home) to coordinate the treatment with experts (at the hospital). The equipment consisted of a UMTS videophone and an Internet-based patient record. Field studies were carried out at the outpatient clinic and by following visiting nurses. A total of 15 participants were invited to five workshops and experiments held in our laboratories, at the hospital, and between hospital and patients' homes. Preliminary results were promising: (1) both clinicians and patients found the equipment easy to use; (2) the doctor could prescribe treatment at a distance; (3) the visiting nurse had real-time contact with the hospital and treatment could begin immediately according to the doctor's orders; (4) the patient saved time in not having to travel to the hospital.

Introduction

Diabetes and its complications is a rapidly increasing problem in the western world. One of the most common complications from diabetes is the development of foot ulcers.[1] Treatment of diabetic foot ulcers is often performed by non-experts and without continuity. The end result may be patients having toes, feet or leg unnecessarily amputated.[2] We have therefore investigated the possibility of moving experts from the hospital to the patient's home by the use of technology. The question is whether the continuity and quality of treatment can be maintained by connecting the experts at the hospital with the visiting nurse in the patient's home.

Others have experimented with telemedicine for similar purposes with promising results (see for example [3] or [4]). In these settings *asynchronous* telemedicine has been employed. The problem with diabetic foot ulcers is that they often do not show the same indications as normal wounds and expertise is necessary for the

correct treatment. This means that an expert needs to take responsibility for the treatment. A *synchronous* dialogue between the expert and the visiting nurse performing the actual treatment is therefore required. Since many of the patients are elderly and do not have Internet connections in their homes, a mobile system may be useful. To this end we consider UMTS (Universal Mobile Telecommunication System, also known as 3G) videophones to be a feasible solution, despite the limited bandwidth and image resolution compared to conventional videoconferencing systems.

Methods

A multidisciplinary team of clinicians, visiting nurses, patients and relatives took part in a design process, along with researchers from both health science and computer science domains. We used the method of Participatory Design[5] to collect data in the first two phases of the project.[6] At the beginning of the project field studies were carried out at the outpatient clinic and by following visiting nurses. A total of 15 participants were invited to five workshops and experiments held in our laboratories, at the hospital, and between hospital and patients' homes.

Videophones

During the workshops various setups for the videoconferencing were tried out.

Online ulcer record

In treatment of diabetic foot ulcers, patient and relatives, visiting nurses and experts at the hospital each complete their own type of paper record. This causes problems with keeping information updated and synchronized. To create a more convenient way of sharing information between the visiting nurses and the clinician we have developed an electronic ulcer record. This electronic ulcer record also contains general clinical information apart from ulcer descriptions to be shared between the contributors to patient treatment. In order for this to work in practical terms contact information, schedules and other logistic information must be present and up to date in the records. The online ulcer record allows digital images of the wound to be stored. This facilitates a continuous evaluation of the ulcer from one consultation to the next by comparing images.

Results

Videophones

Initially it was considered necessary for the visiting nurse to bring a laptop (including webcam, microphones, loudspeakers, digital still camera and power supplies) to the home of the patient. At one workshop a visiting nurse looked at all the technical equipment and responded: "What about those of us who go by bicycle?" Subsequently, the UMTS technology was tested, and the users found it much easier and more convenient to use. The videophones were chosen for the pilot test and because of simplicity of use and their light weight. In other experiments images of different resolutions were evaluated, and it was concluded that the VGA quality of the videophones was sufficient in most cases. However, when communicating by videophone, it is of crucial importance that the visiting nurse clearly demonstrates and describes the location of the ulcer. It is also important that clinical manifestations are clearly described in words. One

consultation almost ended before the clinicians realized that they were talking about different locations of the ulcer. Another consultation showed that the expert nurses at the hospital need to be aware of their technical jargon, since some words might seem offensive when spoken over a distance, e.g. "Do you have a knife, so that you can cut into that ulcer?" In spite of the videophone's small-sized display the patient was very much part of the dialogue. Both the patient and relatives felt that they were part of the conversation, although they always had to talk very loudly to be heard by the doctor. At times the visiting nurse had to repeat patient comments to the doctor.

Online ulcer record

We supplemented images taken with the mobile phone with images from an ordinary digital camera, and the clinicians found these images valuable – to quote the doctor: "It is even better than the human eye, because it corresponds to using a magnifying glass". The nurses at the hospital also found an advantage in educational terms, for instance by showing the pictures to patients having problems looking at their feet due to physical or visual impairments.

The record system was capable of notifying the doctor by SMS messages and this proved to be a valuable feature. Beside the browser-based interface, the record system has an interface suitable for the videophone's PDA-sized screen showing a limited subset of the record, and furthermore it can accept input from SMS messages, voice messages and email messages. In the workshops and experiments we noticed a difference in the usage of the record between the hospital staff and the visiting nurses. In the morning the visiting nurses will read the journal to prepare for the visit (from their office PC), but during the rest of the day they may only use the record system with the small PDA version for uploading the most recent images. Experience with shared documentation suggests that the ones benefiting the most from the records ought to be the ones spending time to write in it.[7] For this reason the hospital staff may be the main source of documentation in the record system, which has been the case in our pilot tests.

Discussion

We have performed four teleconsultations during actual courses of treatment. Our findings strongly suggest that establishing expert coordinated treatment in the home of the patient can be performed successfully. The experts felt that they had sufficient basis for coordinating treatment. Somewhat to our surprise, the visiting nurses were capable of handling the technology, despite some disbelief in their own technical skills. The patients expressed satisfaction with the course of treatment and relief at not having to go to the hospital and spend much time waiting for transport and consultation.

However, as is the case with many experiments in telemedicine our findings also indicate that the organisation needs adjustments for the technology to be successfully integrated.[8] For example, scheduling online consultations has proven to be a difficult task because it requires that the visiting nurse, the patient, the hospital nurse and the hospital doctor simultaneously select a time to suit all. It is also important that all those involved are on time for the agreed consultation – a 10 minutes delay may cause significant practical problems.

Acknowledgements

We thank ISIS Katrinebjerg, Systematic Software Engineering and the Family Hede Nielsen Foundation, the National Diabetes Foundation for financial support. The Diabetic Foot Centre at the Department of Endocrinology M, Aarhus University Hospital; patients, staff, visiting nurses and other project group members are pre-requisites for this project. Finally, we thank Dansk Telemedicin A/S for their help in developing the electronic wound record.

References

- 1 Diabetes care and research in Europe: The Saint Vincent declaration. *Diabet Med* 1990; 7: 360
- 2 Watkins PJ. The diabetic foot. *BMJ* 2003; **326**: 977-9
- 3 Debray M, Couturier P, Greuillet F, *et al.* A preliminary study of the feasibility of wound telecare for the elderly. *J Telemed Telecare* 2001;7: 353-8
- 4 Chan WM, Woo J, Hui E, Hjelm NM. The role of telenursing in the provision of geriatric outreach services to residential homes in Hong Kong. *J Telemed Telecare* 2001; 7: 38-46
- 5 Kyng M, Greenbaum J. *Design at Work: Cooperative Design of Computer Systems*. Hillsdale, NJ: Lawrence Earlbaum Associates, 1991
- 6 Clemensen J, Larsen SB, Bardram JE. Developing pervasive e-health for moving experts from hospital to home. 441-448. 2004. IADIS Press. Proceedings of the IADIS e-Society Conference, Avilla, Spain. See <http://www.iadis.net/dl>. Last checked 10 July 2005
- 7 Dourish P, Bellotti V. Awareness and coordination in shared workspaces. 107-114. 1992. *Proceedings of the 1992 ACM Conference on Computer-supported Cooperative Work*. ACM Press, NY, USA. 1992. See <http://doi.acm.org/10.1145/143457.143468>. Last checked 10 July 2005
- 8 Wootton R, Hebert MA. What constitutes success in telehealth? *J Telemed Telecare* 2001; 7: 3-7

Transmission of online digital documents for the health assessment component of e-visa applications

Anthony MacDermott¹ and Bernard Crowe²

1 Department of Immigration and Multicultural and Indigenous Affairs, Canberra, Australia

2 Bernard Crowe and Associates, Canberra, Australia

Correspondence:

Bernard Crowe
10 Warren Place
Chifley
ACT 2606
AUSTRALIA
(Fax: +61 2 6285 1797; Email: ycrowe@webone.com.au)

Summary

Up to 350,000 health assessments are conducted annually for persons seeking a visa to enter Australia. Health screening is conducted by accredited panel doctors and radiologists in the visa applicant's home country. Their findings are forwarded to the appropriate government department in Australia. The move to an eVisa system, with certain visas being available via the Internet, has seen the introduction of a compatible electronic health assessment system. An online system to support health assessment processing was implemented in two stages. The first, eHealth1, has been in operation since July 2002 and the second, eHealth2, commenced in November 2003. In a pilot trial in Singapore during 2003 and 2004, 87% of student visa applications were lodged through the eHealth2 system. The main advantage of the eHealth2 process is the rapid transmission of a digital photograph and X-ray image. This avoids the delay of sending documents and films by post. The success of the pilot has led to the expansion of eHealth2 to other electronic visa sectors, such as working holiday makers, long stay business people and visitors. The eHealth2 system is fully operational in Singapore, Hong Kong, Japan, South Korea and Taiwan.

Introduction

Potential immigrants seeking a permanent visa for Australia must meet the health standards set by the Department of Health and Ageing. Other visa applicants intending to stay in Australia for study, work or tourism may also be required to undergo medical assessment prior to being granted a visa. Up to 350,000 health assessments are conducted annually.

The health requirement and associated screening processes that the Department of Immigration and Multicultural and Indigenous Affairs (DIMIA) has adopted are based on advice from the Department of Health and Ageing. The health requirements for visa applicants are designed to ensure that:

- risks to public health in the Australian community are minimised
- public expenditure on health and community services is contained
- Australian residents have access to health and other community services.

Medical assessment for visa applicants may consist of an X-ray, a full medical examination or in some cases an assessment of fitness to travel. Health screening is conducted by accredited panel doctors and radiologists in the visa applicant's home country. Their findings are forwarded to a Medical Officer of the Commonwealth (MOC) in Australia to determine if the applicant meets the health requirement.

The move to electronic visa issuing (the eVisa system), with more visas being available via the Internet, has also seen the introduction of a compatible electronic health assessment system. An online system to support health assessment processing was implemented in two stages. The first, eHealth1, has been in operation since July 2002 and the second, eHealth2, commenced in November 2003.

eHealth2 system

Based on the applicant's health declarations, the eHealth1 system identifies cases which require health checks. The applicant is prompted by the system to download health forms and make an appointment with an approved panel doctor and radiologist. Once complete, the hard copy health forms are forwarded to a DIMIA office for input into the eHealth1 system which then allows automated visa issue where all criteria are met.

The eHealth2 system allows visa applicants to enter basic health data when they lodge their application, and it alerts the applicant if health checks are required. Panel doctors and radiologists use the eHealth2 system to record the results of medical and radiographic examinations, and to submit this data to a central server in Australia. The MOC or administrative officer is able to download this information for assessment as required.

The main advantage of the eHealth2 process is the rapid transmission of a digital photograph and X-ray image. This avoids the delay of sending documents and films by post. In addition, instructions and certain data fields in eHealth 2 are active and intuitive, and identity checking is better ensured with mandatory fields, see Figure 1.

The practical requirements for the eHealth2 are:

- identifying panel radiologists and panel doctors with appropriate information technology and broadband Internet access
- identifying panel radiology practices able to produce DICOM-compatible X-ray images via Computed Radiography (CR) or Digital Radiography (DR) imaging equipment

- instructing radiology practices in image compression and attachment to the online health file
- training panel radiographers in visa applicant identification procedures, digital photograph acquisition and attachment to the online health file
- training of doctors and administrative staff in completing and submitting online health examination forms
- notifying eVisa applicants of the availability of the eHealth2 system and directing them to appropriate panel practices
- archiving of health files, including X-ray and photographic images, completed online forms and scanned attachments
- use of a grading system to allow administrative clearance (if applicable) of medical examinations and X-rays without significant findings
- training administrative staff in processing of online cases
- installing digital workstations for MOC assessment of online health cases, including the capacity to view and print DICOM images.

Pilot trial

A pilot trial was conducted in Singapore to determine the viability of obtaining and transmitting all health assessment data associated with applications for student visas. During 2003 and 2004, 87% of student visa applications were lodged through the eHealth2 system.

Discussion

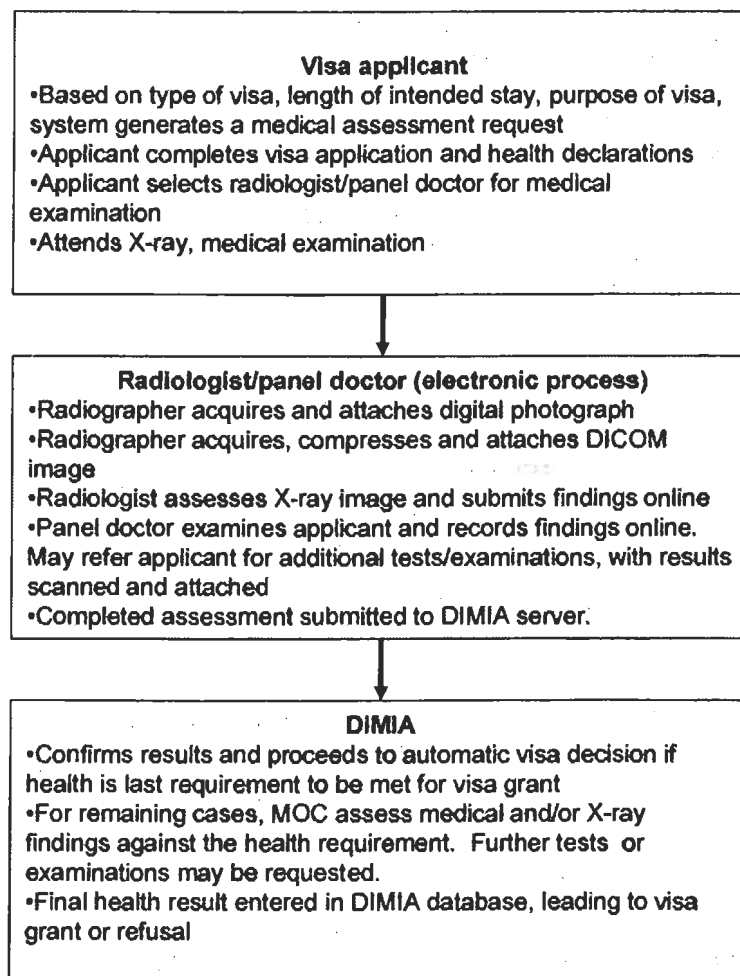
The eHealth2 system is a web-based application that can be accessed by registered users via a secure Internet connection from anywhere in the world. It is an easy-to-use system that provides a number of advantages over the current paper-based health assessment process. The main advantages are faster processing and on-line access to client health information by DIMIA staff.

The eHealth2 system allows medical and radiological examinations to be completed entirely electronically. eHealth2 facilitates electronic recording of medical observations, digital photographs, digital X-rays and scanned test results. These results are archived electronically, saving floor space and avoiding the need for (and risks of) manual document handling. eHealth2 also allows tracking of movements of hard copy documents, if necessary as adjuncts to the on-line reports.

The success of the pilot has led to the expansion of eHealth2 to other electronic visa sectors, such as working holiday makers, long stay business people and visitors. The eHealth2 system is fully operational in Singapore, Hong Kong, Japan, South Korea and Taiwan.

In summary, eHealth2 has a number of benefits for visa applicants. It is more convenient, because it allows applicants to enter health data online rather than obtaining and completing paper forms, and is available for use 24 hours a day, 7 days a week. The system has significantly reduced the processing times for visa applications where medical checks are required. Clients can now obtain their visas in a matter of hours, including their medical examinations.

Figure 1. Summary of how the eHealth2 system works



Development of a pilot telemedicine network for paediatric oncology in Brazil

André Nebel de Mello¹, Adilson Yuuji Hira², Regis Rossi Alves Faria², Marcelo Knörich Zuffo² and Vicente Odone Filho¹

1 Unidade de Onco-Hematologia, Instituto da Criança HC-FMUSP, Sao Paulo, Brazil

2 Laboratório de Sistemas Integráveis, Escola Politecnica da Universidade de Sao Paulo, Sao Paulo, Brazil

Correspondence:

André Nebel de Mello
Laboratório de Sistemas Integráveis
Escola Politecnica da USP
Av. Prof. Luciano Gualberto, travessa 3, 158
Butantã
Cidade Universitária
Sao Paulo CEP 05508-900
BRAZIL
(Fax: +55 11 3091 5664; Email: andrenm@gmail.com)

Summary

We established a pilot telemedicine network for paediatric oncology in Brazil, linking the School of Medicine at the University of Sao Paulo in Sao Paulo City to the "Hospital de Base" in Porto Velho, Rondonia located in the Amazon region, 3000 km away. The videoconferencing link used ISDN transmission at 384 kbit/s. The network was used for patient screening, follow-up, treatment monitoring and other activities. Between March 2000 and March 2002, 69 videoconferences were held and 33 patients followed, 29 with cancer. During this period 16 patients required transfer, 18 patients died and 11 achieved cancer remission. The main cause for patient mortality (infection) was not one that could be addressed directly by telemedicine. Using the School of Medicine as benchmark, the average mortality rate for paediatric cancer patients in the pilot was higher. However, it was lower than previous levels observed at Rondonia (62% versus 80%).

Introduction

In developing countries, cancer is the second leading cause of death among children under 15 years of age. In Brazil, about 3500 new cases are reported each year.[1] At present 70% of affected children can be cured, according to the Brazilian National Cancer Institute INCA.[2]. There has been a decreasing trend in mortality over the past two decades, largely due to early diagnosis and new therapeutic protocols. The Brazilian Society of Paediatric Oncology has accredited 58 specialized paediatric cancer services in the country.

Many patients are still referred to treatment centres in an advanced stage of disease. The difference can be dramatic, because it has been demonstrated that children with leukaemia who are treated in non-accredited centres and not following agreed guidelines have twice the accepted rates of mortality.[2] Regarding patient management and referral, more frequent and better contact between referring institutions and accredited treatment centres, allowing for initial screening, diagnosis and advice to attending physicians, are bound to increase the overall effectiveness and cost/benefit ratio of the whole system.

Since there is a small number of accredited cancer treatment centres, mainly located in large cities, most of the affected children must travel and stay away from their homes for extended periods of time and pose difficulties for parents to stay with their children.

Methods

To address the childhood cancer problem described we decided to implement a pilot telemedicine network. As the specialized centre we selected the Children's Institute of the University of Sao Paulo's Medical School whose paediatric haematology-oncology unit accepts an average of 500 new cancer patients a year, 23% from outside Sao Paulo.

The selected referring institution was the Hospital de Base Dr Ari Pinheiro, located in Porto Velho, Rondonia state, located in Amazon region (Figure 1). It is the only hospital with cancer care support in such state. The hospital has two clinical oncologists, one dental surgeon and one haematologist, but no paediatric oncologist.

Videoconferences were initially scheduled twice a week, with prior communication by phone or email in order to schedule other medical specialists in Sao Paulo for the discussion. Biopsy and marrow samples were sent by mail when needed, all the remaining exams were sent in electronic form.

The equipment is listed in Table 1.

Table 1. Equipment

	Initial	Final
Specialized centre	VTel HS200 384 Kbit/s ISDN	Pictoretel SwiftSite 760 TBR 384 kbit/s ISDN
	29" TV colour monitor	33" TV colour monitor
	VHS recorder	VHS recorder
	PC microcomputer	PC microcomputer
	3 128 kbit/s ISDN modems	3 128 kbit/s ISDN modems
	Broadband modem	Broadband modem
		Multimedia projector
		Laser printer
Referring centre		Samsung Video Presenter SVP5200
	VTel SmartStation 384 kbit/s ISDN	Pictoretel SwiftSite 760 128 kbit/s ISDN
	3 128 kbit/s ISDN modems	128 kbit/s ISDN modem
	33" TV colour monitor	33" TV colour monitor
	Satellite connection terminal	Satellite connection terminal
	Dial-up modem	Dial-up modem
	RF PDH Link	RF PDH Link
		Flatbed scanner

After each session the participants on both sites filled an evaluation questionnaire. The patients were also interviewed after the meetings they attended and again when transferred to Sao Paulo.

Results

Between March 2000 and March 2002, 33 patients were evaluated in 69 videoconferences. Other activities associated with the project included continuing medical education and management conferences for the project. Of the 33 patients, 29 were diagnosed with cancer: 7 had acute lymphoid leukaemia, 6 had neuroblastoma, 6 had CNS tumours, 3 had Burkitt's lymphoma, 2 had rhabdomyosarcoma, 2 had osteosarcoma, 1 had giant cell fibroblastoma and 1 had Hodgkin's lymphoma.

During the follow-up 16 patients were transferred to Sao Paulo. Of those patients eight remained in Sao Paulo and eight returned to Rondonia. A total of 18 out of 29 patients died during the study period, five by disease progression, two on relapse and 11 due to infection. Also eight patients were transferred or abandoned the project before treatment completion.

90% of the videoconferences were conducted without the patient's presence and only in three occasions a patient in Sao Paulo contacted his family in Rondonia. The questionnaires and interviews showed that there was an improvement of the relationship between the referring institution and the centre of excellence, decreasing the risks associated with children referred and transported without need to centre of excellence. The evaluation of affected children before they were referred produced a better evaluation of prognosis, urgency and risk of mortality

and morbidity, especially in situations where prioritizing was required because of a shortage of beds and/or outpatient slots.

The image and sound quality were considered excellent in 12% of videoconferences, good in 52%, fair in 26% and poor in 10%. The ratings by the doctors in the referring institution were higher overall than in the specialist centre. The time delay was the most frequent complaint regarding the transmission.

Despite some familiarity with the system after the first 2-4 videoconferences, most people still referred to it as non-natural conversation in the written answers. Patients were quicker to accept the video consultations than their parents and 96% enjoyed being close to home. The number of meetings per week increased from 1 in the first two months to 2.5 in the following six months, but decreased steadily after that to just 1 per month in the three final months of the project, Figure 2. The main reason for the decrease in the number of meeting held was the loss of interest by the participants in Rondônia.

Discussion

According to the Cancer Incidence and Mortality Report 1991-1999 of the Brazilian Ministry of Health, the five-year survival rate in cancer patients in Rondonia is 15% and in the Sao Paulo City it is 44%. The project was therefore associated with a decrease in mortality. Also, the number of patients that required transfer was higher than expected. The leading cause of death was infection, possibly due to lower prevention standards in the referring centre, but also associated with the immune suppression caused by the cancer treatment.

The chosen method of telecommunication (ISDN) was more expensive than the IP (Internet Protocol) based transmission. While we upgraded the equipment once in the specialized institution, we had a higher equipment failure rate in the referring institution, with two complete changes in equipment and frequent maintenance calls due to mishandling by the participants and adverse weather conditions that shortened the equipment lifespan. Securing financial sources is the main obstacle in most telemedicine projects, and the present one was no exception. Without a proper business model, telemedicine projects are not viable.

Conclusions

Our experience shows that it is possible to create a network for paediatric oncology and other subspecialties to supervise the treatment of patients in remote areas. However, a higher bandwidth than 384 kbit/s is required in order to produce the best videoconferencing conditions. There is also a need for more interactive ways of conducting the conferences in order to keep all parties interested.

Even though the mortality rate was higher than our institution's average, it was still significantly lower than the previous levels in the referring institution (62% versus 80%). The main cause for patient mortality was not one that could be addressed directly by telemedicine. Although they were not an obstacle for the pilot study, the telecommunication costs were the biggest hurdle for a sustainable telemedicine network.

Acknowledgements

We are gratefully for grants from the telephone company Embratel and from NEC do Brazil, and for equipment donated by the Vtel company. The hardware and software installation and maintenance was provided by the Laboratory for Integrated Systems from the Polytechnic School Sao Paulo University.

References

- 1 Parkin DM, ed., International Agency For Reserch On Cancer. *Cancer Incidence in Five Continents – Vol 7*. Lyon: IARC Scientific Publications, 1997
- 2 Rodrigues KE, Camargo B. [Early diagnosis of childhood cancer: a team responsibility]. *Rev Assoc Med Bras* 2003; **49**; 29-34

Figure 1. Location map

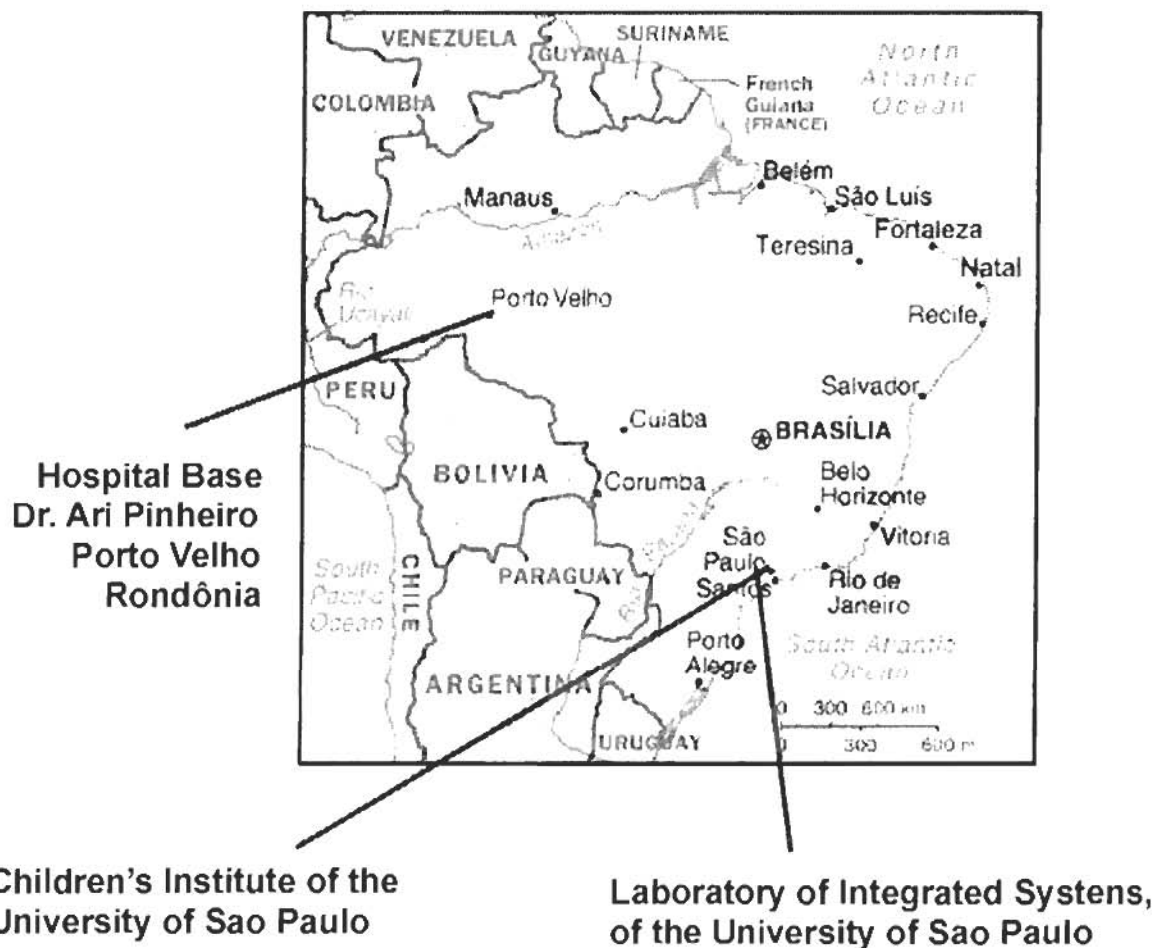
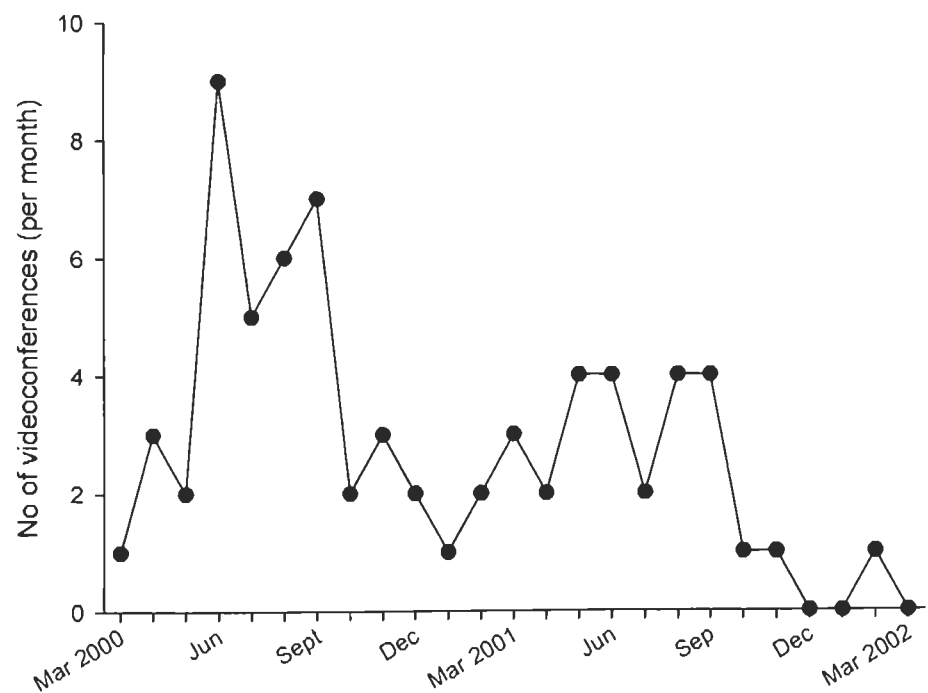


Figure 2. Videoconferences

Figure 2



Establishment of the Brazilian telehealth network for paediatric oncology

Adilson Yuuji Hira¹, Thiago Tognoli Lopes¹, André Nebel deMello², Vicente Odone Filho², Marcelo Knörich Zuffo¹ and Roseli de Deus Lopes¹

1 Laboratório de Sistemas Integráveis, Escola Politécnica da Universidade de São Paulo, São Paulo, Brazil

2 Unidade de Onco-Hematologia, Instituto da Criança HC-FMUSP, São Paulo, Brazil

Correspondence:

Adilson Yuuji Hira
Laboratório de Sistemas Integráveis
Escola Politécnica da USP
Av. Prof. Luciano Gualberto, travessa 3, 158
Butantã
Cidade Universitária
São Paulo – CEP 05508-900
BRAZIL
(Fax: +55 11 3091 5664; Email: ayhira@lsi.usp.br)

Summary

A telemedicine network has been established in Brazil to support distance medical practice in paediatric oncology. ONCONET comprises a national network of universities, research institutes and medical institutions. The system is web-based and hosted on a high performance computing infrastructure based on clusters of computers. It is based on open source software, designed to provide high performance, fault-tolerance and high availability. The ONCONET began operation in 2004. Currently 30 hospitals affiliated to the Brazilian Society for Pediatric Oncology are users of the ONCONET. Six hospitals are connected by broadband access through the National Education and Research Network and 24 by conventional Internet access. The Multimedia Patients Registry also became operational in 2004, and its database contains information about 3200 patients from the 30 hospitals. The technological platform was notable for its low production cost. It thus appears to be a sustainable solution to the problem of delivering continuing medical education in a large country with widely dispersed health professionals.

Introduction

Paediatric cancer care is difficult in Brazil, especially in remote regions, because of the difficulty in gaining access to appropriate health services. Usually, the reference centres are located in metropolitan areas and patients often have to travel for specialized treatment. To address these problems, a telemedicine network has been established. ONCONET comprises a national network of universities, research institutes and medical institutions, to support distance medical practice in paediatric oncology. The goals were to:

- establish a network comprising the Brazilian Society for Paediatric Oncology (SOBOPE), six paediatric oncology centres in six different states and three universities (Figure 1)
- implement a cluster-based computer architecture
- offer advanced health services, such as multimedia patient records, multimedia cooperative cancer treatment protocols, collaborative second medical opinion and distance learning applications.

Methods

The system service framework is the childhood cancer Web portal (<http://www.oncopediatria.org.br>). This incorporates the research results and developments adopted by the SOBOPE. All applications were hosted on a high performance computing infrastructure based on clusters of computers (Oncocluster).

The system is web-based and when completed it will have six hospitals connected at high bandwidth through the National Education and Research Network (RNP – Rede Nacional de Ensino e Pesquisa).[1] In addition, 52 hospitals associated with the SOBOPE will be connected through conventional Internet access. The minimum bandwidth for each hospital is 512 kbit/s and the ideal bandwidth is 1 Mbit/s. This is necessary for the transmission of multimedia medical data (text, voice, static images, video). In each state of Brazil, the RNP arrives at a regional PoP (Point of Presence). The hospitals of the ONCONET are connected to the regional PoP.

The system is designed to provide high performance, fault-tolerance and high availability. It is based on open source software, from operating system to application server. The operating system is Linux (Red Hat). For load-balancing, in order to provide better cluster performance, the Linux Virtual Server was used.[2] The Heartbeat[3] was used to protect against hardware and software failures.

Results

The ONCONET began operation in 2004. Currently 30 hospitals affiliated to the SOBOPE are users of the ONCONET, six by broadband access through the RNP and 24 by conventional Internet access. The Multimedia Patients Registry also became operational in 2004, and its database contains information about 3200 patients from the 30 hospitals.

Discussion

The project has resulted in a model that is technologically and economically viable. We believe that it is essential to develop our own telemedicine applications with the Brazilian environment in mind, instead of trying to adapt ready-made commercial products. It is also necessary to provide for maintenance of both hardware and software. The project has managed to provide a collaborative environment for those institutions that have participated in the pilot. The project has also pioneered the joint work of universities and health institutions for the creation of a nation-wide Brazilian telemedicine project.

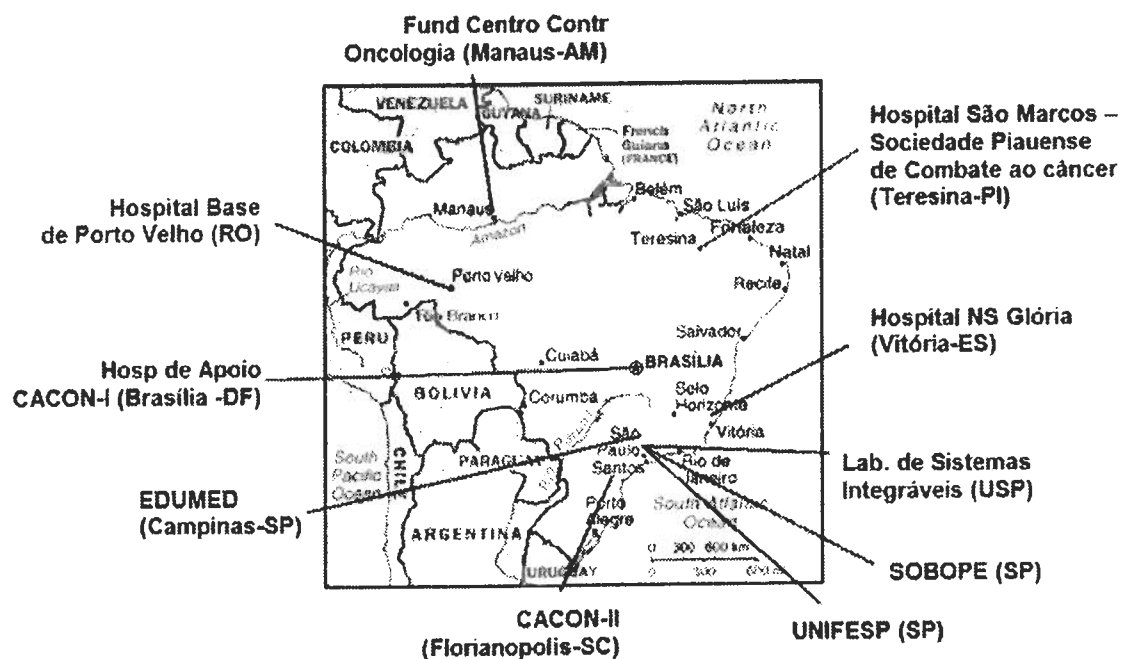
With ONCONET we were able to integrate remote institutions in a larger community. The use of collaborative tools for second opinions and distance learning may lead to an increase in the speed and accuracy of radiology and pathology diagnoses. Our aim is to improve and standardize the patients' treatment, and to make available up-to-date information provided by the best treatment centres in the country. The standardization of treatment and the improvement of the treatment conditions of childhood cancer, even in regions with severe lack of resources, may improve overall survival.

The use of ONCONET, with a high performance infrastructure, allows us to execute new applications, such as medical image treatment, pattern detection in examinations, construction and rendering of volumetric images. The technological platform was notable for its low production cost. It thus appears to be a sustainable solution to the problem of delivering continuing medical education in a large country with widely dispersed health professionals. In future, the increased use of the system will generate large quantities of data that will require an increase in the number of Web servers and databases in the clusters (i.e. horizontal and vertical scalability will be required).

References

- 1 Rede Nacional de Ensino e Pesquisa. See <http://www.rnp.br/en/>. Last checked 14 July 2005
- 2 Linux Virtual Server. <http://www.linuxvirtualserver.org>. Last checked 14 June 2005
- 3 Heartbeat. <http://www.linux-ha.org>. Last checked 14 June 2005

Figure 1. ONCONET sites



Web-based patient records and treatment guidelines in paediatric oncology

Adilson Yuuji Hira¹, Thiago Tognoli Lopes¹, André Nebel de Mello², Vicente Odone Filho², Marcelo Knörich Zuffo¹ and Roseli de Deus Lopes¹

1 Laboratório de Sistemas Integráveis, Escola Politécnica da Universidade de São Paulo, São Paulo, Brazil

2 Unidade de Onco-Hematologia, Instituto da Criança HC-FMUSP, São Paulo, Brazil

Correspondence:

Adilson Yuuji Hira
Laboratório de Sistemas Integráveis
Escola Politécnica da USP
Av. Prof. Luciano Gualberto, travessa 3, 158
Butantã – Cidade Universitária
São Paulo CEP 05508-900
BRAZIL
(Fax: +55 11 3091 5664; Email: ayhira@lsi.usp.br)

Summary

We have established a web-based system in Brazil offering health information in childhood cancer and services such as electronic patient records and treatment protocols. The system was based on open-source software. The database has records for about 3200 patients from 30 Brazilian hospitals. An evaluation by doctors from the six hospitals comprising the Neuroblastoma Cooperative Group was positive, mainly because the system allows easy online access, but also because the electronic register performs data validation when information is inserted. Our experience shows that it is possible to use a web-based system to provide paediatric cancer services at a distance.

Introduction

Paediatric cancer represents the second most common cause of childhood death in several regions of Brazil. The main reasons for this are:

- a lack of medical specialists, primarily in the most remote regions of Brazil
- poor allocation of financial resources and lack of investment in the health department
- a heterogeneity in the treatment of cancers.

With proper diagnosis and treatment, the cure rate among paediatric cancer patients can be 70%. This is achieved in the best hospitals of Brazil, which are mainly located in the most well-developed regions. Large number of patients from Brazil's remote regions seek high quality health care in the urban centres, leading to overcrowding of the hospitals there. The use of the Internet represents one possible way of offering advanced services at a distance. This should assist medical practice, improve medical care services and disseminate knowledge throughout the field.[1]

Web portal

The Oncopediatria portal (<http://www.oncopediatria.org.br>) is a web-based system, which offers services and information regarding paediatric cancer and is focused on maintaining electronic patient records and cooperative treatment protocols (Figure 1). The main objectives are:

- to improve the information flow in research programmes and cooperative treatment protocols
- to disseminate and harmonize treatments through the use of protocols that produce the highest cure rates
- to establish the basis for a national demographic record of paediatric cancer
- to make available statistics, demographic data and analyses of the results of treatments using the protocols.

The system uses the recording standards of the Brazilian Health Department, which establish norms for the construction of electronic records, and define the content and logical structure of information regarding health care. The architecture and implementation have been described elsewhere.[2]

Patient records and cooperative treatment protocols

In Brazil, patient records are often incomplete or only archived on paper, leading to poor quality records of cancer incidence. Brazilian statistics are derived from North American incidences, impairing the country's cancer management. The Brazilian Society of Paediatric Oncology (SOBOPE) publishes cooperative protocols on paediatric cancer treatment, which are based on research by cooperating groups. These treatment protocols define the most advanced treatment programmes in childhood cancer, offering better cure rates and improved survival. Nevertheless, current dissemination methods are inefficient and several institutions still follow obsolete protocols. Even institutions which have already adopted the SOBOPE protocols experience difficulties in sharing patient data and publishing results.

Multimedia patient registry

The Oncopediatria system has adopted the record structure of the International Classification of Childhood Cancer (ICCC) proposed in 1987 by the International Agency for Research on Cancer (IARC) of the World Health Organization.[3] The system provides a user-friendly multimedia interface, allowing secure access to electronic medical records via the Internet. Medical professionals have different levels of access to the data according to the security rules defined by SOBOPE and the Brazilian Federal Council of Medicine. Patients can view their own data but

can only modify their contact information. One interface is shown in Figure 2. The treatment results are anonymised, to protect the individual patient's privacy.

Multimedia cooperative treatment protocols

Some of the SOBOPE cooperative protocols have been implemented, offering protocol guidelines[4] for physicians. The applications model the events of the treatment phase, such as diagnosis, chemotherapy cycles, radiotherapy sessions, surgical revaluations, bone marrow transplant, laboratory examinations and imaging. The first such multimedia treatment protocol concerns the treatment of high-risk neuroblastoma (NEURO-IX-2000). A protocol for non-Hodgkin's lymphoma is being developed, divided into Burkitt, lymphoblastic and anaplastic lymphoma. In the multimedia protocol, much of the record is textual, but parts of the record are medical images. The system allows images to be stored in several common image formats such as JPEG and DICOM (Digital Imaging and Communications in Medicine).

Methods

Members of the SOBOPE community started using the Multimedia Patients Registry in 2004. In May 2005, the system had 142 registered doctors and the database had records for approximately 3200 patients from 30 Brazilian hospitals. Doctors from the six hospitals comprising the Neuroblastoma Cooperative Group are using the neuroblastoma multimedia protocol as well. Thirty doctors from these hospitals evaluated the system and provided feedback to the design team.

Results

The evaluation of the SOBOPE doctors who used the system was positive, mainly because the system allows easy online access but also because the electronic register performs data validation when information is inserted. This produces better quality data. There was some resistance from certain doctors to using the Internet, since they were not familiar with such technology. This is a problem related to culture change in the community.

Discussion

The Oncopediatria portal is being implemented in 58 hospitals of Brazil. Activities such as the development of Ewing tumour treatment protocols have begun, as well as the analysis of bone marrow transplant protocols. The system offers a radical change of treatment model for childhood oncology in Brazil. The present work demonstrates that it is possible to use a web-based system to provide health services at a distance, through applications based on free software and open systems.

References

- 1 Detmer WM, Shortliffe EH. Using the Internet to improve knowledge diffusion in medicine. *Communications of the ACM* 1997; **40** (8): 101-8
- 2 Hira AY, Lopes TT, de Mello AN, Filho VO, Zuffo MK, de Deus Lopes R. Establishment of the Brazilian telehealth network for paediatric oncology. *J Telemed Telecare* [SFT5]

- Figure 1. The Oncopediatrics portal

48

Attitude to telemedicine, and willingness to use it, in audiology patients

Robert H Eikelboom^{1,2} and Marcus D Atlas^{1,2}

1 School of Surgery and Pathology, University of Western Australia, Nedlands, Australia

2 Lions Ear and Hearing Institute, Perth, Australia

Correspondence:

RH Eikelboom
Lions Ear and Hearing Institute
Ground Floor E-Block
Sir Charles Gairdner Hospital
Nedlands WA 6009
AUSTRALIA
(Fax: +61 8 9346 3637; Email: robeik@cyllene.uwa.edu.au)

Summary

We studied the willingness of patients to use telemedicine for ear- and hearing-related appointments, and the factors that influenced their decision to participate in telemedicine. A survey was designed with questions about details of patient appointments, perceived advantages and barriers to telemedicine and prior use of the Internet for health related matters. A total of 116 patients in four audiology centres were surveyed from December 2004 to May 2005. There were 54 male and 62 female respondents; 46% of the participants were aged over 66 years. 75% had not previously heard of telemedicine. The most common reasons for willingness to use telemedicine were to reduce the time waiting for an appointment and cost. The most common barrier to using telemedicine was a preference for face-to-face visits. 32% were willing to use telemedicine, 10% would sometimes be willing, 28% were unsure, and 30% were not willing. There was no relationship between willingness and age or gender, except that females over the ages 55 were less willing. Patients who had previously heard of telemedicine and used the Internet for health related matters, especially males, were more inclined to have a telemedicine appointment.

Introduction

An important factor in the successful implementation of telemedicine is an understanding of the attitudes of potential users to it and the factors that influence their decisions. The willingness of patients to use telemedicine has been assessed in a number of settings, including psychiatry[1] and dermatology.[2] Willingness depends on the patient's attitude to telemedicine, their satisfaction with their current care and their relationship with their health care provider.[3]

There has been little investigation of motivating factors for patients. It is often said that restrictions of access to medical services because of distance or time are important determinates. Although savings in travelling, time and cost have been shown,[4] a link to patient motivation or satisfaction has not been established. Cost, which can be combination of potential savings and cost for more immediate or convenient service, may also affect the willingness and motivation of patients. Here too, studies are few outside of the home-telecare situation. Bradford *et al.*[5] have shown that 55% of cardiac patients are willing to pay US\$20 for a telemedicine service.

The present study was designed to determine the willingness of patients to use telemedicine for ear- and hearing-related appointments, and to establish some of the factors that would influence their decision to participate in telemedicine.

Methods

A questionnaire was designed for patients attending one of four audiology clinics in metropolitan Perth. The questions were in three parts: about the appointment, telemedicine, and personal information. Figure 1 shows all the questions, excluding the preamble. Patients attending the clinics between December 2004 and May 2005 were invited to participate in the survey.

Results were analysed using the program SPSS v11.5. Patients were divided into two age categories for the analysis: those aged 16-55 years (n=41), and those over 55 years of age (n=73). Data from three respondents were excluded because the information was invalid.

Results

A total of 116 patients completed the survey, 54 males and 62 females. 46% of the participants were aged over 65 years, reflecting the age of patients that attend these audiology clinics. 45% of participants had used the Internet for health related matters, and only 25% were previously aware of telemedicine.

The motivations for telemedicine recorded by the participants are shown in Figure 2 and the barriers to telemedicine in Figure 3. The main issues were that telemedicine had the potential to reduce the time patients would have to wait for an appointment, and that patients were more comfortable with a face-to-face consultation. Reducing time off work and confidentiality were of lesser importance.

On balance, 32% of respondents were willing to use telemedicine, 10% would sometimes be willing, 28% were unsure and 30% were not willing. The willingness for each age group is shown in Figure 4. The significant relationships between various responses are shown in Table 1.

Discussion

The analysis of the survey data showed that a willingness to use telemedicine was significantly linked to a previous awareness of telemedicine and use of the Internet for health related matters, particularly in males. Age and gender were only linked to willingness to use telemedicine for females in the over 55-year-old age group. Therefore, as familiarity with the applications of computers and the Internet can be expected to grow in the community in future, it will probably become easier to introduce telemedicine into clinical practice.

Agreement with each of the advantages of telemedicine suggested to the participants was linked to their willingness to use telemedicine, particularly in the over 55-year-old age group. Males were especially motivated by a reduction in travelling distance and for less reliance on others for transport, whereas females appeared to be more attracted to the reduction in cost of the appointment.

The barriers to telemedicine had less relation to willingness to use telemedicine; the non face-to-face nature of telemedicine appointments counted most against it, particularly for males and for the over 55-year-old age group. The under 55-year-old age group were more concerned that a telemedicine appointment was not as good as a face-to-face appointment. This may be an important consideration when planning a telemedicine service.

Confidentiality was considered to be a crucial factor. Only three participants considered confidentiality as the most important factor, while five others noted it as a barrier. This should not inhibit the development of a telemedicine service, although it remains important from a medicolegal perspective.

Almost none of the factors regarding the participant's current appointment appeared to be crucial in deciding the attitude to telemedicine. There was a link to willingness to use telemedicine only for the younger age group who travelled 10-50 km for the appointment, or for those who had set aside two hours or less for their appointment. Therefore, travel distance (16 participants travelled over 50 km) and time for the appointment (20 participants set aside over 3 hours) were not deciding factors, with responses equally divided between those willing and not willing to use telemedicine. This suggests that most people, including those who travel long distances and who have to devote a considerable amount of time to their appointment, have accepted their investment of travel and time for an appointment.

The present study surveyed a relatively small number of participants and the results may not therefore be generalizable. However, the findings suggest that a successful telemedicine system in an ear and hearing setting should focus on reducing waiting times and the costs of appointments, and that it will be necessary to overcome the reluctance of some patients' preference for a face-to-face consultation.

Acknowledgements

We thank Kate Lewkowski, Sharon Brown, Desma Dietsch, Pippa Styles, Sharon Safstrom and Ruth Carson for their assistance in the design and administration of the survey.

References

- 1 Werner P. Willingness to use telemedicine for psychiatric care. *Telemed J E Health* 2004; **10**: 286-93
- 2 Qureshi AA, Kvedar JC. Patient knowledge and attitude toward information technology and teledermatology: some tentative findings. *Telemed J E Health* 2003; **9**: 259-64
- 3 Werner P, Karnieli E. A model of the willingness to use telemedicine for routine and specialized care. *J Telemed Telecare* 2003; **9**: 264-72
- 4 Brown-Connolly NE. Patient satisfaction with telemedical access to specialty services in rural California. *J Telemed Telecare* 2002; **8** (suppl. 2): 7-10
- 5 Bradford WD, Kleit AN, Krousel-Wood MA, Re RM. Willingness to pay for telemedicine assessed by the double-bounded dichotomous choice method. *J Telemed Telecare* 2004; **10**: 325-30

Figure 1. Survey questions and answers

Questions about your appointment	Answers
1. Are you completing this survey on behalf of someone else?	Child/Other
2. How far did you have to travel for your appointment today?	Less than 10 km/10-50 km/50-100 km/Over 100 km
3. How long did you have to wait before you could see the doctor or audiologist?	1 week or less/1 week to 1 month/2-3 months/4-6 months/Over 6 months
4. How many hours did you set aside for this appointment? Include all time if you have travelled from the country.	1 h or less/1-2 h/3-4 h/Over 4 h
5. Did you have to take time off work today for your appointment?	Yes, half a day/ Yes, a full day/Yes, more than one day/No
6. Did you take someone along to your appointment?	No/Yes – it was not necessary, but for company/Yes – to help with the transport/Yes – I'm a parent or guardian
7. How did you travel to the appointment?	Car/Train and bus/Walked/Other
8. What is the nature of your appointment? Tick all that apply.	First visit to specialist/Visit to specialist shortly before surgery/Visit to specialist soon after surgery/Visit to specialist at least 6 months after surgery/Hearing test – first visit/Fitting or adjustment of hearing aid/Fitting or adjustment of hearing implant
Questions about telemedicine	Answers
9. Before today, were you aware of the term 'telemedicine' or 'telehealth'?	Yes/No/Unsure
10. Would you be willing to have a telemedicine appointment? Tick all that apply.	If the travelling distances were reduced/If the time devoted to the appointment was reduced/If it meant less time off work/If the time to wait for the appointment was reduced/If you had to rely less on others for transport/If the cost of the appointment (excluding travel costs) were reduced/Not willing/

11. What is the most important advantage? Tick one only.	If the travelling distances were reduced/If the time devoted to the appointment was reduced/If it meant less time off work/If the time to wait for the appointment was reduced/If you had to rely less on others for transport/If the cost of the appointment (excluding travel costs) were reduced./Other
12. Why <u>wouldn't</u> you be willing to have a telemedicine appointment? Tick all that apply.	You are more comfortable with a face-to-face visit with the doctor or audiologist/You are concerned it will not be as good as a face-to-face visit/You have all the time that is needed/The travel to the clinic allows you to do other things as well/You are not sure about the confidentiality of telemedicine/No concerns
13. What is the most important disadvantage? Tick one only.	You prefer a face-to-face visit with the doctor or audiologist/You have all the time that is needed/The travel to the clinic allows you to do other things as well/You are not sure about the confidentiality of telemedicine/No concerns
14. On balance, would you be willing to have a telemedicine appointment for an ear and hearing related appointment?	Yes/Sometimes/No/Unsure
15. Would you consider telemedicine for other types of medical or allied health appointments?	No/Yes/Unsure
Questions about yourself	Answers
16. Have you used the Internet for health related reasons? Tick all that apply.	Yes – to find out more information about my ear or hearing condition/Yes – to find out more information about other health related matters/Yes – to find a specialist or audiologist/Yes – to arrange an appointment/No
17. Your gender is:	Male/Female
18. Your age is:	<5 years/5 to 15 years/16 to 25 years/26 to 35 years/36 to 45 years/46 to 55 years/56 to 65 years/66 to 75 years/over 75 years
19. The postcode of your home address is:	
20. Further comments:	

Figure 2. Suggested motives (left bars) and the most important motivations (right) that participants recognised.

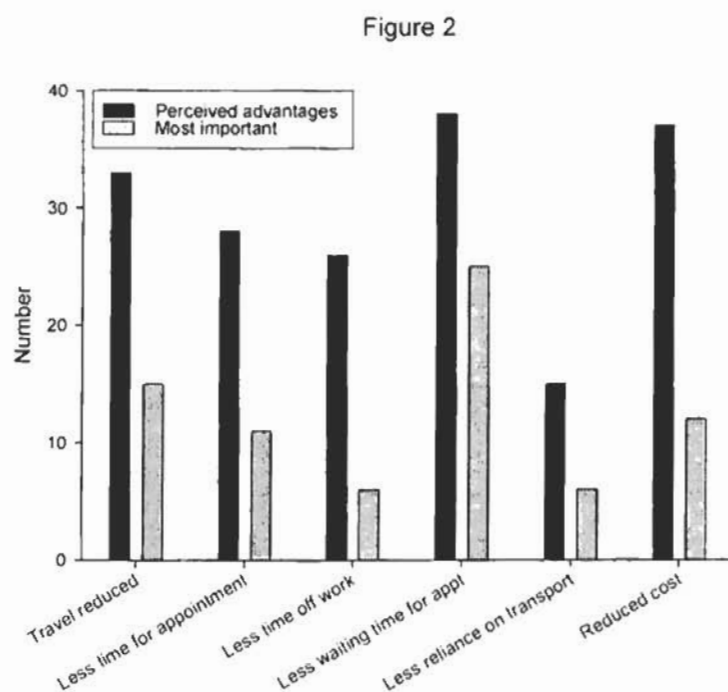


Figure 3. Barriers to telemedicine (left bars) and the most important barriers (right) that participants recognised.

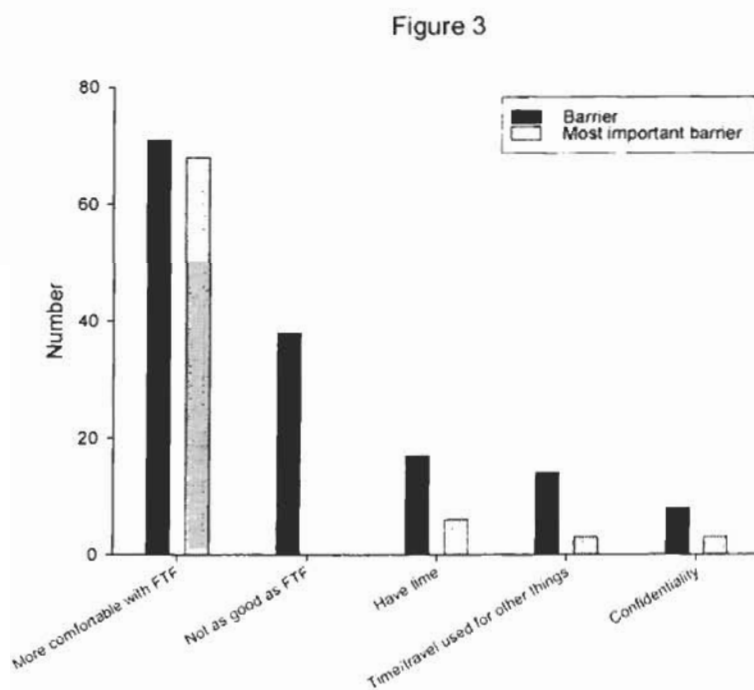


Figure 4. Willingness to use telemedicine for each age group.

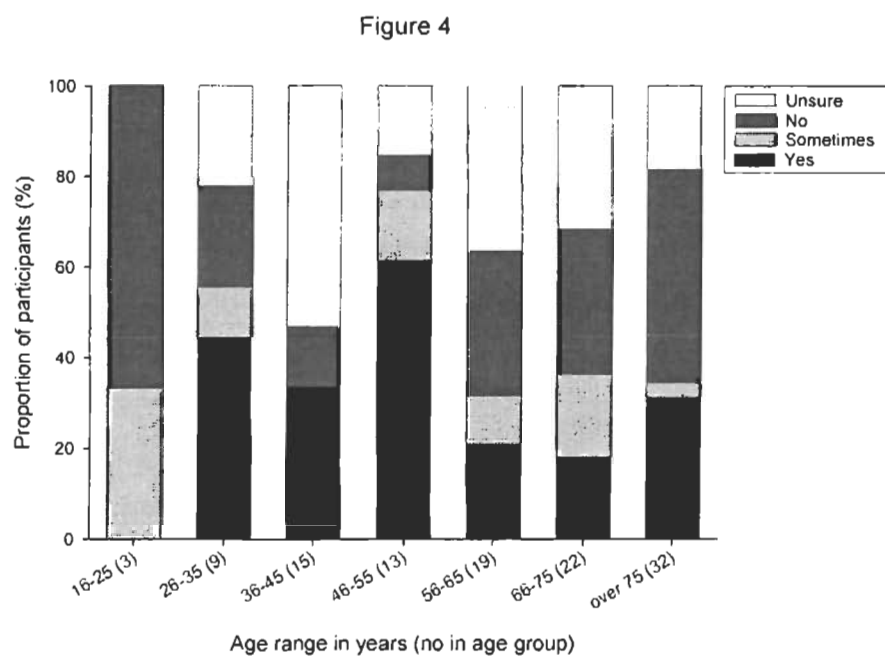


Table 1. Significant ($P<0.05$) relationships between results of the survey.

Row variable	Column variable	Comment
Willing to use telemedicine	Awareness of telemedicine	
	Use of internet for health related matters	
	Willing: travelling distance is reduced	
	Willing: time devoted to appointment is reduced	
	Willing: less time off work	
	Willing: time to wait for appointment is reduced	
	Willing: less reliance on transport	
	Willing: less cost	
	Not willing: more comfortable with face-to-face	i.e. inverse relationship
	Not willing: not as good as face-to-face	i.e. inverse relationship
Willing to use telemedicine and gender	Age	Females >55 y age group
	Awareness of telemedicine	Males only
	Use of internet for health related matters	Males only
	Willing: travelling distance is reduced	Males only
	Willing: time devoted to appointment is reduced	Females and males
	Willing: less time off work	Females and males
	Willing: time to wait for appointment is reduced	Females and males
	Willing: less reliance on transport	Males only
	Willing: less cost	Females only
	Not willing: more comfortable with face-to-face	Males only
	Not willing: not as good as face-to-face	Females and males
Willing to use telemedicine and age	Travel distance	16-55 y age group travelling 10-50 km
	Time devoted to appointment	16-55 y age group
	Willing: travelling distance is reduced	>55 y age group
	Willing: time devoted to appointment is reduced	>55 y age group
	Willing: less time off work	>55 y age group
	Willing: time to wait for appointment is reduced	>55 y age group
	Willing: less cost	>55 y age group
	Not willing: more comfortable with face-to-face	>55 y age group
	Not willing: not as good as face-to-face	16-55 y age group
	Gender	>55 y age group

The clinical champion role in the development of a successful telehealth wound care project for remote Australia

Isabelle Ellis

Combined Universities Centre for Rural Health, University of Western Australia,
Australia

Correspondence:

Isabelle Ellis
167 Fitzgerald Street
Geraldton
WA 6530
AUSTRALIA
(Fax: +61 8 9964 2096: Email: iellis@cucrh.uwa.edu.au)

Summary

The role of a clinical champion in a wound care project was examined in terms of an emancipatory processes framework. During the project the role changed significantly, as the needs of the project changed. In the early phase of the project the clinical champion's role was that of team leader. During the middle phase of the project the clinical champion's role changed to health services advocate and coach. During the final phase of the project the clinical champion's role changed again to that of salesperson and academic. Experience with the clinical issue being addressed by the new service, and clear motivation to complete the project, thereby seeing the new service established allowed the clinical champion to motivate the team to overcome the difficulties in the change process.

Introduction

The Kimberley region of the Western Australian Department of Health was successful in gaining funding to introduce telehealth services in 2001. One such service was based on the Alfred/Medseed Wound Imaging System (AMWIS). In order to establish the new telehealth services in the Kimberley a telehealth coordinator was employed, i.e. a clinical champion.

It has been widely reported that local clinical champions are essential for the success of any diffusion of innovation. However there is little published data on what the role of clinical champion entails and how that role affects the implementation of an innovation. The role of the clinical champion in the wound care project was examined in terms of an emancipatory processes framework.[1]

Emancipatory processes are derived from the research methods of emancipatory action research. Emancipatory processes can be used to guide the researcher in their role development ensuring that the research process is one of empowerment

for the participants. These processes assist the researcher to define the scope of their participation and provide a framework for reflection. The Royal College of Nursing, in their practice development information outlined seven emancipatory processes:

- 1 using self-reflection and fostering self-reflection in others
- 2 development of critical intent of individuals and groups
- 3 developing moral intent
- 4 working with values, beliefs and assumptions
- 5 focusing on the impact of the context of practice
- 6 seeing the possibilities
- 7 fostering widening participation and collaboration of all involved.[1]

In action research the researcher can take on a variety of roles depending on the methodology used. There are different applications under the umbrella of participatory research – action research, rapid rural appraisal, participatory rural appraisal, participatory action research, appreciative inquiry and grounded action. All of these methodologies use approaches in the research process that focus on sharing knowledge and power in the researcher/participant nexus.[2-5]

It has been suggested by Simmons and Gregory [3] that many of the attempts to solve organisational problems fall short because they are not systematically derived from the data nor sophisticated enough to address the multidimensional complexities inherent in the problems.

Methods

The study explored the barriers to telehealth using grounded action methodology. Grounded action was designed specifically for the purpose of investigating and addressing the complexity of organisational, and social problems and issues.[3] As with all action research projects there is a cyclical process of plan, act, observe, reflect.[6] The reflection at the end of each cycle feeds into the planning for the next cycle.[7] In grounded action the cycle consists of generating the explanatory theory; generating the operational theory; implementing the action; transformative learning; and evaluation.[3]

A variety of data sources were used. A purposive volunteer sample of participants agreed to be interviewed several times during the study. Twelve interviews were conducted between February and November 2003. In addition data were collected about the treatment plans and feedback to treating nurses from specialist wound care nurses for eight patients during the study period. Email messages were collected between the team members between August 2002 and November 2003. A total of 77 were analysed. Meeting minutes, correspondence about the project and video-recordings of videoconference meetings were analysed. Other data included field notes and memos kept by the researcher during the project and various reports about the project.

Results

Clinicians, policy makers, managers, IT and support staff and researchers have different values, beliefs and assumptions around complex practice development. The local clinical champion needs to create a bridge across the competing values and motivations before success can be anticipated. The common value discovered for all participants was a desire to provide equitable access to health care and services to people in medically underserved rural and remote areas.

Reflective practice

The clinical champion facilitated the reflection that occurred simultaneously with the implementation. Reflection at the end of each action cycle enabled the team to modify the operational theory to meet the projects ongoing needs.

Group critical intent

Group critical intent enabled planning of strategic action that leads to a shared vision and sense of community. The clinical champion's role in this was that of team leader in the early phase of the project. At this stage the action problem was suspended and the clinical champion developed a collaborative project with the region's Directors of Nursing. This quality assurance project examined the current wound care practices in the outpatient departments of the Kimberley region hospitals.

Once the extent of the help required was determined the clinical champion's role changed from team leader to advocate, enlisting the support of the software developer and the staff of the Kimberley region. A funding proposal was then prepared for the Department of Health.

During the middle phase of the project the clinical champion's role changed again, this time to health services advocate and coach. The clinical champion organised various meetings. Face to face interviews were conducted with clinicians, IT and support staff, and the research team. Performance goals were set with the Kimberley region team and communication goals were set with the research team. Teams were followed to ensure that goals were being met and when problems were encountered strategies were put into place to assist, or meetings were arranged and goals were modified to ensure that the project could continue.

During the final phase of the project the clinical champion's role changed to that of salesperson and academic. During this phase the clinical research data were gathered and analysed and communicated to the key stakeholder groups in the Kimberley and more widely.

Developing moral intent

Developing moral intent emphasises the development of practice along moral lines where practitioners examine critically their actions to ensure that they are not promising things that cannot be delivered, and planning things that have no chance of being funded.[1] Having a clear understanding of health service provision in the Kimberley region through previous clinical roles in the region enabled the clinical champion to understand the complex issues that impact on the quality and continuum of care, which would impact on the research project.

Working with values, beliefs and assumptions

Having a shared vision and clarifying the assumptions of the group prior to any action occurring is the first step in conflict minimisation within the group. The clinical champion's role in this area was to conduct the preliminary wound care quality assurance project with the wound care nurses working in the outpatient departments of each of the Kimberley region hospitals. A report for the Kimberley region senior managers enabled them to develop a shared understanding of the situation into which the telehealth application was to be used.

Context of the practice situation

Recommendations about the context of the practice situation include focusing on factors such as leadership, organisational responsiveness, power relationships and motivating factors for change when trying to implement a new procedure or practice.[1,8-10] The clinical champion provided insight to the research team about attempting to insert a telehealth system into a securely established health delivery system.

Using grounded action methodology the clinical champion discovered the core variable misplaced faith in the action scene. The problem occurred in the lack of understanding of the needs of patients with complex co-morbidities leading to lower limb ulcers by poorly prepared practitioners on the one hand; and the belief that patients were receiving an adequate standard of care by people whose role was to manage the health services. Four key themes emerged from the data, attributed expertise, power and professional dominance, communicating and management skills.

Providing information to the health service staff about the research requirements of ethics approvals before project commencement, informed consent, data management and security and research project timeframes was a role of the clinical champion.

Seeing the possibilities

Examining the problem often highlights why it has not been addressed before.[1] Maintaining the positive focus of improving wound care outcomes for people with chronic lower limb ulcers and avoiding amputation where possible was the motivation the clinical champion used to enthuse the teams to overcome the identified barriers.

Fostering widening participation

Fostering wider participation allows the involvement of the whole health team including the community, other agencies external to the community and funding bodies.[1] Presenting the project methodology and the findings at different forums during the project enlisted a wider interest. This interest led to wider participation, since people then enlisted the help of others.

Discussion

During the project the role of the clinical champion metamorphosed from marketer and salesperson to health services advocate and coach. Performance goals were set with the Kimberley region team and communication goals were set with the research team. Teams were followed up with varying frequency to ensure that goals were being met. When problems arose strategies were negotiated to ensure that the project could continue. During the final phase of the project the role of the local clinical champion changed to salesperson, academic and patient advocate. During this phase the clinical research data were analysed and communicated to the key stakeholder groups in the Kimberley and to policy makers more widely. Effectiveness in wound healing was demonstrated by the project. More important, effectiveness in communicating the results ensured continuing investment and was the catalyst for policy change in a new service.

Acknowledgements

I thank Nick Santamaria, Keryln Carville, Kylie Woods and the staff of the Kimberley region of Western Australian Country Health Services. The Kimberley Telehealth Wound Care Project was funded by the Telehealth Development Unit of the Western Australian Department of Health.

References

- 1 Royal College of Nursing. *Emancipatory Processes*. See <http://www.rcn.org.uk/resources/practicedevelopment/about-pd/processes/emancipatory/>. Last checked 17 July 2005
- 2 Cornwall A, Jewkes R. What is participatory research. *Soc Sci Med* 1995; **41**: 1667-76
- 3 Simmons OE, Gregory TA. Grounded action: achieving optimal and sustainable change. *Forum: Qualitative Social Research* 2003; **4**: See: <http://www.qualitative-research.net/fqs-texte/3-03/3-03simmonsgregory-e.pdf>. Last checked 17 July 2005
- 4 Hughes I. *Action Research Electronic Reader*. See <http://www.scu.edu.au/schools/gcm/ar/arr/arow/rintro.html>. Last checked 17 July 2005
- 5 Hecker R. Participatory action research as a strategy for empowering aboriginal health workers. *Aust N Z J Public Health* 1997; **21**: 784-8
- 6 Kemmis S, McTaggart R. *The Action Research Planner*. 3rd edn. Warrn Ponds, Australia: Deakin University, 1988.
- 7 Dick B. *Sources of rigour in action research: addressing the issues of trustworthiness and credibility*. In: *Association for Qualitative Research Conference Proceedings "Issues of Rigour in Qualitative Research"*, 1999. Melbourne Australia
- 8 McCormack B, Kitson A, Harvey G, Rycroft-Malone J, Titchen A, Seers K. Getting evidence into practice: the meaning of context. *J Adv Nurs* 2002; **38**: 94-104
- 9 Kitson A. Recognising relationships: reflections on evidence-based practice. *Nurs Inq* 2002; **9**: 179-86
- 10 Ellis I, Howard P, Larson A, Robertson J. From workshop to work practice: an exploration of context and facilitation in the development of evidence-based practice. *Worldviews on Evidence-Based Nursing* 2005; **2**: 84-93

Challenges for implementing wireless handheld technology in healthcare: views from selected Queensland nurses

Raj Gururajan¹ and Clint Moloney²

1 Department of Information Systems, University of Southern Queensland, Australia

2 Research Manager, Toowoomba Health Service District, Queensland, Australia

Correspondence:

Raj Gururajan
Department of Information Systems
University of Southern Queensland
QLD 4350
AUSTRALIA
(Fax: +61 7 4631 5594; Email: gururaja@usq.edu.au)

Summary

Many healthcare providers in Australia are exploring the use of wireless technology to improve service delivery. It appears that the solutions so far have been dictated by the hardware vendors and that the business case is yet to drive the implementations. A focus group discussion was facilitated with eight senior management staff involved in healthcare in Western Australia. This resulted in a set of challenges which were used to invite opinions from nursing staff in Queensland. A total of 31 interviews were conducted. The analysis returned a set of 63 themes, which were grouped. These groupings reflected the challenges as lack of user friendly applications, unreliable technology, substandard testing, short staff, concerns for security, reliance on technology, existing problems, work schedule, training, outdated health policy, coverage of wireless, confidentiality and lack of awareness. The interviews clearly indicated the need for training and awareness procedures. The present study provides some of the information necessary to realise an enterprise-wide implementation of wireless technology.

Introduction

Wireless technology has begun to be used in healthcare applications, mainly to solve local problems, where ad hoc solutions are provided at department or unit levels. Common to most of these wireless developments is the enthusiasm exhibited by hospital IT people, push for innovative solutions to solve existing problems, the complications of establishing wired networks due to cost, drive by the executive officer to trial innovative solutions (usually read in a magazine while travelling) and to test 'proof of concept'. However, in many cases, it also appears that there is a lack of an integrated approach to implementation since users such as nurses are often not consulted. To our knowledge, there has been no proper study

to verify the claims made in the literature about the challenges of implementing wireless solutions in healthcare.

Previous studies in the area of telemedicine clearly demonstrate that technology alone will not solve the problems encountered in healthcare.[1,2] The management's attitude in assuming that hospital users are computer literate has been cited as a major reason of failure. It should be noted that in many studies of information systems, training was identified as one of the main factors in success. Despite this, it appears that current implementations in wireless technology have ignored the aspect of training.

Previous studies in health have also identified security as the most significant factor in the successful implementation of wireless technology. In a study conducted with Western Australian (WA) health executives involved in policy making, it was found that there were 15 factors that inhibit the successful adoption of wireless technology in their healthcare environment.[3]. The present study was designed to obtain opinions from nursing staff in a specific health district about challenges to implementing wireless technology in their work place.

Methods

As a pilot study, a focus group discussion was facilitated with eight senior management staff involved in healthcare in WA in February 2005. These participants came from both public and private hospitals, as well as academia. They were chosen based on their experience, role, leadership and knowledge of wireless technology as applicable to their healthcare setting. The aim of the exercise was to rank the challenges and to establish the variability of the responses. This resulted in a set of challenges – security concerns, availability of suitable handheld devices, existing software limitations, cost, user demand (some do not want it; some have not accepted it), unrealistic user perception and expectations, management of handheld devices, legal issues, potential for problems with electronic records, clinical issues, environment of change, standards, consumer issues, technology is arriving at an advancing rate and data storage issues. These initial set of challenges were used to invite opinions from nursing staff in Queensland through a set of interviews.

The main study used interviews to collect data in order to understand users' feelings. Ethics approval was obtained from the appropriate committees. User opinions were obtained prior to any implementation studies. Participants for the interview were selected from the nursing staff. Only nurses working with technology were eligible for participation: any nursing staffs involved with administration only were ineligible for interview. The nurses were chosen from a wide range of backgrounds, including pharmacy, oncology and emergency medicine. A total of 31 interviews were conducted. The interviews were scheduled in such a way that nurses' work schedules were disrupted as little as possible. Each interview lasted for about 45 min. The interviews were recorded and the interview schedule, participant names, location, start time and end time were documented. The interviews were then transcribed for data analysis using software for qualitative data analysis (NVivo , QSR International Pty Ltd).

Results

The analysis returned a set of 63 themes (nodes in NVivo). These were grouped, based on similarity of interview dialogue. These groupings reflected the challenges as lack of user friendly applications, unreliable technology, substandard testing, short staff, concerns for security, reliance on technology, existing problems, work schedule, training, outdated health policy, coverage of wireless, confidentiality and lack of awareness.

Discussion

The results of the interviews gave useful insights into the challenges as seen by the users in implementing wireless technology in healthcare. The terms "user friendly" and "user friendliness" are particularly significant, because the first term is expressed in terms of users using a new system and the second term is expressed in terms of management issues associated with implementing the system. The subtle difference also indicates the adoption of a new technology as seen by its users and by the managers.

There were similarities between the outcomes of the interview data were and the results of the WA executives. For example, security was a challenge in the view of both groups. While WA participants expressed concerns about security, Queensland nurses expressed concerns about security as well as confidentiality of data. WA executives were concerned about software limitations, but nurses were concerned about testing, reliability and awareness. The clinical issues were mentioned by both groups. While executives were concerned with legal issues, environmental changes and unrealistic user perceptions, nurses identified staff shortages (to handle new technology), the unreliability of the technology as well as system, existing health policies and their orientation towards wireless technology as issues.

The focus group and the interviews, conducted with two different sample groups in two different health domains, using two different qualitative techniques identified similar challenges in implementing wireless technology in healthcare. While the focus group yielded 15 barriers, the interviews resulted in similar numbers with freely expressed opinions. The interviews clearly indicated the need for training and awareness procedures. The present study provides some of the information necessary to realise an enterprise-wide implementation of wireless technology.

References

- 1 Anogeianaki A, Ilonidis G, Anogianakis G, *et al.* A training network for introducing telemedicine, telecare and hospital informatics in the Adriatic-Danube-Black Sea region. *J Telemed Telecare* 2004; **10** (suppl. 1): 1-3
- 2 Bensink M, Armfield N, Russell TG, Irving H, Wootton R. Paediatric palliative home care with Internet-based video-phones: lessons learnt. *J Telemed Telecare* 2004; **10** (suppl. 1): 10-3
- 3 Gururajan R, Quaddus M, Fink D, Vuori T, Soar J. *Drivers and barriers to adoption of wireless handheld system in WA healthcare: Selected views.* HIC 2005. Melbourne: HISA, 2005

Achievements and challenges on policies for allied health professionals who use telehealth in the Canadian Arctic

D Hailey¹, V Foerster², B Nakagawa³, TM Wapshall⁴, JA Murtagh⁵, J Smitten⁶, JA Steblecki⁷ and G Wong⁸

1 Health Telematics Unit, University of Calgary, Canada

2 Oxford Station, Ontario, Canada

3 Fraser Health Authority, British Columbia, Canada

4 Brockville Psychiatric Hospital, Ontario, Canada

5 Victoria, British Columbia, Canada

6 Grant MacEwan College, Edmonton, Canada

7 Health Law Institute, University of Alberta, Edmonton, Canada

8 Virtual Healthcare Solutions Inc., Iqaluit, Nunavut, Canada

Correspondence:

Dr David Hailey

22 Sinclair Street

Kambah

ACT 2902

AUSTRALIA

(Fax: +61 2 6231 1090; Email: dhailey@ozemail.com.au)

Summary

We formulated policies and procedures for allied health professionals (AHPs) who provide services using telehealth in Nunavut, Canada's newest Arctic territory. These are a supplement to the clinical policies and procedures already established for Nunavut physicians and nurses. The services were in the areas of audiology, dietetics/nutrition, midwifery, occupational therapy, ophthalmic services, pharmacy, physiotherapy, psychology, respiratory therapy, social work and speech therapy. Documents specific to each of the services were developed, drawing on information from Government of Nunavut data, Nunavut healthcare providers and links made through the Internet. Topics covered included the scope and limitations of telehealth services, staff responsibilities, training and reporting, professional standards and cultural considerations. We also considered generic policies covering common issues such as jurisdiction, licensure and liability. The policies and procedures for AHPs will enhance and expand the successes already achieved with telehealth in Nunavut. The challenges are to balance the preferred approaches to service provision with the realities of health care and communications in an Arctic setting.

Introduction

The Arctic Canadian territory of Nunavut has a population of only 30,000 in a geographically vast area, with connections being primarily by air. Telehealth is a key factor in health service delivery in the territory's 25 small remote communities. Physicians and other health professionals who provide telehealth consultation services are frequently located outside the territory in the "south," so local providers, including allied health professionals (AHPs) require a framework to define their roles, responsibilities, and supporting infrastructure.

On behalf of the Government of Nunavut, we formulated policies and procedures applicable to AHPs who use telehealth, in order to complement an earlier clinical manual developed for physicians and nurses.[1] Health service areas involving AHPs include audiology, dietetics/nutrition, midwifery, occupational therapy, ophthalmic services, pharmacy, physiotherapy, psychology, respiratory therapy, social work and speech therapy.

Methods

For each of the 11 types of service, we obtained survey and utilization data from the Government of Nunavut. Information on the services and the role of AHPs were obtained from telehealth experts and service providers in Nunavut, relevant documentation from regulatory bodies and professional associations (both national and provincial), and the Internet. We were guided on relevant generic issues by the previously developed Nunavut clinical manual and by a well-accepted Canadian framework of telehealth guidelines.[2]

We prepared generic policies covering common issues, adopting many from the earlier clinical manual and revising others as needed. We also drafted policies and procedures specific to each service area, including scope and limitations of telehealth services, staff responsibilities, training and reporting, professional standards and cultural considerations.

Results

Material directly relevant to policies for AHPs in telehealth proved to be sparse, with much available literature relating to reimbursement and employment issues in other jurisdictions. However, helpful input was obtained from guidelines published by the Western Australian Department of Health including those on speech pathology services and dietetic services.[3,4]

Generic policies

Most of the generic policies pertaining to all the services under consideration were adopted directly from the earlier clinical manual but changes were required to those on jurisdiction, licensure, and liability.

For jurisdiction, the scope was modified to apply to all persons who might be regarded as being AHPs, rather than only employees of the Telehealth Network, and reference to physicians was removed.

The Policy on Licensure was a challenge as a number of allied health professions are not regulated in Nunavut, although licensure in another jurisdiction may be

required. The original clinical policy was modified to state that AHPs involved in telehealth must be licensed and in good standing with an appropriate licensing body, according to Government of Nunavut rules. An AHP must first seek licensure in the jurisdiction where the patient is located. In the absence of such a licensing body the AHP must obtain licensure in a jurisdiction as required by law. If these provisions cannot be met, the AHP must obtain licensure in any Canadian jurisdiction having a licensing body. AHPs are to advise their licensing body about the nature and frequency of telehealth sessions to be delivered, and obtain approval for such involvement. The amended policy further requires AHPs to comply with any terms as may have been imposed by the licensing body.

The Medical Liability policy was changed to include advice about the nature of informed consent and material related to physicians was removed. A clause on general medical negligence was modified to require AHPs to exercise the degree of care and skill which could reasonably be expected of a normal, prudent AHP of the same experience and standing. Also, the revised policy requires AHPs and/or their employers to maintain appropriate professional practice insurance.

Specific policies and procedures

In developing the specific policies for each of the service areas, attention was paid to the responsibilities of both the "clinical staff" (physicians and nurses) and the AHPs, including responsibility for a telehealth session. Telehealth consultations will be conducted by health professionals (consultants) who meet licensure or other qualifications and requirements determined by the Government of Nunavut. Due to small numbers of healthcare providers in Nunavut, individuals working within centres that accommodate telehealth technology may take on roles and responsibilities in provision of telehealth services that they do not normally assume. Such additional duties must be deemed to be in the client's best interest and agreed to by all parties involved, including the client.

This leaves the way open for additional involvement of AHPs, but such decisions must take into account the responsibilities for their training in telehealth. In formulating the specific policies we wished to emphasize the need for AHPs to have appropriate training and support, particularly for individuals providing services in the most remote communities. It is the responsibility of the consultant, in association with the telehealth manager, to ensure that AHPs are adequately trained for telehealth duties. Also, AHPs, the consultant and the Regional Telehealth Coordinator have joint responsibility to ensure that AHPs are fully aware of their reporting obligations and of appropriate sources of advice.

Each service-specific policy includes a summary of the roles and responsibilities of the individuals who may be involved in a telehealth consultation, including the clerk, site technician, community nurse, community physician and consultant, as well as the AHP. Separate summary sections cover the responsibilities of individuals such as managers who are not immediately involved in the telehealth consultation.

The policies also state that relevant codes of ethics and professional standards applicable to the health service must not be altered by the use of videoconference applications, and that the consultant must be aware of cultural considerations when providing a videoconference service to clients from a different cultural

background (85% of the Nunavut population is Inuit and 50% speak their native language, Inuktitut, rather than English or French).

Information on telehealth service-specific procedures includes responsibilities for all those involved in providing the telehealth service before, during, and after the consultation, and advice on telehealth etiquette. In addition, details are included on supplies and technology that should be made available in the rooms designated for telehealth consultations and in the health centres.

Valuable feedback on draft policy and procedures documents was obtained from AHPs and consultants involved in the Nunavut telehealth program. Reaction was supportive and helpful – Nunavut AHPs were generally thrilled to be consulted and involved. Misleading wording was identified, as were statements that did not match local practice patterns. For example, a recommendation that face-to-face speech pathology services be provided within three months of the onset of exclusive videoconference service provision was not seen as realistic as some communities were visited only twice per year.

Discussion

This work is a step towards providing a structure in support of AHPs who work with telehealth in Nunavut. Reference to the policies and procedures will help develop the success already achieved with telehealth in the territory, where an extensive network is now in place. The documents that have been prepared complement policies and procedures already formulated for medical practitioners and nurses.

The challenges are to balance preferred approaches to service provision with the realities of health care and communications in an Arctic setting. AHPs must carry major responsibilities and, therefore, they require appropriate support and definition of duties, as reflected in the policies.

It is hoped that the policies and procedures will provide a helpful framework for AHPs and others involved with telehealth in Nunavut. They will need to be reviewed and updated in the light of further experience in the provision of telehealth services. Also, it seems likely that more specific direction on some legal and professional issues will require further consideration.

Acknowledgements

We are grateful to Joyce Taguchi, Carlos Gonzalez and Henry Marks (Virtual Healthcare Solutions Inc., Iqaluit), and to Angela Butt (Government of Nunavut) for their support of the project.

References

- 1 Digital Healthcare Solutions. *Recommendations for Telehealth Policies and Procedures. Presented to: The Department of Health and Social Services, Government of Nunavut.* Iqaluit: July 2003
- 2 National Initiative for Telehealth Guidelines. *National Initiative for Telehealth (NIFTE) Framework of Guidelines.* Ottawa: NIFTE, 2003. <http://cst->

sct.org/resources/FrameworkofGuidelines2003eng.pdf. Last checked 16 June 2005

- 3 Department of Health, Western Australian Government. *Guidelines for Speech Pathology Videoconference Service Delivery in Rural and Remote Settings*. 2004.
<http://www.country.health.wa.gov.au/projects/tahbs/docs/Speech%20Pathology%20VC%20Guidelines.pdf>. Last checked 31 May 2005
- 4 Department of Health, Government of Western Australia. *Guidelines for Dietetic Videoconference Service Delivery in Rural and Remote Settings*. February 2004.
<http://www.country.health.wa.gov.au/projects/tahbs/docs/Dietetic%20VC%20Guidelines.pdf>. Last checked 16 June 2005

Lifeshirt system for wireless patient monitoring in the operating room

Nina Halín¹, Mika Junnila², Pekka Loula¹ and Pertti Aarnio²

1 Tampere University of Technology, Pori, Finland

2 Satakunta Central Hospital, Pori, Finland

Correspondence:

Nina Halín

PO Box 300

FIN-28101 Pori

FINLAND

(Fax: +358 2 627 2727; Email: nina.halin@tut.fi)

Summary

We examined the functionality and reliability of a wearable physiological monitoring system (LifeShirt) during normal daily activities and in a hospital Operating Room environment. The garment collects information such as ECG and oxygen saturation, stores it in a recorder from which it can be read afterwards. Ten normal subjects wore the shirt continuously for eight hours per day. Feedback from the testers was quite positive, although the collected data varied in quality. Ten hospital patients also wore the shirt during endoscopy. The data collected during the hospital stay was qualitatively adequate. Measuring respiratory function caused the biggest problems. The study showed that intelligent garment technology could be used in an OR environment for patient monitoring, albeit not in real time. It may also be useful in home follow-up.

Introduction

The techniques that may be used in operating rooms (OR) in future include wireless information systems,[1] speech guidance services, different kinds of video streams, wearable technology [2-6], electronic patient record systems [7] and virtual reality[8]. Feasibility studies show that the OR environment benefits from the use of modern information and wearable technology [1-10]. It has also been shown that technology can improve the quality of operations and the follow up of patients in the recovery ward or at home. Some of these techniques require expensive investment although some only involve rearrangement of existing activities. We have examined wireless wearable monitoring systems with a view to making recommendations about their use.

LifeShirt

At the time of the study, almost all current applications were limited to the recording of a single variable, e.g. blood pressure. The monitoring of multiple physiological functions is complicated and requires special measurement devices. The LifeShirt (Vivometrics, Inc., Ventura, CA, USA) is a multi-function, ambulatory device capable of monitoring several physiological signals.[11] The system consists of three parts: a garment which contains various sensors, a data recorder and PC-based analysis software (Figure 1). Sensors are woven into the vest around patient's chest and abdomen. A two-axis accelerometer records patient posture and activity level. The LifeShirt vest weighs 200 g.

Data are collected from respiratory bands which measure pulmonary function (e.g. tidal volume and respiratory rate) as well as the electrical activity of the heart (ECG). A data recorder continuously encrypts and stores the patient's physiological data on a compact flash memory card. Finally, PC-based software (Vivologic) decrypts and processes the recorded data, and provides viewing and reporting features for clinicians after the monitoring has finished (Figure 2). Summary reports that present processed data in graphical and numerical formats can also be generated.[12]

The LifeShirt system is designed for ambulatory applications rather than the OR environment and the system is able to measure many variables that are not needed during OR procedures. We focused on the variables that are important in pre- and postoperative monitoring.

Methods

First we tested the LifeShirt outside the hospital with ten subjects, five women and five men. They all wore the LifeShirt continuously for eight hours per day. This eight hour period was planned so that the testers were both at work and at home. All the testers were healthy working-age people, without disease. The sensors stayed in place for eight hours on all the testers. We also analyzed the collected data.

We also tested the LifeShirt system in the OR. We had ten endoscopic patients, so called daycare-unit patients. Seven of the operations were performed under spinal anaesthesia and the remaining three under general anaesthesia. The patients gave informed consent before participating. The main goal was to test the suitability of the new technology in an OR environment. Using the LifeShirt, we monitored ECG and oxygen saturation.

Results

Feedback from the testers was quite positive. None of them found LifeShirt uncomfortable to wear. Also the sensors proved to stay at place at least eight hours on all the testers. In the OR group the nursing staff had a positive attitude towards the testing and they observed that the LifeShirt garment did not disturb their work.

In the group that tested LifeShirt outside the hospital the collected data varied in quality. The ECG was of satisfactory quality but we noticed that measuring the ECG was sensitive to motion disturbances, which caused changes in the baseline

and other artefacts. This created difficulties in analyzing the ECG. There was less disturbance in the ECG in the OR group because the patients moved less. The ECG was of satisfactory quality and the accuracy for monitoring day-case procedures was satisfactory. There were no substantial differences in the ECG whether it was recorded by the anaesthesia monitor or read from the LifeShirt recorder afterwards.

In several patients the oxygen saturation was not recorded for unknown reasons. This was a major weakness of the LifeShirt system. The system warns when a sensor comes off but does not warn when data are not stored. Also it cannot be confirmed from the recorder that data are being stored during the session.

Measuring respiratory function caused the biggest problems. We found that the LifeShirt system was not accurate when the vest did not fit properly. However in the OR group the data for respiratory function was more reliable.

Discussion

In our study the LifeShirt system proved to be functional when everything worked well. The system also revealed a number of weaknesses. Foremost they appeared as failures in data recording. The LifeShirt system proved that intelligent garment technology could be used in an OR environment for patient monitoring, albeit not in real time. A development of the technology would enable high-risk patient monitoring during a hospital stay without having to connect the patient to monitors. The vest could be put on the patient on arrival and taken off on departure. However, the LifeShirt would not be suitable for operations on the chest and abdomen.

Intelligent garment technology could also be used in home follow-up. Patients who have undergone day case surgery are discharged the same day when they are still recovering from the operation. Intelligent garment would improve the safety of early discharge. The patient should also be able to call for help when needed. This would require suitable service systems that do not exist yet. However, research in this area is in progress.[13,14]

Developing intelligent garment technology might reduce health care costs and improve the quality of treatment.[15] That is why more research on intelligent garment technology is required. The economics of such technology will only become clear after commercial solutions and service systems are available.

Acknowledgements

LifeShirt is a registered trademark

References

- 1 Viapiano J, Ward DS. Operating room utilization: the need for data. *Int Anesthesiol Clin* 2000; **38**: 127-40
- 2 Geldner G, Eberhart LH, Trunk S, *et al.* Efficient OP management. Suggestions of optimisation of organisation and administration as basis for establishing statutes for operating theatres. *Anaesthesist* 2002; **51**: 760-7

- 3 Hagihira S, Takashina M, Mori T, Taenaka N, Mashimo T, Yoshiya I. Infrared transmission of electronic information via LAN in the operating room. *J Clin Monit Comput* 2000; **16**: 171-5
- 4 Doyle TE, Kucеровsky Z, Greason WD. The digital hearing aid, wearable computing, and electrophysiological response. *Biomed Sci Instrum* 2002; **38**: 129-34
- 5 Ouchi K, Suzuki T, Doi M. LifeMinder: a wearable healthcare support system using user's context. *Proceedings of the 22nd International Conference on Distributed Computing Systems Workshops (ICDCSW'02)* 2002: 791-2. See <http://www.informatik.uni-trier.de/~ley/db/conf/icdcs/icdcs2002.html>. Last checked 21 June 2005
- 6 Thomas M, Jovanov E, Raskovic D. Issues in wearable computing for medical monitoring applications: a case study of a wearable ECG monitoring device. *Wearable Computers, The Fourth Symposium* 2000; 43-9
- 7 Jovanov E, O'Donnel A, Morgan A, Priddy B, Hormigo R. Prolonged telemetric monitoring of heart rate variability using wireless intelligent sensors and a mobile gateway. *Proceedings of the Second Joint EMBS/BMES Conference* 2002: 1875-6
- 8 Lukowicz P, Anliker U, Ward JA, Tröster G, Hirt E, Neufelt C. AMON: a wearable medical computer for high risk patients. *Proceedings of the 6th Symposium on Wearable Computers (ISWC'02)* 2002: 133-4. <http://www.informatik.uni-trier.de/~ley/db/conf/iswc/iswc2002.html>. Last checked 21 June 2005
- 9 Anderson JG. Security of the distributed electronic patient record: a case-based approach to identifying policy issues. *Int J Med Inform* 2000; **60**: 111-8
- 10 Riva G, Gamberini L. Virtual reality in telemedicine. *Telemed J E Health* 2000; **6**: 327-40
- 11 Grossman P. The Lifeshirt: a multi-function ambulatory system that monitors health, disease, and medical intervention in the real world. *Stud Health Technol Inform* 2004; **108**: 133-41
- 12 Cardenas AF, Pon RK, Cameron RB. Management of streaming body sensor data for medical information systems. *Proceedings of METMBS* 2003: 186-91
- 13 Kyriacou E, Pavlopoulos S, Berler A, *et al*. Multipurpose healthcare telemedicine systems with mobile communication link support. *BioMedical Engineering OnLine* 2003 ;**2**: 7
- 14 Anagnostaki AP, Pavlopoulos S, Kyriakou E, Koutsouris D. A novel codification scheme based on the "VITAL" and "DICOM" standards for telemedicine applications. *IEEE Trans Biomed Eng* 2002; **49**: 1399-411
- 15 Lind L, Sundvall E, Ahlfeldt H. Experiences from development of home health care applications based on emerging Java technology. *Medinfo* 2001; **10**: 830-4

Figure 1. LifeShirt system

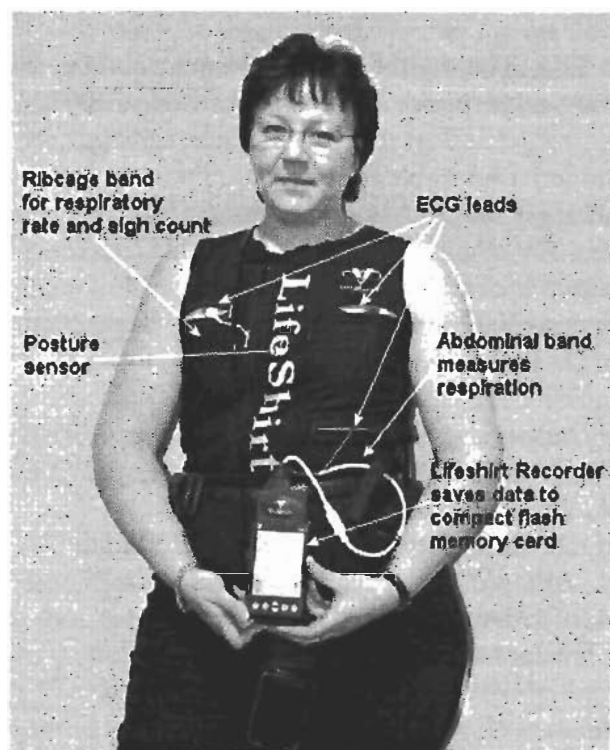
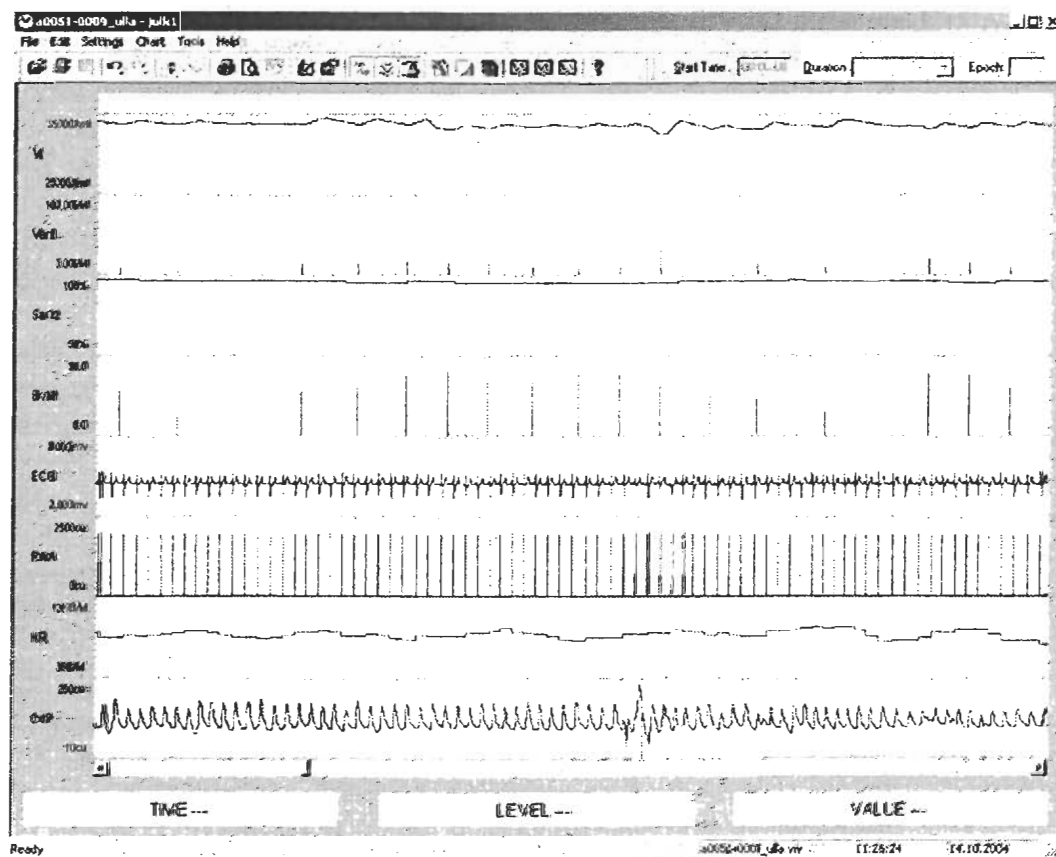


Figure 2. Recordings from the system



Telemedicine by email in remote Cambodia

Paul J Heinzelmann¹, Gary Jacques² and Joseph C Kvedar¹

1 Partners Telemedicine, Boston, USA

2 Sihanouk Hospital Center of Hope, Phnom Penh, Cambodia

Correspondence:

Dr Paul Heinzelmann
Partners Telemedicine
Two Longfellow Place, Suite 216
Boston
MA 02114
USA
(Fax: +1 617 228 4601; Email: pheinzelmann@partners.org)

Summary

An email-based telemedicine service was implemented in two remote village communities in Cambodia. Volunteer physicians at the Brigham and Women's Hospital, Massachusetts General Hospital and the Sihanouk Hospital Center of Hope in Phnom Penh, provide monthly consultations to the local clinicians. Between February 2001 and May 2005 there were 469 teleconsultations. The 214 telemedicine cases managed in the first 28 months were reviewed. The mean duration of the chief complaint at the initial patient visit was 37 months for the first six months and had dropped to 8 months by the end of the study period. Of 63 adult patients surveyed, all were either satisfied (54%, n=34) or very satisfied (46%, n=29) with their experience in the telemedicine clinic. 78% (n=49) were willing to pay, on average, US\$0.63 for their visits. The introduction of basic point-of-care laboratory testing in November 2004 was associated with a reduction in patients requiring off-site referral for completion of laboratory testing (69% before to 35% afterwards, $P<0.001$). The success of the pilot telemedicine program confirms the value of email support for non-physician health care workers in the developing world.

Introduction

Cambodia ranks among the lowest countries in the world in terms of human development and poverty. There are great disparities in access to health care services, particularly for those in rural areas where approximately 40% of the population exists below the poverty line.[1] Information and communication technologies (ICTs) such as email, offer great potential to improve health care delivery, but there are also unique challenges.[2,3]

Operation Village Health is a project that aims to improve health care delivery in remote regions of Cambodia. It is led by Partners Telemedicine in collaboration with two non-profit-making organizations, the Sihanouk Hospital Center of Hope and American Assistance for Cambodia. The project employs email for provider-to-provider consultations for two village communities in the provinces of Preah Vihear and Ratanakiri.

Telemedicine activities occur at both sites. The present paper concerns telemedicine at the health centre in the village of Th'naut Malou, in the Rovieng district of the Preah Vihear province, see Figure 1. The health centre serves approximately 4000 villagers in a region which has no mobile or conventional telephone infrastructure, running water or public transport. Electricity is supplied by solar panels and generators, albeit intermittently. Despite these limitations, Internet connectivity has been available for the past five years to a nearby school through donated satellite services (valued at \$285 per month) and provided by a Thai telecommunications company. It is through this infrastructure that Operation Village Health operates.

Once a month, a Cambodian nurse leaves the capital city of Phnom Penh with a driver for the 5-7 hour trip to the health centre in Rovieng. The nurse is equipped with a digital camera, stethoscope, otoscope and donated medications. Patients are triaged at the health centre and those deemed appropriate and who give consent, receive a teleconsultation. Patient assessments are documented and transcribed into English and are sent via email with relevant clinical images to volunteer consultants at the Sihanouk Hospital in Phnom Penh and at Partners Telemedicine in Boston. Cases are reviewed and recommendations are returned by email within 12 h to the Cambodian nurse.

The service began in February 2001.

Methods

Two reviews were conducted.

Clinical

The 214 telemedicine cases from February 2001 to June 2003 were reviewed. Intermediate outcomes were examined, including the number of patient transfers to off-site facilities and the average duration of chief complaint among newly presenting patients. In addition, a random sample of patients was retrospectively surveyed using a questionnaire examining patient satisfaction and willingness-to-pay.[4]

Operational

In November 2004, equipment for six diagnostic tests was made available for discretionary use by the local nurse, as well as directed use according to recommendations by physicians consulting via telemedicine. The tests were: haemoglobin, glucose, urine analysis, urine pregnancy, stool occult blood and group A streptococcus. The proportion of telemedicine cases that included laboratory testing, and the proportion of laboratory tests requiring completion offsite were examined retrospectively. Comparisons were made between the 57

telemedicine patient encounters occurring from November 2004 to March 2005 with the 119 telemedicine patient encounters occurring between October 2003 and October 2004, which served as unmatched historical control cases.

In addition, site visits were made by Partners Telemedicine staff in November 2003 and November 2004 to evaluate operations qualitatively. Interviews and passive observation were used to identify potential obstacles to efficiency and provider adoption. A convenience sample of participating Boston-based consulting physicians was also queried via email and telephone about perceived programme weaknesses.

Results

Clinical

A total of 469 teleconsultations was carried out from 15 February 2001 to 30 May 2005. The mean duration of the chief complaint at the initial patient visit was 37 months for the first six months of the study period. This dropped to 8 months by the end of the study period (Figure 2).[4] Similarly, the proportion of patients referred for care at other facilities decreased by 51% per year of clinic operation (95% confidence interval, 27-75%; $P<0.001$), Figure 3.

Of 63 adult patients surveyed, all were either satisfied (54%, $n=34$) or very satisfied (46%, $n=29$) with their experience in the telemedicine clinic. 78% ($n=49$) were willing to pay, on average, US\$0.63 for their visits.

Operational

Preliminary data from the patient encounters after testing was introduced showed that the overall proportion of encounters receiving laboratory testing had not increased (Fisher's exact test, $P=0.71$), Figure 4. Conversely, the proportion of all encounters that required off-site referral for completion of laboratory testing decreased significantly from an average of 69% to 35% ($P<0.001$).

The interviews, observations and informal inquiries identified several operational challenges as important for capacity building and sustainability. These included:

- increased emphasis on clinician education
- quality assurance of local patient assessments and consultant responses
- improved efficiency of documentation and transcription of patient encounters
- improved information management through use of a networked database and electronic medical records
- improved provider satisfaction and adoption.

Discussion

The results of the present study suggest that the decrease in duration of chief complaint among initial patient visits was a benefit of telemedicine. The decrease in referrals to offsite facilities was probably the result of improved communications between the local provider and consultants, and increased local provider independence (i.e. there was a learning effect). However, the decrease in referrals may also have reflected other factors such as less severe illness among

clinic patients over time (and therefore less need to transfer patients) and the growing practice of sending blood for testing to the laboratory at Sihanouk Hospital in Phnom Penh (rather than transferring the patients themselves). The introduction of point-of-care testing appeared to improve the ability to manage patients locally and reduce the need for transfer. In the long term, the value of telemedicine centres on the ability to educate local health care providers. Increased local capacity occurs through knowledge transfer from the telemedicine providers. The patient survey indicated broad satisfaction and a willingness to pay for telemedicine.

Telemedicine initiatives in the developing world face a number of challenges, and have gained the attention of international agencies such as the World Health Organization.[5,6] Strategies for integrating these initiatives into existing health systems require a collaborative approach, the identification of best practices and well-designed trials.[7] Operation Village Health is an example of such an approach.

Acknowledgements

We thank Kathleen Fiamma, Doug McClure and Marco Senelly of Partners Telemedicine; Jack Middlebrooks, Rithy Chau and Somontha Koy of the Sihanouk Hospital Center of Hope; Bernard Krisher and Noun So Thero of American Assistance for Cambodia.

References

- 1 Ministry of Planning, Royal Government of Cambodia. *Cambodia Human Development Report: village economy and development*. August 1999. See <http://www.un.org.kh/undp/publications/nhdr/1999.pdf>. Last checked 15 July 2005
- 2 Chandrasekhar CP, Ghosh J. Information and communication technologies and health in low income countries: the potential and the constraints. *Bull World Health Organ* 2001; **79**: 850-5
- 3 Graham LE, Zimmerman M, Vassallo DJ, *et al*. Telemedicine--the way ahead for medicine in the developing world. *Trop Doct* 2003; **33**: 36-8
- 4 Brandling-Bennett HA, Kedar I, Pallin DJ, Jacques G, Gumley GJ, Kvedar JC. Delivering health care in rural Cambodia via store-and-forward telemedicine: a pilot study. *Telemed J E Health* 2005; **11**: 56-62
- 5 World Health Organization. *eHealth for Health-care Delivery: strategy 2004-2007*. See http://www.who.int/ehd/en/eHealth_HCD.pdf. Last checked 15 July 2005
- 6 World Health Organization. *Health Metrics Network*. See http://www.who.int/healthmetrics/about/concept_paper.doc. Last checked 15 July 2005
- 7 Wootton R. Telemedicine and developing countries--successful implementation will require a shared approach. *J Telemed Telecare* 2001; **7** (suppl. 1): 1-6

Figure 1. Location of Operation Village Health

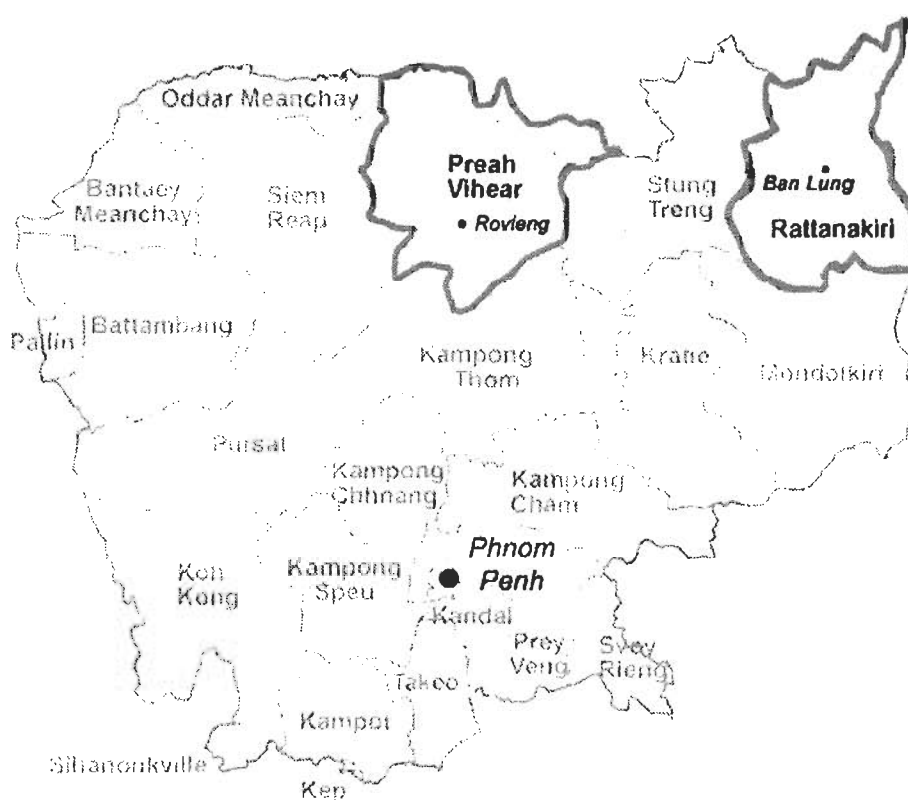


Figure 2. Duration of patients' primary chief complaint at initial visit during three phases of the study period. (Redrawn with permission from *Telemedicine Journal and E-health* 11(1) 2005, published by Mary Ann Liebert, Inc.)

Figure 2

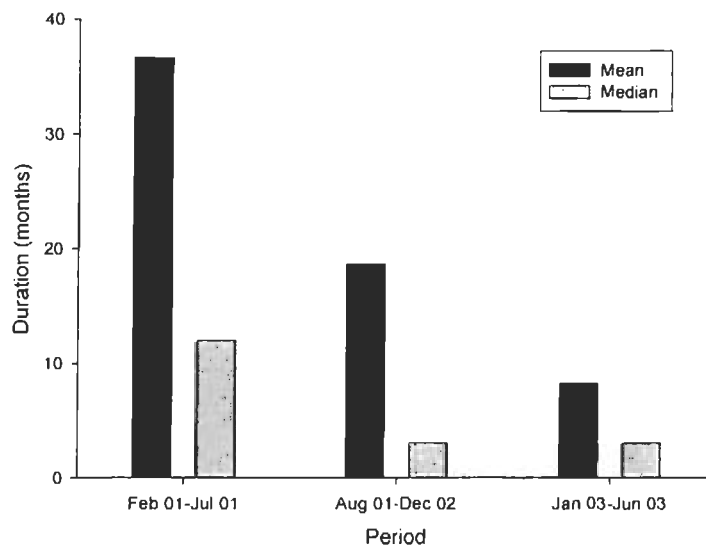


Figure 3. Proportion of patients referred off-site for care during the study period.
(Redrawn with permission from *Telemedicine Journal and E-health*, 11(1)
2005, published by Mary Ann Liebert, Inc.)

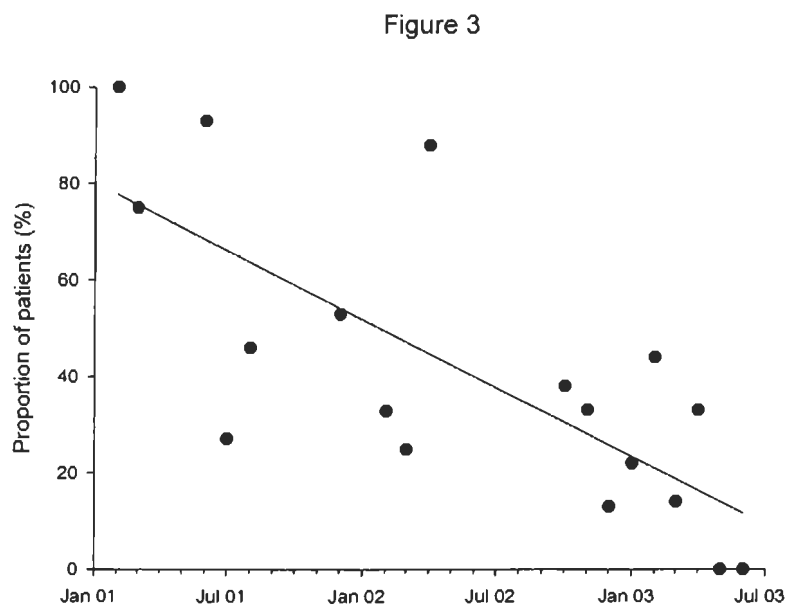
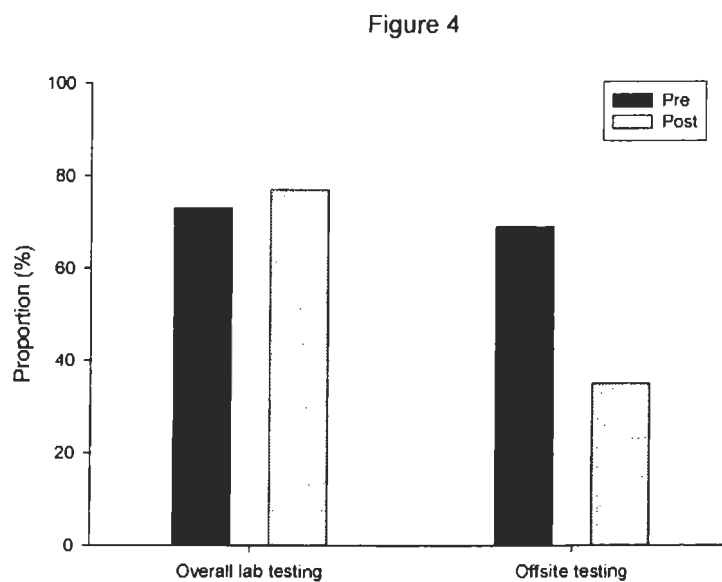


Figure 4. Overall laboratory testing per patient encounter and percent of all laboratory testing requiring offsite completion (Pre-intervention vs Post-intervention).



Difficulties in moving routine medical checks from the specialist level to the General Practitioner level, supported by electronic message exchange

Eva Henriksen¹, Monika Johansen¹, Trygve Deraas² and Eli Arild¹

1 Norwegian Centre for Telemedicine, University Hospital North Norway,
Tromsø, Norway

2 Institute of Community Medicine, University of Tromsø, Norway

Correspondence:

Eva Henriksen
Norwegian Centre for Telemedicine
University Hospital North Norway
PO Box 35
NO-9038 Tromsø
NORWAY
(Fax: +47 77 75 40 98; Email: eva.henriksen@telemed.no)

Summary

We began a project to move routine medical checks for appropriate patients from the specialist level to the patient's normal general practitioner (GP). The GP's analysis and conclusions would be checked by the specialist, using electronic messaging. The idea for the project came from the top level of the Regional Health Authority. Despite that, the project was closed down before pilot testing began. We used stakeholder theory as a post-project evaluation to analyse what happened and where it went wrong. A common mistake in project planning is to focus the planning effort on system tasks and not pay attention to a well-thought-out handling of the project's stakeholders. This was what happened in our project. The project showed that ideal objectives and good political intentions are not enough to successfully implement a new e-health service.

Introduction

Many routine medical checks that are performed by specialists in hospital outpatient clinics could be moved to the patient's normal general practitioner (GP). In principle, the GP's analysis and conclusions could be checked by the specialist, using electronic messaging. This idea was initiated from the top level in the Northern Norway Regional Health Authority.

There were several good reasons for this approach, which would:

- reduce long waiting lists to see specialists
- achieve better cooperation between primary care and specialist level, using existing infrastructure for electronic message exchange
- reduce patients' travelling time and cost.

The project as proposed defined a service that was opposite to conventional telemedicine projects, where the GP "orders" a telemedicine consultation from a specialist. In the present case it was the specialist that would order a specific consultation to be performed by the GP.

The challenges in the project were not technological, since usually it is not technology issues that undermine a project, it is everything else.[1] The problems encountered were related to the selection of an appropriate illness group and corresponding specialist department, to find the GP offices belonging to the hospital and at a certain distance from the hospital, and for each GP to identify individual patients with a suitable clinical picture. After the first selection we ended up with one specialist department (A in Table 1) and 23 GPs from 10 different health centres. It turned out to be more difficult to retain the specialist department and subsequently to recruit a new one (B or C). In the end, this was the main reason why the project was terminated without running a pilot test.

A common mistake in project planning is to focus the planning effort on work-tasks and not pay attention to handling the project's stakeholders.[2] This was also the case in our project. We used stakeholder theory as a post-project evaluation to analyse what happened and where it went wrong.

Methods

Stakeholder analysis is a technique to identify people, groups and institutions that may significantly influence a project, positively or negatively, and to anticipate the kind of influence these groups will have on the project.[3] Stakeholder analysis is useful for understanding stakeholders' interests, their needs and possible contributions to the project, and setting goals that appeal to them.[2] We based our stakeholder analysis on the work of Andersen[2] and Mikkelsen and Riis.[4] The analysis addressed three steps:

1. identification: who are the stakeholders?
2. position analysis: what perception does the individual stakeholder have of the different project aspects?
3. strategy for managing stakeholders.

Results

Identification

Stakeholders are individuals and groups who are actively involved in the project (internal) and those who are positively and negatively affected by project work or project results[2], i.e. any group or individual who can affect or is affected by the project's objective.[5] In a narrow sense, stakeholders are those that the project depends on for its survival.[5] Our analysis focused on the external stakeholders (Table 1).

The selection of stakeholders for the pilot project was a time-consuming and elaborate process. The first step was to choose the specialist department. Identification of suitable illness groups within the department's area had to be done by the department's specialists, based on the nature and frequency of the illness, and the number of patients.

The next step was to identify municipalities belonging to the chosen department and to recruit GPs from each municipality. Finally, we had to pick out patients from these municipalities. The specialist then had to look at the patients' casenotes to see if their condition made them suitable for participation in the project.

If there were not enough patients at this stage, we had to go back one step and recruit more GPs. Only after the return of the patients' consent forms would we have the actual number of participating patients in the project. At this stage the specialist department had to stop calling in these patients for routine appointments and instead ask the GPs to call them in.

Position analysis

The position analysis summarised in Table 1 is based on direct communication with external stakeholders in meetings and conversations. We experienced some differences in attitude from the specialists of the three hospital departments; this is indicated in the Table. The initial choice of department A was based on the estimated number of suitable patients.

Strategy for managing stakeholders

A stakeholder map with respect to "power" and "interest" proposes how to handle different stakeholder types.[6,7] There are two dimensions to the matrix: the stakeholder's level of interest in the project, and the stakeholder's power to influence the project. Our three stakeholder groups have been placed in the stakeholder map (Figure 1) based on interpretations of the position analysis in Table 1.

The three stakeholder groups were:

1. the regional health authority. They had the original idea for the project so their initial interest was fairly high (D). However, their interest fell after the project started (C). Their formal power over the project was considerable as they could simply remove the finance if they were not satisfied and thus stop the project. They treated the project as one of many in which they were involved, i.e. as just another way of cost saving.
2. hospital specialists. They were crucial for the project (D), because the project's survival depended on their participation. But the specialists were not dependent on the project and could not see the benefit, so their interest in the project was low. This middle-position is indicated by placing them between C and D. Because of their importance for the project's survival, they had considerable power. In contrast to the health authority, the specialists' power was *informal*.

3. GPs. They seemed to have the most interest in the project. They are normally closer to the patients and would see the benefits more easily. They had fairly low power when acting alone, but could gain power if they joined together and acted as a single group. If a large group of GPs decided not to participate it would be destructive to the project. Their possible change in position is indicated by a dotted arrow in the stakeholder map.

Discussion

Management of project stakeholders is a task of growing importance for project managers.[6] As our stakeholders were not clustered near the centre of the stakeholder map (Figure 1), our management process became turbulent and unstable.[6] If a project has some stakeholders with strong power or influence who are negative to the project or some aspects of it, they may have devastating effect on the project's progress.[2] Due to our failure in involving stakeholders we ended up with people showing little interest in the project.

Our project represented a change process. According to Lorenzi,[8] a change process consists of several stages, from not yet acknowledging that a change is needed, to making the change and maintaining it. In our case the specialists were not ready for the change. In fact they had not even acknowledged that such a change was needed.

Needs are the fundamental driving force behind projects.[9] In our project the needs emerged from, and were articulated by, the regional health authority. In our effort to recruit GPs and specialists, we observed that the needs were recognized by the GPs who were in closest contact with the patients, while the hospital specialists were doubtful of the benefit.

Stakeholder analysis should have been carried out early in the project. It is extremely important that the project participants take part in planning and accept the plans.[10] Project goals should have been revised in close cooperation with the stakeholders with highest influence and power: the specialist department and the health authorities. This would have maintained the health authorities' interest and fostered the specialists' interest.

Our project was aimed at the centre of strategic plans for Norwegian healthcare. Despite the fact that the idea was initiated from the top level of the regional health authority, the project was closed down before pilot testing. Thus the project showed that ideal objectives and good political intentions are not enough to successfully implement a new e-health service. It will also be a matter of good planning, and a matter of interest and goodwill from the participating medical environment, which must recognize the needs and experience relevance to their clinical setting.

References

- I Stumpf SH, Zalunardo RR, Chen RJ. Barriers to telemedicine implementation. *Healthcare Informatics Online* April 2002. See http://www.healthcare-informatics.com/issues/2002/04_02/stumpf.htm. Last checked 23 June 2005)

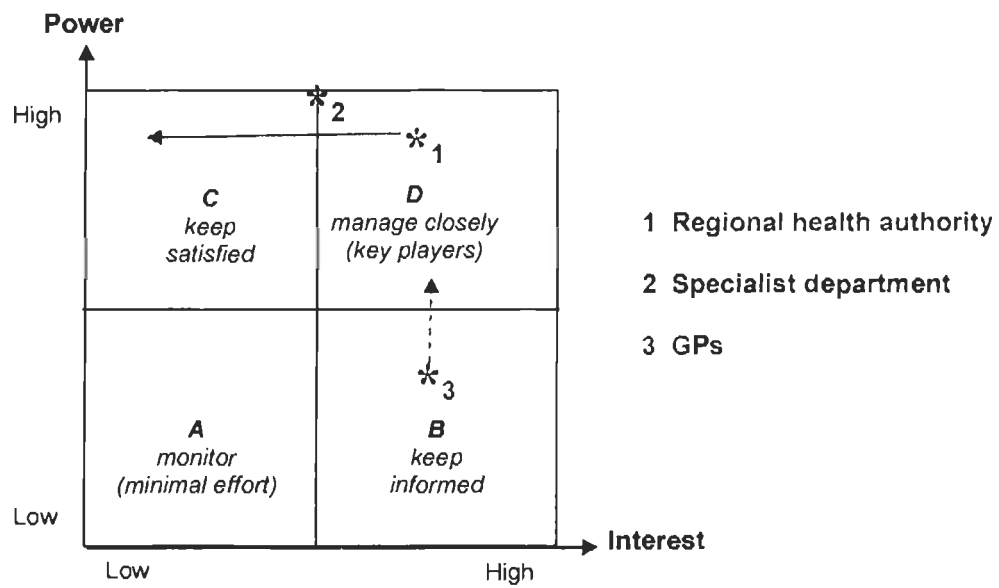
- 2 Andersen ES, Grude KV, Haug T. *Goal Directed Project Management. Effective Techniques and Strategies*. 3rd edn. London: Kogan Page Ltd, 2004
- 3 MSH (Management Sciences for Health) and UNICEF: Stakeholder Analysis. <http://erc.msh.org/quality/ittools/itstkan.cfm>. Last checked 23 June 2005
- 4 Mikkelsen H, Riis JO. [Stakeholder analysis]. Interessentanalyse. In: [Introduction to Project Management] *Grundbog i prosjekledelse*. Promet, Rungsted. 1996; 255-259
- 5 Freeman RE, Reed DL. Stockholders and stakeholders: a new perspective on corporate governance. *Calif Manage Rev* 1983; **25**: 88-106
- 6 Bonke S, Winch GW. A mapping approach to managing project stakeholders. pp197-208 in: *Project Management Research at the Turn of the Millennium*. Sylvia: PMI, 2000
- 7 Manktelow R. Stakeholder Analysis and Stakeholder Management. Winning support for your projects. http://www.mindtools.com/pages/article/newPPM_07.htm. Last checked 23 June 2005)
- 8 Lorenzi NM. Beyond the gadgets. *BMJ* 2004; **328**: 1146-7
- 9 Frame JD Making certain the project is based on a clear need. In: Frame JD. *Managing Projects in Organizations*. San Francisco: Jossey-Bass, 1995: 109-132
- 10 Andersen ES, Jessen SA. Project Evaluation Scheme: a tool for evaluating project status and predicting project results. *Project Management* 2000; **6**: 61-9

Table 1. Position analysis of stakeholders

Stakeholders	Health authority	Hospital specialist departments A – B – C	GPs
Area of interest. Tasks and contributions in project.	Had project idea and initiative. Lead project's steering committee.	Selection of patients. Work out control procedures. Support GPs' controls.	Perform patient controls, supported by specialists.
Benefit, advantage, consequences, rewards, expectations	+ Reduce costs for hospitals through reduced travel expenses. + More utilisation of electronic message exchange. + Obtain higher degree of cooperation between primary and secondary level.	+ Reduce department's waiting list. - Additional work to participate in project, puts extra load on specialists, means overtime work. - Control patients are well-known and easy patients in contrast to new and unknown cases. Dept. B claimed that the reduction of waiting lists would not be as large as foreseen. Dept. B pointed out that it will be important to register the time used by the specialist to check the GPs' control reports and to reserve time for this type of work.	- Additional work to participate in project, extra patient visits. + Competence transfer + Increase of power and status + Closer contact with specialist department.
Attitude to project. Motives, commitment, satisfaction	Had project idea and initiative and wants it to succeed, but insisted that the project should be an implementation project, not a pre-project. New regulation demanding each health enterprise to pay for patient transportation Proposed a new regulation stating that each hospital should choose at least three illness groups for which the routine control could be moved to GP level.	Reluctant to participate. Not their idea, project imputed to them. May withhold contributions because they feel that what they do for the project is not in balance with what they expect to get in return. Could result in reduced income to the department. Dept. A: Would not stop calling in patients for control before project was really running.	23 GPs from 10 health centres were willing to participate. Not their idea, project imputed to them. Too few patients per GP to really learn the new methods.

Stakeholders	Health authority	Hospital specialist departments A – B – C	GPs
	(Plans not effectuated yet.)	Dept. B: Positive to the idea, they already practice similar GP controls for a few patients and the doctors they cooperate well with.	
Attitude to other stakeholders	Low profile	Dept. B: Doubting whether all GPs would do the required control with good enough quality.	Some GPs mentioned having a complicated relation to one of the specialist departments.
Power and actual influence	<p>Could terminate project and withdraw money.</p> <p>Could put pressure on hospitals by using their formal power to force the specialist to participate – but they did not.</p> <p>The person who had the initial project idea left the Health Authorities about the time when the project started.</p>	<p>Participation from one specialist department is required to run project.</p> <p>Can decide to not participate or to withdraw from project. Project has to terminate if no departments are willing to participate.</p> <p>Dept. A decided to withdraw from the project after 3-4 months of planning, due to changed premises (hospital decided to hire Danish doctors to help cut waiting lists), and because they found that the project would take too much of their time and resources.</p> <p>Both B and C decided not to participate.</p> <p>Dept. C: Idea not suited for their patients. Most controls are one-time and combined with use of technical equipment, e.g. X-ray. Specialist wants to meet patient after operation.</p>	<p>Participation required to run project.</p> <p>Easier to replace a single GP if he drops out, but if a large group of GPs decides not to participate it will be devastating for the project.</p>

Figure 1. Power/interest map for stakeholder prioritization



Information governance standards for managing e-health information

Janis L Huston

HB Consultants, London, UK

Correspondence:

Dr Janis L Huston
39 Bywater House
Harlinger Street
London SE18 5SP
UK
(Fax: +44 20 8317 2389; Email: jangeorg@yahoo.com)

Summary

Integrity of patient information, both from a quality and security perspective, is critical to patient care. In the UK, the Information Governance initiative of the National Health Service (NHS) provides a framework to monitor and control the management of confidential patient data. Information governance standards grew out of the Data Accreditation Programme, first proposed in the 1998 NHS document, *Information for Health*. The Data Accreditation Programme was based on a three-stage assessment of data quality in acute hospitals. Stage One required internal review of policy and procedures for data input into computerised patient administration systems. Stage Two involved an external audit to verify compliance with the standards. Stage Three mandated audits of data outputs, focusing on clinical coding quality. Before Stage Three of the programme was fully implemented, the standards were incorporated into the information governance initiative in which standards were expanded to include primary care and other healthcare settings. These standards address many information management issues, including security and data quality, which are key concerns in telemedicine and e-health applications. Compliance is essential for the successful implementation of the NHS Care Records Service which will allow sharing of electronically-stored patient information across the UK.

Introduction

In telemedicine, the management of health information has been a major concern over the past decade, from both a quality of care as well as medicolegal perspective. The telemedical record has been identified as the weak link in telemedicine.[1] More specifically, issues of privacy and security have been highlighted as major concerns.[2,3] Because of those concerns, a Telemedical Record Model was proposed to manage both paper and computer-based patient records in a telemedicine setting.[4] Results of a study based on that model in 1998 showed that privacy, security and confidentiality of patient information were not a high priority for telemedicine programmes in the US.[5,6]

Managing information in the UK

In 1998, even in the traditional healthcare delivery environment in the UK, the basic premise of confidentiality, security and data quality on which the Telemedical Record Model was based was found to be lacking. As the Health Information Management (HIM) profession does not exist in the UK, and because there are no mandatory clinical recording standards in place, the integrity of patient data has continued to be in jeopardy.[7-9] In 1998, The first major NHS document to address the importance of managing electronically-stored patient information was published in 1998 [10] and was followed by a series of related publications from the government.[11,12] These documents highlighted the need for quality patient data to assure safe and appropriate patient care.

The 1998 document, *Information for Health*, outlined a strategy to implement a national electronic health record in a phased approach from Level One (to include simple patient administrative and clinically coded data) to Level Six (involving more complex telemedical and multimedia patient records).[10] The timetable to achieve this has proved to be unrealistic. One of the biggest challenges will be the general culture change required to foster an attitude of valuing patient data and understanding the importance of protecting it. Security tools can be put into place, but without policies and procedures to ensure that they are used appropriately and without repercussions for employees who abuse them, human failures will prevent security measures from protecting patient information.[13] A culture of accountability and responsibility must be instilled in NHS workforce before the *Information for Health* plan can succeed.

First steps to data quality

Since the publication of the *Information for Health* document, new legislation and standards have been put into place in the UK to assure the protection of private information, particularly the Data Protection Act 1998.[14,15] As a result, a Data Accreditation Programme was implemented to ensure that information available in the NHS was reliable and accurate.[16,17]

The Data Accreditation Programme involved a three-stage audit process which became mandatory for acute care in 2000. The audits were aimed at determining whether national data quality standards were being met by healthcare providers. The data quality standards included: (1) security and confidentiality, (2) coverage, (3) validation and quality assurance, (4) training, (5) accountability, (6) health records management, (7) communications, (8) completeness and validity, (9) timeliness and (10) accuracy. A data quality assessment tool was developed, known as the Compliance Matrix, in which the standards were clarified, along with interpretations and examples of best practice. Examples of supporting documentation were also included to demonstrate compliance.

The process involved an assessment of both internal and external use of data from the hospital patient administration system (PAS), involving mostly administrative, non-clinical patient data. Clinical coding data was to be audited in the Stage Three Review of Data Outputs. These PAS data were considered to be the foundation of the proposed NHS electronic health record, now called the National Care Record Service (NCRS), to ensure the integrity of confidential patient data to be shared across the UK. A key part of the Data Accreditation process focussed on written policies and procedures for each step of the information flow to assure consistent

and accurate data input and output. Results of the initial accreditation audits throughout the UK showed a clear lack of written policies and procedures in NHS hospitals, even for Level One of the proposed NCRS.

Information governance standards model

The last Stage Two audit was completed in 2003. The Stage Three Review of Data Outputs in the Data Accreditation Programme has yet to take place. However, the initial work completed in the Programme has led to the development of the current initiative, now known as the NHS Information Governance (IG) Programme. Information Governance has incorporated a number of Data Accreditation standards and expanded them to include other types of health care providers besides acute care such as primary care and mental health. The Information Governance Standards have been applied to a self-assessment tool called the IG Toolkit.[18]

The tool, an expanded version of the original Compliance Matrix, is called the HORUS Model which addresses Holding, Obtaining, Recording, Using and Sharing of patient information.[19] Information Governance Standards, like those of Data Accreditation, can be expanded to apply to all types of healthcare delivery system, which could include telemedicine. As telemedicine programmes are further developed and more information is shared between sites, more stringent control over the protection of that patient data will be necessary. Further development of the IG Toolkit could help with this.

Parallel initiatives in the US

Parallel initiatives are in progress in the US, where there is a strategy to achieve complete implementation of electronic patient records within the next few years. Similar privacy and security legislation has been passed in the US since the 1998 Telemedical Record Documentation study was completed. The US law, known as HIPAA (Healthcare Insurance Portability and Accountability Act), has raised awareness of the importance of safeguarding personal information. As a result of this, the HIM profession in the US is presently in transition from managing patient records to managing medical information and knowledge. HIM professionals have always served as an intermediary between computer experts and health care providers, but they are now playing an even more important role as a knowledge broker between hospitals and patients as well as other users of patient data.

As a result of the HIPAA and other initiatives, the American Health Information Management Association (AHIMA) launched an e-HIM project in 2003 to promote the migration from a paper to electronic health information structures and to define how personal health information should be managed.[20-25] The vision of the e-HIM committee is that patient information will be stored electronically, will be patient-centred and will be comprehensive, longitudinal, accessible and credible.[25]

Conclusion

In the UK's Information Governance initiative, data quality is crucial. Just as with privacy, patients should be able to expect that the accuracy of their personal health information will be safeguarded. Those expectations apply to all types of healthcare delivery, including and especially in a telemedicine and e-health environment. The main challenges for those involved in healthcare delivery will be to ensure that patients are uniquely and correctly identified, that patient data are accurate and complete, that the integrity of the data is protected, that confidentiality and security is ensured, and that confidential patient information is always available to those who are authorised to access it. The Information Governance initiative is in its early stages but appears to be moving in the right direction.

References

- 1 Huston JL. Telemedical records: the weak link in telemedicine. *J AHIMA* 1996; **67**(6): 69-7
- 2 Huston JL. Telemedical records: Documentation, legal, and privacy concerns. *In Confidence* 1998; **6**(4): 1-4
- 3 Stanberry B. *Legal and Ethical Aspects of Telemedicine*. London: Royal Society of Medicine Press, 1998: 34-5
- 4 Huston JL. A telemedicine record model. *J Telemed Telecare* 1997; **3** (suppl. 1): 86-8
- 5 Huston JL. Telemedical record documentation: a preliminary survey. *J Telemed Telecare* 1999; **5** (suppl. 1): 6-8
- 6 Huston JL. Managing telehealthcare information. *J Healthc Inf Manag* 1999; **13**(4): 49-58
- 7 Huston JL. The state of patient records in the UK: A view from abroad. *Biomedical Informatics Today* 2002; **34**: 4-5
- 8 Huston JL, Brox GA. A breach from within: How secure are your electronic telemedical records? *J Telemed Telecare* 2001; **7** (suppl. 1): 79-80
- 9 Huston JL. The need for mandatory clinical recording standards. *Clin Med* 2004; **4**: 255-7
- 10 National Health Service Executive. *Information for Health: An Information Strategy for the Modern NHS 1998-2005*. London, UK: National Health Service, 1998
- 11 National Health Service. *Building the Information Core: Implementing the NHS Plan*. London: Department of Health, 2001
- 12 Department of Health. *Delivering 21st Century IT Support for the NHS: National Strategic Programme*. London: Department of Health, 2002
- 13 Huston TL, Huston JL. Security in the management of information systems. *Health Care Superv* 1998; **16**(4): 28-34
- 14 Department of Health. *Data Protection Act 1998 Protection and Use of Patient Information*. London: Department of Health, 2000
- 15 Audit Commission. *Data Remember: Improving the Quality of Patient-Based Information in the NHS*. London: Audit Commission, 2002
- 16 National Health Service Information Authority. *Data Accreditation for Acute Providers*. Loughborough, Leicestershire: NHS Information Authority, 2000
- 17 NHS Information Authority: *Data Quality*. See <http://www.nhsia.nhs.uk/dataquality/pages/>. Last checked 31 May 2005

- 18 Information Governance. See
<http://www.nhs.uk/infogov/pages/default.asp>. Last checked 6 June 2005
- 19 National Health Service Information Authority. *What You Should Know About Information Governance*. Birmingham: NHSIA, 2003
- 20 American Health Information Management Association.
<http://www.ahima.org>. Last checked 31 May 2005
- 21 Casey L, Oliver S. HIM professionals vital in transition to e-HIM. *AHIMA Advantage* 2003; **7**(6): 1, 3-4
- 22 Kloss L. E-HIM: A 'glocal' challenge. *J AHIMA* 2004; **75**(1): 17
- 23 Kloss L. Data quality: Part of the e-HIM agenda. *J AHIMA* 2003; **74**(10): 19
- 24 Mon DT. Further defining e-HIM. *J AHIMA* 2004; **75**(2): 54-6
- 25 E-HIM Task Force. *A Vision of the e-HIM Future: A Report from the e-HIM Task Force*. Chicago: American Health Information Management Association, 2003

Instant wireless transmission of radiological images using a personal digital assistant phone for emergency teleconsultation

Dong-Keun Kim¹, Sun K Yoo² and Sun H Kim³

1 Graduate School of Biomedical Engineering, Yonsei University, Seoul, Korea

2 Center for Emergency Medical Informatics, Department of Medical Engineering, Yonsei University College of Medicine, Seoul, Korea

3 Department of Neurosurgery, Yonsei University College of Medicine, Seoul, Korea

Correspondence:

Professor Sun K Yoo
Department of Medical Engineering
Center for Emergency Medical Informatics
Yonsei University
College of Medicine
134 Shinchon-dong
Seodaemun-ku
Seoul 120-752
KOREA
(Fax: +82 2 363 9923; Email: sunkyoo@yumc.yonsei.ac.kr)

Summary

The instant transmission of radiological images may be important for making rapid clinical decisions about emergency patients. We have examined an instant image transfer system based on a PDA phone with a built-in camera. Images displayed on a PACS monitor can be captured by the camera in the PDA phone directly. Images can then be transmitted from an emergency centre to a remote physician via a wireless high data bandwidth CDMA 1x EVDO network. We reviewed the radiological lesions in 10 normal and 10 abnormal cases produced by modalities such as CT, MRI and digital angiography. The images were of 24-bit depth and 1144x880, 1120x840, 1024x768, 800x600, 640x480 and 320x240 pixels. Three neurosurgeons found that a minimum size of 640x480 pixels was required for CT images and 1024x768 pixels for MRI images for satisfactory remote consultation. Although, higher resolution produced higher clinical satisfaction, it also required more transmission time. At the limited bandwidth employed, higher resolutions could not be justified.

Introduction

In an emergency situation, an instant image transfer system can be used to support rapid medical and surgical decision making when specialists are away from the hospital.[1,2] Some Web-based PACS (Picture Archiving and Communication Systems) systems exist which allow access to a patient's radiological images from outside the hospital. However, they are not appropriate for use in time critical

emergency patients.[3,4] Direct photography of X-ray films using a Pocket PC PDA (Personal Digital Assistant) phone with a built-in camera is a possible technique for acquiring and transmitting images.

We have designed an instant image transfer system based on a popular PDA phone with a built-in camera. We have assessed the feasibility of using it for instant image acquisition and real time transmission of radiological images in trauma emergency patients, and its usefulness for making an effective medical decision in an emergency situation.

Methods

Hardware

For an emergency trauma patient, a medical image was photographed by emergency residents using a PDA phone with built in camera. Patients gave informed consent to their participation. The PDA camera phone (RW-6100, Hewlett-Packard) supported various different image resolutions, up to a maximum of 1144x880 pixels with 24-bit colour depth. The images were produced in JPEG format using a compression ratio of approximately 20:1. Images were displayed on the Pocket PC, which had a 240 x 320 pixel TFT LCD screen, Figure1. Data transmission was via a CDMA 1x EVDO wireless network interface card (CF-WLAN card SWL-2300, Samsung) for wireless communication. The CDMA 1x EVDO network had a maximum transfer rate of 2 Mbit/s for downlink and 153 kbit/s for uplink.

Software

The image transfer system was programmed using the Windows CE.NET (Microsoft) software so that it could be operated on various PDA devices. For reliable image delivery over a congested wireless network, we used connection-oriented TCP/IP windows socket programming. In order to reduce the number of operation steps, we designed shortcut buttons for rapid image transmission, including a speed dialling button on the PDA phone. In addition, we developed a PDA image viewer that allowed image zooming, tilting, rotating and saving to local PDA storage.

Image quality

Received images were evaluated on the PDA phone display at different resolutions. We reviewed the radiological lesions in 10 normal and 10 abnormal cases produced by modalities such as CT, MRI and digital angiography. The images were of 24-bit depth and 1144x880, 1120x840, 1024x768, 800x600, 640x480 and 320x240 pixels. To evaluate the received images in terms of different image pixels, we used ROC (Receiver Operating Characteristic) analysis, which is a common method of measuring image quality. Three neurosurgeons reviewed the images.

Feasibility of the PDA system

The effectiveness of the system was evaluated by measuring the transmission time and the number of operation steps required for image transmission. We analysed the average time required for image capture, the initial wireless network set-up time and image transmission. The image capture time contained the time taken to adjust still images from a PACS monitor, photograph and archive images on the PDA.

Results

Image quality

We captured emergency patient's radiological images at different image resolutions, as shown in Figure 2. The ROC test results showed that higher resolution images produced higher satisfaction, see Figure 3. High resolution images were successful in clarifying the radiological lesions. Especially, it was useful to diagnose radiological lesion on digital angiography images with higher image resolution despite the restricted PDA display screen size, which required more operation steps for manipulating images, such as zooming or moving. A minimum size of 640x480 pixels was required for CT images and 1024x768 pixels for MRI images for satisfactory remote consultation.

In all cases, it was very difficult to distinguish the radiological lesion on the image at a resolution of 320x240 pixels, and hence this was not considered sufficient for remote consultation.

Feasibility of the PDA system

Perhaps unsurprisingly, the ROC analysis showed that higher resolution images produce higher satisfaction. However, higher resolution images also have bigger file sizes as shown in Table 1.

Table 1. The file size (kByte) of captured images at different resolutions (pixels)

	1144x880	1120x840	1024x768	800x600	640x480	320x240
Min	204	113	99	60	37	15
Max	225	125	103	69	44	17
Mean	206	116	100	64	41	16

The file size of an image affects its transmission time. We measured the average time of image capture, the initial wireless network set-up time and the transmission time at different image resolutions as shown in Figure 4.

In order to transmit images, it was necessary to click three buttons, including dialling the phone number. The image capture time and network set-up time were almost independent of the different image resolutions. However, the transmission time was significantly influenced by different image resolution. The mean transfer time showed that larger files required more transmitting time. The 1144x880 pixel image which had an average of 200 kByte in file size, took over 26 s to transmit. Receiving time was less than transmitting time because the CDMA 1X EVDO network offered asynchronous bandwidth.

Discussion

In order to assess the quality of instant image acquisition and the effectiveness of real time transmission at different resolutions using a PDA phone, an ROC analysis was performed by three neurosurgeons. The results showed that higher resolution images were preferred, such as 1140x880 pixels, despite requiring additional manipulation such as moving and zooming for exact diagnosis. We suggest that the most appropriate image resolution for capturing instant images using a mobile device is 640x480 pixel resolution. Even though in the ROC test, higher resolution had higher satisfaction for image quality, we found that actual transmitting time and practical operation time of the system was more significant than image quality in an emergency situation. At a resolution of 640x480, ease of operation and portability were satisfactory, and the image quality was sufficient to clarify the radiological problem.

In the present study, we were required to maintain some distance between the PDA phone and the PACS monitor when capturing a displayed image because of the influence of reflected light. This affected the image quality. The clinical value of instant image capturing and transmitting using a PDA phone camera is not yet known. In an emergency situation, it may be useful to transmit radiological images through a CDMA wireless network that is widely available outside the hospital.

In conclusion, higher resolution produced higher clinical satisfaction. However, it required more transmitting time at limited data bandwidth. Especially, for the 1144x880 pixel images, a transmission time that was over 26 s was considered inappropriate for an emergency situation. Therefore, a minimum of 640x480 image resolution for CT and MRI images, and 1024x768 image resolution for angiography, appears to offer the best compromise for making urgent medical decisions.

Acknowledgments

This study was supported by a grant of the Korea Health 21 Research and Development Project, Ministry of Health and Welfare, Republic of Korea (02-PJ3-PG6-EV08-0001)

References

- 1 Yamada M, Watarai H, Andou T, Sakai N. Emergency image transfer system through a mobile telephone in Japan: technical note. *Neurosurgery* 2003; **52**: 986-8
- 2 Yamamoto LG, Williams DR. A demonstration of instant pocket wireless CT teleradiology to facilitate stat neurosurgical consultation and future telemedicine implications. *Am J Emerg Med* 2000; **18**: 423-6
- 3 Yaghmai V, Kuppuswami S, Berlin JW, Salehi SA. Evaluation of personal digital assistants as an interpretation medium for computed tomography of patients with intracranial injury. *Emerg Radiol* 2003; **10**: 87-9
- 4 Yaghmai V, Salehi SA, Kuppuswami S, Berlin JW. Rapid wireless transmission of head CT images to a personal digital assistant for remote consultation. *Acad Radiol* 2004; **11**: 1291-3

Figure 1. (a) instant radiological image capture using the built in camera in the PDS phone; (b) transmission via the CDMA 1X EVDO modem; (c) displaying the received images with the image viewer in the PDA.

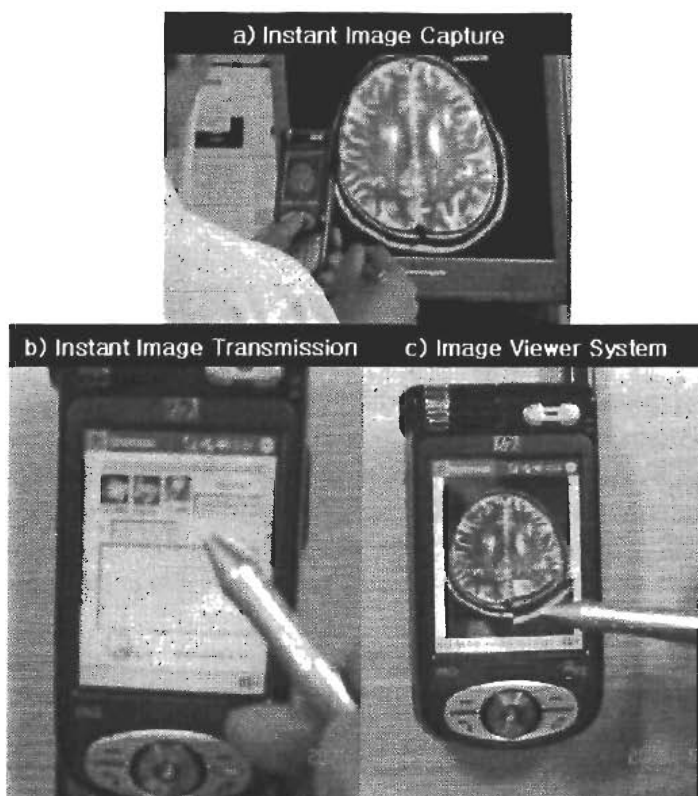


Figure 2. Radiological images displayed on the PDA phone at different resolutions. (a) 1140x880; (b) 1120x840; (c) 1024x768; (d) 800x600; (e) 640x480; (f) 320x240 pixels.

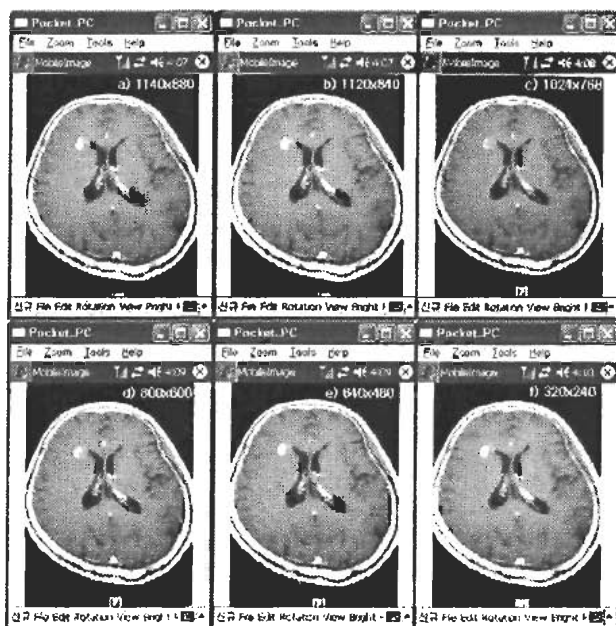


Figure 3. The ROC test results at six different image resolutions

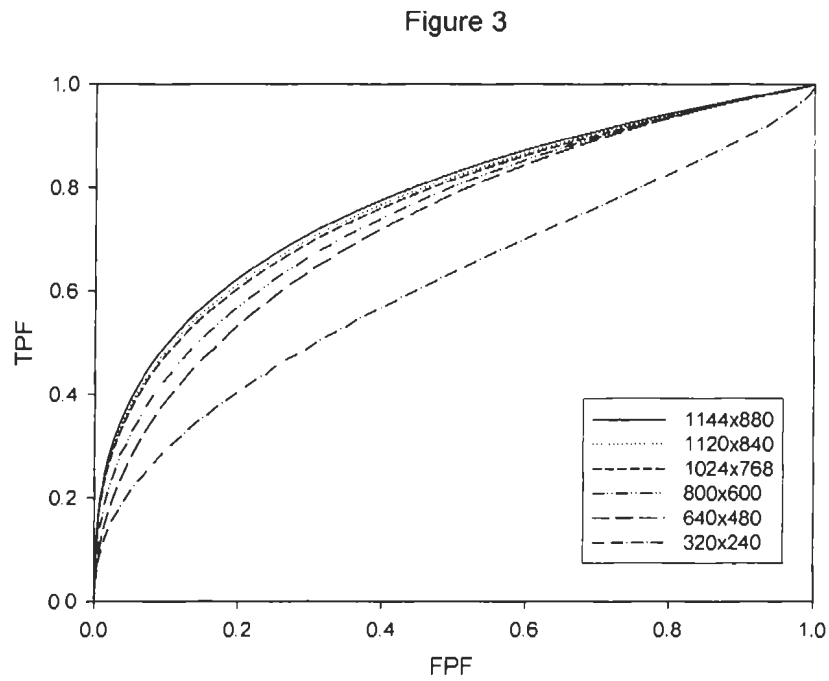
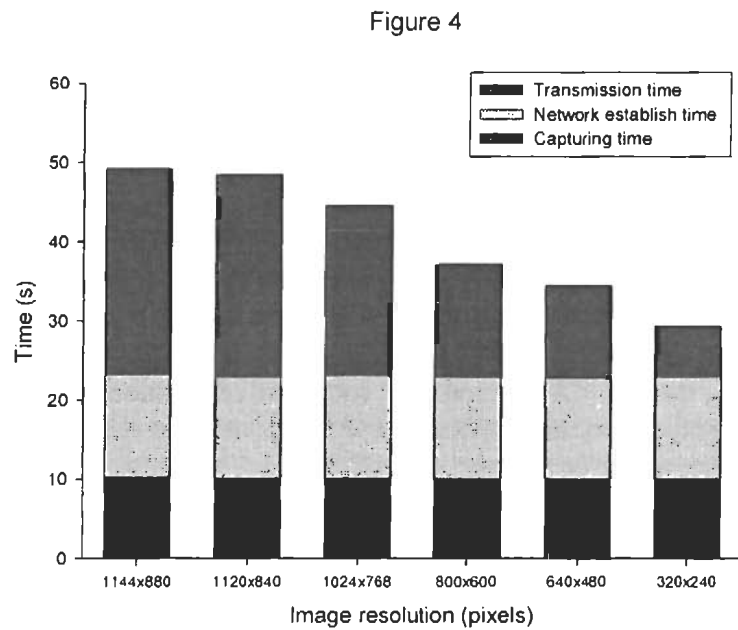


Figure 4. Test results for image capture time, initial wireless network set-up time and transmission time at different image resolutions



Attitudes of breast cancer professionals to conventional and telemedicine-delivered multidisciplinary breast meetings

RG Fielding¹, M Macnab², S Swann², IH Kunkler², J Brebner³, RJR Prescott⁴, JR Maclean⁵, U Chetty², G Neades², A Walls⁶, A Bowman², JM Dixon², T Gardner², M Smith², MJ Lee⁴ and RJ Lee⁴

1 CM-Insight, Weybridge, UK

2 University Department of Clinical Oncology, Western General Hospital, Edinburgh and Edinburgh Breast Unit, Western General Hospital, Edinburgh, UK

3 Telemedicine Laboratory, Department of General Practice, University of Aberdeen, UK

4 Medical Statistics Unit, University of Edinburgh, UK

5 Bristol-Myers Squibb Company, New Jersey, USA

6 Dumfries and Galloway Royal Infirmary; Dunfermline; UK

Correspondence:

Dr Ian Kunkler

Department of Clinical Oncology

Western General Hospital

Crewe Road

Edinburgh EH4 2XU

UK

(Fax: + 44 131 537 2216; Email: I.Kunkler@ed.ac.uk)

Summary

We surveyed attitudes of breast cancer professionals to standard face-to-face and future telemedicine delivered breast multidisciplinary team (MDT) meetings. Interviews, which included the Group Behaviour Inventory, were conducted face-to-face (n=19) or by telephone (n=26). The mean total score on the Group Behaviour Inventory was 96 (SD 19) for 33 respondents, which indicated satisfaction with standard MDT meetings, irrespective of role and base hospital. Positive attitudes to videoconferencing were more common among participants with previous experience of telemedicine (Spearman's rank correlation 0.26, $p=0.91$). Common themes emerging from the interviews about telemedicine-delivered MDTs included group leadership, meeting efficiency, group interaction, group atmosphere and technical quality of communication. Most participants were satisfied with standard breast MDTs. Nurses and allied health professionals were least supportive of telemedicine.

Introduction

Multidisciplinary care has been a key element of cancer policy in Scotland. Traditionally cancer centres and district general hospitals have held their multidisciplinary cancer meetings separately. Visiting surgical and non surgical oncologists often travel long distances from cancer centres to district general hospitals to participate in multidisciplinary team meetings (MDTs) at considerable cost to the National Health Service. The feasibility of using telemedicine to link multidisciplinary teams between a cancer centre and district general hospital for discussion of patients with various cancers including breast, has been demonstrated.[1] However little is known of the attitudes of UK breast cancer professionals towards telemedicine in this context.

Methods

A randomised trial, TELEMAM, is being conducted to evaluate the clinical and cost effectiveness of telemedicine to facilitate breast MDTs between two district general hospitals (Dumfries and Galloway Royal Infirmary and Queen Margaret Hospital, Dunfermline) and the regional cancer centre (Edinburgh Breast Unit). At Dumfries there was a full time breast surgeon with a clinical oncologist visiting to participate in the breast MDT meeting. In Fife the breast unit at Queen Margaret Hospital was a satellite unit of Edinburgh Breast Unit with surgical and oncology staff visiting from Edinburgh to participate in MDT meetings.

Semi structured interviews were designed to collect both qualitative and quantitative data on attitudes to current face-to-face MDT breast meetings and to the future use of videoconferencing in breast cancer management. The measurement of attitudes and expectations towards videoconferencing was informed by research on communication and telephone apprehension.[2,3] Interviews were conducted face-to-face (n=19) or by telephone (n=26).

The group behaviour inventory comprised a series of 35 positive statements about participant opinions and attitudes to face-to-face MDTs (Appendix 1). Responses to each statement were on a five point scale from completely disagree to completely agree. A total questionnaire score was derived by allocating a score of 0, 1, 2, 3 or 4 to the response to each statement and summing the scores for all 35 statements. The total score ranged from 0 to 140 with a lower score indicating greater disagreement with the positive statements and a higher score more agreement. The total questionnaire score was approximately normally distributed, so means with SDs were calculated for different groups based on the interview responses and compared using analysis of variance (ANOVA). Interview responses to questions on the theme of feelings about videoconferencing were summed to create a score.

Results

Interviews

The distribution of participants by professional role and base hospital is summarised in Table 1.

Table 1. Number of participants at each hospital and their roles

Role	Base hospital			
	Edinburgh	Dumfries	Fife	Fife/Edinburgh
Medical	5	1	6	1
Surgical	6	2	1	3
Nursing or allied health professionals	10	1	3	0
Research	3	1	0	2

Three quarters of participants with Dumfries and Fife as their primary base had undertaken teleradiology or telepathology work compared to half Fife/Edinburgh and one third in Edinburgh alone. Participants in Edinburgh and Dumfries anticipated more use of telemedicine in the long term. There were small differences between base hospitals in feelings about videoconferencing, importance of the TELEMAM trial and its anticipated success.

Total questionnaire score

The overall mean total questionnaire score was 96 (SD 19) (Figure 1). Since the overall mean score exceeded 70, the midpoint between the minimum and maximum possible score, we concluded that MDT members were generally satisfied with their standard MDT meeting.

Participant characteristics

The total satisfaction score with the standard breast MDT was similar among different staff roles (Table 2). The highest mean score was among research staff and the lowest among nursing and allied health professionals. There was a significant difference between staff based at the different hospitals. The highest level of satisfaction with the standard MDT was in Fife. Those who attended both Edinburgh and Fife MDT meetings were least satisfied.

Table 2. Total questionnaire score in relation to participant characteristics

		n	Mean (SD)	Min, max	P-value, ANOVA
Role	Medical	11	97 (20)	64, 131	0.96
	Surgical	7	95 (29)	53, 128	
	Nursing or allied health professionals	9	94 (17)	61, 115	
	Research	6	100 (10)	89, 112	
Base hospital	Edinburgh	18	92 (16)	61, 128	0.004
	Dumfries	3	92 (25)	64, 111	
	Fife	8	116 (11)	97, 131	
	Fife/Edinburgh	4	81 (19)	53, 95	
Base department	Breast unit	24	94 (20)	53, 128	0.24
	Oncology and breast unit	3	90 (4)	97, 95	
	Mammography and breast unit	2	92 (11)	84, 100	
	Radiology	3	110 (14)	97, 125	
	Pathology	1	131 (--)		

The mean total score (Table 3) was slightly higher for those involved in one MDT per week compared to those involved with more than one MDT per week ($P=0.13$). However, there was a significant difference in the mean total score between those who 'always' attended and those who attended 'most of the time'. The satisfaction was higher for those attending more frequently. There was no significant relationship between total questionnaire score and years of attendance at MDTs (Spearman's rank correlation 0.16, $P=0.37$).

Table 3. Total questionnaire score in relation to experience of MDT meetings

Question	Response	Total questionnaire score			
		n	Mean (SD)	Min, max	P-value, ANOVA
Weekly number of MDT meetings	1	16	101 (19)	61, 131	0.26
	2	15	90 (20)	53, 128	
	3	2	99 (17)	87, 111	
Attendance (most frequent over all MDT meetings)	Most of the time	11	85 (19)	53, 111	0.02
	Always	22	102 (17)	64, 131	

The mean total score for satisfaction with the standard breast MDT were similar for those with the least and most experience of audio, video and computer-based conferencing (Table 4).

Table 4. Total questionnaire score in relation to previous experience with conferencing

Question	Response	Total questionnaire score			
		n	Mean (SD)	Min, max	P-value, ANOVA
Work audioconferencing	None – some	8	97 (26)	53, 128	0.94
	Quite a lot – a great deal	25	96 (17)	61, 131	
Home audioconferencing	None	15	98 (23)	53, 131	0.69
	A little – a great deal	18	95 (16)	61, 125	
Work videoconferencing	None	17	95 (18)	61, 125	0.66
	A little – a great deal	16	98 (21)	53, 131	
Home videoconferencing	None	27	94 (20)	53, 128	0.16
	A little – a great deal	6	106 (14)	93, 131	
Work computer conferencing	None	28	98 (20)	53, 131	0.30
	A little – a great deal	5	88 (14)	64, 97	
Home computer conferencing	None	27	96 (19)	53, 131	0.87
	A little – a great deal	6	97 (22)	64, 128	
Work teleradiology or telepathology	None	19	94 (21)	53, 131	0.44
	A little to a great deal	14	99 (17)	64, 125	

The level of satisfaction with the standard MDT was not related to the perceived benefit of videoconferencing (Table 5). There was a trend for those with a positive attitude towards videoconferencing to be more experienced in the use of telemedicine at work, but the effect was not significant (Spearman's rank correlation, 0.26 $P=0.091$).

Table 5. Total questionnaire score in relation to feelings about videoconferencing

Question	Response	Total questionnaire score			
		n	Mean (SD)	Min, max	P-value, ANOVA
How easy do you think the technology is to set up (for meeting organisers)?	Difficult	10	101 (12)	87, 122	0.23
	Undecided	6	84 (17)	53, 100	
	Easy	16	98 (23)	61, 131	
How easy do you think technology is to use (for you)?	Difficult	5	101 (13)	87, 115	0.75
	Undecided	7	92 (19)	53, 112	
	Easy	21	96 (21)	61, 131	
How nervous will you be?	Difficult/Undecided	11	99 (12)	79, 115	0.59
	Confident	22	95 (22)	53, 131	
How good will you be?	Poor/Undecided	9	102 (19)	61, 131	0.28
	Good	23	94 (19)	53, 128	
How will you like using it?	Dislike/Undecided	7	101 (14)	79, 115	0.50
	Like	26	95 (20)	53, 131	
How reliable will it be?	Unreliable/Undecided	11	95 (16)	61, 122	0.80
	Reliable	22	97 (21)	53, 131	
How useful will it be?	Undecided	5	100 (11)	84, 112	0.72
	Useful	27	97 (20)	53, 131	
Feelings about videoconferencing score	0–17 (bad)	13	99 (10)	84, 115	0.19
	18–20 (intermediate)	8	85 (19)	53, 108	
	21–36 (good)	12	100 (25)	61, 131	

Qualitative analysis

Interviews were analysed to identify any common themes generated by or emerging from the interviews. The main themes were group leadership, group dynamics, group atmosphere, meeting efficiency and technical quality of communication. A matrix was created to show all the themes generated from the qualitative analysis of interviews. Examples of opinions grouped by category are shown in Table 6.

Table 6. Examples of opinions expressed during the interviews

Size	Smaller meetings allow for more free input Larger meetings are good as they allow attendance for educational purposes
Efficiency	Meeting is efficient by its very nature of being a multidisciplinary meeting as decisions based on all input can be made at one time and delivered to patient immediately Meetings have a tendency to drift away from the point Not everyone arrives promptly and this can lead to waiting It is not a true multidisciplinary meeting unless all disciplines are represented All the information for the meetings is not always available The consultant whose patient is being discussed is not always present The multidisciplinary method of meeting is very expensive Efficiency may be compromised if the meeting goes on too long
Leadership	Formal chair may alleviate tendency to digress from the point Formal chair may stifle atmosphere that allows a free flow of ideas and contributions
Decision quality	Decisions adhere to guidelines and are considered good quality Decisions may not always take account of the emotional consequences of the decision Decision guideline determined / not always made on the basis of the individual patients needs
Interaction process	Formal chair may help alleviate some contributions being dominated by individuals/disciplines Participants can contribute freely Junior staff may feel unable to contribute freely Disciplines may champion their own causes which is inappropriate at this meeting Secondary conversations occur amongst participant (often within disciplines)
Audio quality	Use of more microphones would help sound quality Audio quality is poor for those at the back of the room and not immediately around the table Audio quality is acceptable as long as microphones are used
Location	Room is too small Seating layout makes some participants feel isolated Those attending but not participating could view meeting from a separate location
Preference for medium	Videoconferencing may make meetings too formal Videoconferencing may make non verbal cues difficult to pick up Videoconferenced meetings may lack the human element Videoconferencing is acceptable in the right context but face to face is preferred
Duration of meeting	Participants suffer fatigue towards the end of a long meeting Meetings that over run mean patients are kept waiting at what is already a time of stress Meetings always give time to each discussion regardless of potential to over run
Climate	Meetings have a positive climate Meetings could be intimidating for junior staff Large meetings could be intimidating Climate allows for participants to contribute freely when necessary

Discussion

Not all breast cancer professionals participated in the pre-trial interview and questionnaire. Also, the data were obtained from a single cancer centre and two district general hospitals. Thus it may be difficult to generalise the results of the present study to breast cancer professionals in the UK as a whole. As a result of self selection, we cannot exclude the possibility of some bias. In addition, the small numbers limit the comparisons between subgroups.

Published studies relating to satisfaction of physicians with telemedicine in oncology are principally based on those who already had experience of telemedicine for delivering cancer care.[4,5] In contrast, we studied cancer professionals with limited or no previous experience. While participants were reasonably positive about telemedicine, professions allied to medicine were less supportive. Their concerns and those identified from the group behaviour inventory need to be addressed in service planning.

Acknowledgements

The TELEMAM trial is funded by a grant (no 1217319) from the Department of Health Research and Development Fund. The telemedicine equipment is funded by a grant from the New Opportunities Fund.

References

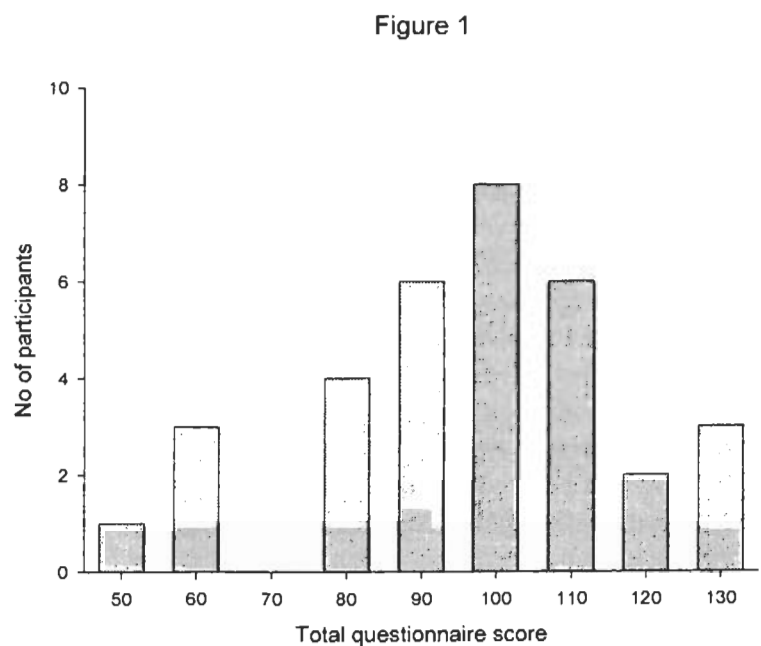
- 1 Axford AT, Askill C, Jones AJ. Virtual multidisciplinary teams for cancer care. *J Telemed Telecare* 2002; **8** (suppl. 2): 3-4
- 2 McCroskey JC. Oral communication apprehension: reconceptualisation and a new look at measurement. In: Burgoon M, ed. *Communication Yearbook Vol 6*. Beverly Hills: Sage, 1982: 136-70
- 3 Fielding RG. Telephone apprehension: conceptualisation and empirical investigations. Paper presented to the *Annual Conference of the International Communication Association*, Dublin, June 1990
- 4 Allen A, Hayes J, Sadasivan R, Williamson SK, Wittman C. A pilot study of the physician acceptance of tele-oncology. *J Telemed Telecare* 1995; **1**: 34-7
- 5 Kunkler IH, Rafferty P, Hill D, Henry M, Foreman D. A pilot study of tele-oncology in Scotland. *J Telemed Telecare* 1998; **4**: 113-9

Appendix 1. Group Behaviour Inventory - 35 item questionnaire

1. The MDT meeting that I attend is about the right size, with neither, too many or too few people attending.
2. The MDT meeting that I attend takes place in a suitable room with the facilities that it needs.
3. The MDT meeting that I attend is of about the right duration, being neither rushed because there is not enough time, or taking longer than is necessary.
4. The MDT meeting that I attend has available to it all of the information it needs.
5. The MDT meeting that I attend has available to it all the different kinds of expertise it needs.
6. The people in the MDT meeting that I attend have good group discussion skills and are good at group decision making.
7. The MDT meeting that I attend have a clearly understood goal which is accepted and shared by all participants.
8. During the meetings, the MDT meeting that I attend focuses on the task in hand and doesn't waste time talking about other things.
9. All of the people who attend this MDT meeting share the same values and approach to what they are doing.
10. The MDT meeting that I attend has a very positive climate/atmosphere.
11. There is not much tension amongst and between the people at the MDT meeting that I attend.
12. In the MDT meeting that I attend each person has a clear role which is understood and accepted by the other members.
13. In the MDT meeting that I attend everybody understands the different kinds of contributions that each person can make, and people can be relied upon to contribute as and when they should.
14. The MDT meeting that I attend has a clearly understood and an accepted way of organising its discussions.
15. These ways of organising its discussions are efficient and effective.
16. I find the discussions at the MDT meeting that I attend are interesting.
17. The people at the MDT meeting that I attend don't talk too much, but on the other hand everything that needs to be said does get said.
18. Contributions to the discussion are made by most people at the meeting, and the discussion is quite equally shared amongst all of the people at the meeting.
19. In the MDT meeting that I attend the amount a person contributes is based more on their ability to contribute than on some arbitrary characteristic such as their position or status.
20. In the MDT meeting that I attend the discussion is not dominated by just a small minority of the participants, rather, nearly everybody makes a significant and useful contribution to the discussion.
21. Influence on the decisions that get made is quite widely shared amongst all of the people at the MDT meeting that I attend.
22. The MDT meeting that I attend takes place in a suitable room with the facilities that it needs.
23. The MDT meeting that I attend uses ways of making its decisions that are understood and accepted by everybody at the meeting.
24. The way that decisions are made at the MDT meeting that I attend is efficient and effective.
25. The MDT meeting that I attend is quite flexible in the way it can change how it goes about things when it needs to.

26. The MDT meeting that I attend generally gets a lot done.
27. The MDT meeting that I attend generally makes good quality decisions and rarely makes mistakes.
28. I think that I learn a lot from the discussions that occur in MDT meeting that I attend.
29. I think that most of the people who attend the MDT meeting learn a lot from the discussions that occur.
30. I feel satisfied with my role in the MDT meeting and with my contribution to the way it works.
31. Most people in the MDT meeting that I attend feel satisfied with their role and with their contribution to the way it works.
32. The MDT meeting that I attend is one where there is a high level of cohesiveness; people feel good about the group and the other people in it.
33. The role of the MDT meeting that I attend is clear to the rest of the organisation, as is the way it fits into the overall work of the organization.
34. The MDT meeting that I attend is well-regarded by the rest of the organization.
35. There is not a lot of conflict between the MDT meeting that I attend and the rest of the organization.

Figure 1. Histogram of total questionnaire score



A tele-ultrasound needs analysis in Queensland

Chris Lewis

Logan Hospital, Queensland, Australia

Correspondence:

Chris Lewis
Wesley Hospital
Chasley St
Auchenflower 4066
AUSTRALIA
(Fax: +61 7 3871 1249; Email: clewis1@vtown.com.au)

Summary

A tele-ultrasound survey was distributed to clinicians and sonographers in regional and rural sites throughout Queensland. 28 people were invited to complete a profile questionnaire and 27 people were invited to complete a caselog. Twenty-five of the 28 questionnaires were returned (89% response rate). Twenty-two of the 27 case-logs were returned (81% response rate). Obstetric ultrasound was the most frequently performed ultrasound examination, accounting for 846 (35%) of the 2410 recorded during the two-week survey period. The respondents considered that 182 cases would have benefited from further consultation: 79% for diagnostic advice, 13% for patient management advice and 8% for advice on examination technique. Six hospitals appeared to have the greatest need for a tele-ultrasound service. There was a strong preference for the store and forward transmission of static images: 70% preferred this modality, in comparison with 19% who preferred real-time transmission and 11% who preferred store and forward transmission of video clips.

Introduction

There are two long-established tele-ultrasound projects in Queensland. The first is between the Centre for Maternal Fetal Medicine at the Mater Mothers Hospital in Brisbane and the Townsville Womens' Hospital, 1500 km to the north.[1]. Extensive trials have been conducted since the first pilot project in 1997 which have established that 384 kbit/s is the minimum bandwidth required for real time obstetric teleultrasound.[2]. The second project is a collaboration between the University of Queensland and the Royal Children's Hospital. Since November 2000 a range of telepaediatric services has been offered to regional centres, including a regular echocardiology tele-ultrasound service.[3]

An analysis was undertaken in 2004 to assess the level of need for tele-ultrasound in regional Queensland. The needs analysis was aimed at those regional and rural hospitals that had inadequate specialist support for their ultrasound practitioners.

Methods

Two survey documents were used: a profile questionnaire and a caselog. Information gathered from the questionnaire included the number and qualifications of those performing ultrasound studies; the ultrasound equipment available; responsibility for reporting of examinations; frequency of any existing reporting service; annual caseload; estimated number of referrals for second opinion or tertiary assessment; and available teleradiology equipment. The participants were also requested to state their views on tele-ultrasound. If they saw a role for tele-ultrasound in their setting, they were requested to nominate its preferred uses, i.e. a clinical aid and/or an educational tool.

The second component of the survey required participants to complete a daily caselog of their ultrasound examinations over a two week period. Participants were requested to complete the caselog from the perspective of having specialist access via a tele-ultrasound link. For each case they stated either that they were satisfied with the examination and that no further assessment was required, or that they thought the patient required further specialist assessment via a tele-ultrasound consultation. In the latter case three types of consultations were potentially available: advice about examination technique, diagnostic advice and management advice.

Participants were also requested to nominate the method of image transfer that would suit each consultation. The three options provided were the store and forward transmission of static images, store and forward transmission of a video-clip and real-time videoconference.

The survey was distributed to clinicians and sonographers in regional and rural sites throughout Queensland. 28 people were invited to complete the profile questionnaire and 27 people were invited to complete the caselog. An existing tele-ultrasound user at Townsville was excluded from the caselog survey.

The questionnaire and caselog results were categorised according to the Queensland Health Peer Grouping of Hospitals.[4] With the exception of those hospitals that outsourced their medical imaging services, all regional and rural Queensland hospitals with ultrasound equipment were canvassed to participate in the project. The Royal Flying Doctor (RFDS) service was also invited to participate. The only branch conducting ultrasound examinations was the Cairns RFDS. In tabulating the results the RFDS are incorporated in the small hospitals category.

Results

Twenty-five of the 28 questionnaires were returned (89% response rate). Twenty-two of the 27 case-logs were returned (81% response rate), Table 1.

Table 1. Participation

Category	Questionnaire	Caselog
Principal referral and specialist hospitals	4	2
Large hospitals	8	8
Medium hospitals	5	5
Small hospitals	8	7
<i>Total</i>	25	22

Preferred use of tele-ultrasound

Twenty-three of the 25 respondents to the questionnaire (92%) indicated that a tele-ultrasound link between their hospital and the major metropolitan referral centres would provide some benefit for their hospital. Of the 23 respondents who indicated that tele-ultrasound had benefits to offer, there was a slight preference for its use as an educational tool over its clinical role, see Figure 1. Whilst there was some variation within hospital groupings, which was helpful in identifying specific areas of need, 16 hospitals nominated the benefits as both clinical and educational.

Case mix analysis

The survey established the mixture of cases performed at the public hospitals and RFDS unit who responded to the survey. Obstetric ultrasound was the most frequently performed ultrasound examination, Table 2. These cases accounted for 846 (35%) of the 2410 recorded during the two-week survey period. The distribution of cases was similar in the 182 examinations listed for specialist advice.

Table 2. Clinical case mix

	Cases		Specialist advice required	
	No	%	No	%
Obstetric	846	35	46	25
Abdominal	685	28	41	23
Gynaecological	344	14	35	19
Vascular	218	9	13	7
Small parts	209	9	32	18
Paediatric	88	4	14	8
Other	20	0.8	1	0.5
<i>Total</i>	<i>2410</i>	<i>100</i>	<i>182</i>	<i>100</i>

Consultation type

Of the cases nominated by the participants for further consultations, 79% were earmarked for diagnostic advice, 13% for patient management advice and 8% for advice on examination technique.

Need for specialist advice

The need for specialist consultation was calculated for the four hospital groups. The level of need ranged from 2% of all cases conducted over the survey period for the principal referrals hospitals, to 15% of cases for the medium sized hospitals, see Table 3.

Table 3. Clinical need

Category	No of cases	Cases in which specialist advice was required	
		n	%
Principal referral and specialist hospitals	525	11	2
Large hospitals	1153	76	7
Medium hospitals	348	53	15
Small hospitals	384	38	10
Total	2410	178	7

Hospitals with most need

Hospitals demonstrating most need for a tele-ultrasound service were identified. Two benchmarks were set based on the case log results: first, those hospitals nominating more than 10 consultations per fortnight, and second, those hospitals nominating more than 10% of their case load for consultation. Those hospitals meeting both criteria were considered to be in most need. There were six hospitals in this category, see Table 4.

Table 4. Hospitals demonstrating most need for a tele-ultrasound service.

	Hospitals nominating >10 cases per fortnight for consultation	Hospitals nominating >10% of their case load for consultation	Hospitals nominating >10 cases per fortnight AND >10% of their case load for consultation
	Goondiwindi	Gladstone	Ipswich
		Moranbah	Bundaberg
		Beaudesert	Dalby
			Gympie
			Warwick
			Thursday Island
Total	1	3	6

Image transmission

There was a strong preference for the store and forward transmission of static images: 70% preferred this modality, in comparison with 19% who preferred real-time transmission and 11% who preferred store and forward transmission of video clips.

The comments in the questionnaires suggested the reason was concerns about the length of time required to organise teleconsultations. The sonographer at Mossman hospital said, "Being a sole operator I have time constraints and it would take time to organise a tele-ultrasound link and coordinate myself, the patient and a consultant at the other end if we were needing diagnostic advice. In this case store and forward or video clip would be appropriate, but it still takes time to organise!"

Discussion

The needs analysis showed that 92% of the regional and rural ultrasound practitioners who responded supported the development of tele-ultrasound linkages with major referral centres for both clinical and educational purposes. Caselogs showed that the hospitals with the greatest need were the medium and small size hospitals where 12-16% of the cases were considered candidates for teleconsultation. The highest clinical demands were in obstetrics, abdominal pathology and gynaecology. Most of the assistance needed was in clinical diagnosis (79%). Overall, the clinical demand for tele-ultrasound consultation amounted to 178 patients per fortnight, or about 360 patients per month. This is a significant demand, as it would effectively double the State's current total telehealth activity of 200-300 patients per month [4] which covers all medical disciplines.

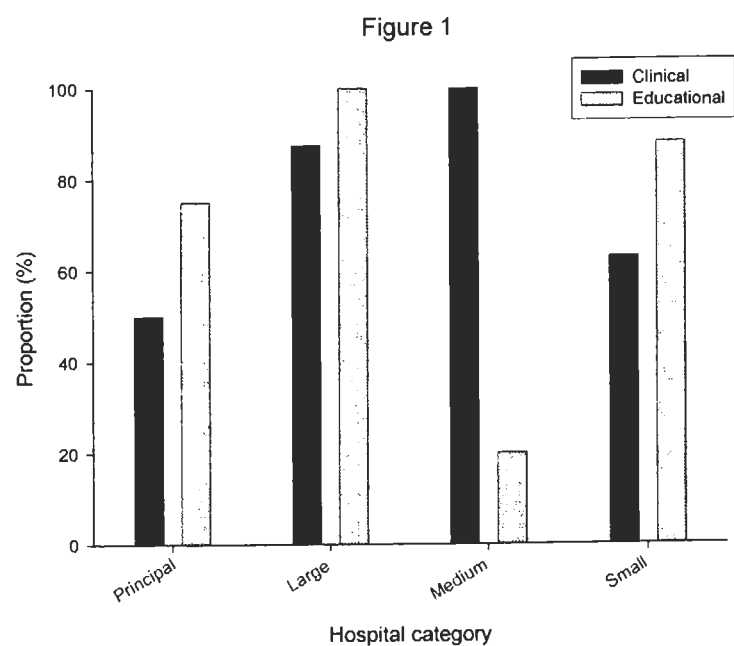
Acknowledgements

I thank Dr Fung Yee Chan and Alison Lee-Tannock (Mater Hospital, South Brisbane), Dr Anthony Smith (University of Queensland), Alan Taylor and Kate Curran (Queensland Health). I am also grateful to the sonographers and doctors who completed the questionnaires and the very time-consuming case logs.

References

- 1 Soong B, Chan FY, Bloomfield S, Smith M, Watson D. The fetal tele-ultrasound project in Queensland. *Aust Health Rev* 2002; **25**: 67-73
- 2 Chan FY, Whiteall J, Hayes L, *et al*. Minimum requirements for remote realtime fetal tele-ultrasound consultation. *J Telemed Telecare* 1999; **5**: 71-6
- 3 Justo R, Smith AC, Williams M, *et al*. Paediatric telecardiology services in Queensland: a review of three years' experience. *J Telemed Telecare* 2004; **10** (suppl. 1): 57-60
- 4 Queensland Health. *Queensland Hospitals in the 21st Century: Leading the Way*. See <http://www.health.qld.gov.au/quality/Publications/MQ/PublicRpt.pdf>. Last checked 12 July 2005

Figure 1. Preferred use of tele-ultrasound



Electronic patient record systems and the GP: an evaluation study

K Mäkelä¹, K², I Virjo², J Aho³, P Kalliola³, A-M Koivukoski³, H Kurunmäki³, M Kähärä³, L Uusitalo³, M Valli³, V Vuotari³ and S Ylinen³

1 Tampere University of Technology and Seinäjoki Central Hospital, Finland

2 University of Tampere, Finland

3 District of South-Ostrobothnia, Finland

Correspondence:

Kari Mäkelä

Telemedicine Laboratory

Tampere University of Technology

Koskenalantie 16

60220 Seinäjoki

FINLAND

(Fax: +358 6 429 8801; Email: kari.2.makela@tut.fi)

Summary

We studied how well Electronic Patient Record (EPR) systems meet the needs of general practitioners (GPs) and other health care professionals for specific information. GPs in eight health centres in the South-Ostrobothnia region of Finland were invited to participate. They used three types of EPR system. They were asked to access EPRs to obtain 20 types of information for patients receiving anticoagulant treatment. In total 2389 patient cases were studied. All of the information requested was available for 73% of the cases (range 55-93%). There was a significant difference between the type of EPR system and the percentage of patients for whom information was available through the EPR. However, further analysis showed that differences in performance between EPR systems probably reflected differences in the way EPRs were used by different organisations. Great care should be taken in attempts to rank EPR systems based on their performance.

Introduction

Finland is undergoing a rapid transition in health care, in which paper-based patient records are being replaced by electronic patient records (EPRs). Practically all health care centres in Finland now use EPRs. Central hospitals and university hospitals have also widely implemented electronic systems. One of the key aims in employing EPRs is to improve the handling and exchange of data within and between health care organisations. Quantifying how well the present systems cope with this is an extremely challenging task.

The present study had two aims: to evaluate how well EPR systems can meet the needs of general practitioners (GPs) and other health care professionals for specific information, and to determine whether there are any significant differences between EPR systems in this respect. The work focused on a single patient group in one health care district in Finland, namely patients undergoing anticoagulant treatment in the South-Ostrobothnia region in Finland. The central hospital of the district (Seinäjoki Central Hospital) has used electronic systems for many years, but a new EPR and administration system was being implemented at the time of the study.[1] All health centres in the area have used EPR systems for some years.

It was also hoped that this project would serve as a forum for dialogue between health care professionals and information technology specialists, and in general would improve the interaction between healthcare staff and technology developers.

Methods

South-Ostrobothnia covers a large area, but is fairly sparsely populated with a total population of approximately 200,000 people. The patient group chosen for this project had the following characteristics:

- several groups of health care professionals deal with these patients, thus allowing some quantification of the information flow for differing needs within health care. These patients typically shuttle between health care organisations as well
- the information specific to these patients (i.e. relating to anticoagulant treatment) is fairly specific and thus relatively easily quantifiable. For example, the INR (International Normalized Ratio) is a key variable used to check that the proper level of anticoagulant medication is being maintained
- the patient group is sufficiently large to allow meaningful analysis of results.

The study formed a part of a larger project which commenced in early 2003. In the initial stage, questionnaires were sent by mail to all health care professionals in 15 health care centres in the South-Ostrobothnia region. The purpose was to find out which information sources the health centre staff found to be most useful in transferring information from secondary care to primary care. The results clearly indicated that the EPR system then in use in the health centres were not very useful sources of information.[2]

The results of the questionnaire study prompted the follow-on project, which began at the end of 2003. GPs who indicated their willingness to continue in the project compiled a list of all patients who had undergone anticoagulant treatment during the first three months of 2004 in their health centre. A total of eight health centre participated. The GPs were requested to access the EPR of their organisation for 20 specific types of information concerning anticoagulant patients. The data requested were:

- patient information (age, sex, patient study number)
- start date of treatment
- main reason for treatment, main classification (ICD 10 code)
- secondary classification (ICD 10 code)

- INR target level
- planned duration of treatment
- actual duration of current treatment
- last INR value
- second-last INR value
- time between last and second-last INR determination.

Results

During the study period, there were a total of 2389 anticoagulant treatment cases in the participating health care centres. All of the information requested was available in the EPR for 73% of the cases (range 55-93%). Three different types of EPR were in use in the health centre, with one system being used in five health centres. In the majority of the health centres, the EPRs had been in use for several years (range 1.8-9 years).

There was no significant relation between the proportion of patients for whom all information was available in the EPR, and the duration for which the EPR system had been in use. There was, however, a significant difference ($P < 0.01$) between the type of EPR system, and the percentage of patients for whom all information was available through the EPR.

Discussion

After the results were compiled, feedback and discussion sessions were conducted with the GPs participating in the study to discuss the initial results and their significance. It became evident that there were few, if any, technical reasons why certain information was or was not available in electronic format: the main reason seemed to be user behaviour. Clearly no information can be accessed if it has not been entered in the first place.[3,4] Several health centres indicated that they were short of qualified personnel, hence frequent use of substitute and replacement staff led to situations where all personnel might not have been adequately trained in the correct use of EPRs. In some cases a simple lack of time led to skipping the input of some patient information.

Most GPs participating in the study also felt that they were able to access clinically relevant data from the EPR. The relatively low proportion of information that was accessed during the study (73%) would have been significantly higher if only the type of data needed in day-to-day work was requested. However, the GPs themselves were involved in drawing up the list of data to be accessed before the start of the study, so it can be argued that the data requested (that is, the data that was asked to be accessed) is clearly of some significance.

The study itself also changed how EPR systems were used in health centre centres. For instance, more data input was delegated to nursing staff. Even attention to working practices, as caused by participating in the study, affected how systematically data were entered into EPRs. After the discussion sessions were completed, most participants indicated that a significantly higher proportion of the requested data would be available electronically in future. In other words, the process of participating in the study and in the discussion sessions seemed to have improved the use of the EPR systems.

The differences observed in performance between the EPR systems probably reflect differences in the way they were used by different organisations, rather than any inherent superiority of one system over another. It could be speculated that once a certain level is reached for EPRs ("good enough"), the user becomes more important in determining the quality of information systems.[5]

Conclusion

The present study revealed that despite wide use of EPR systems in health care centres, these electronic databases cannot yet compete in all aspects with conventional paper-based records relevant to anticoagulant treatment. This is a reflection of the difficulty of structuring clinical data to make it easily accessible, while still retaining a simple and user friendly method of inputting the information.[6]

Since differences observed in performance between EPR systems may not reflect only differences between the software, but also differences in the way these are utilised by different organisations, great care should be taken in attempts to rank EPR systems based on their performance. User issues can be more significant in determining the EPR performance than the software itself, so more emphasis should be placed on training and best practice dissemination in EPR use.[5]

The present study also highlighted the significance of feedback between users and information technology developers: a greater mutual understanding will not only benefit all parties, it will be crucial if new and better software is to be developed.

Acknowledgements

We thank the Seinäjoki Central Hospital and the South-Ostrobothnia Health District for funding part of this research. We are also grateful to the staff at the health care centres participating in this study.

References

- 1 Hagman E, Rajala J, Mäkelä K. Electronic patient record and administration system project in the hospital district of Etelä-Pohjanmaa. *Proceedings, Medical Technology Seminar III, Seinäjoki 2004*. Seinäjoki: Hospital District of South Ostrobothnia, 2004: 28
- 2 Virjo I, Aho J, Kalliola P, *et al.* Patient's own anticoagulant treatment card still most important in transferring information. *Socialmedicinsk tidskrift bilaga* 2005; **82**: 63
- 3 Thiru K, Hassey A, Sullivan F. Systematic review of scope and quality of electronic patient record data in primary care. *BMJ* 2003; **326**: 1070
- 4 Jordan K, Porcheret M, Croft P. Quality of morbidity coding in general practice computerised medical records: a systematic review. *Fam Pract* 2004; **21**: 396-412
- 5 Majeed A. Ten ways to improve information technology in the NHS. *BMJ* 2003; **326**: 202-6
- 6 Garrido T, Jamieson L, Zhou Y, Wiesenthal A, Liang L. Effect of electronic health records in ambulatory care: retrospective, serial, cross sectional study. *BMJ* 2005; **330**: 581

Twenty years' experience of a telehealth service in the UK

Peter Mansfield

Good HealthKeeping Ltd, Lincolnshire UK

Correspondence:

Dr Peter Mansfield
Good HealthKeeping Ltd,
26-27 Garrod House
Manby Park Lincolnshire LN11 8UT
UK
(Fax: +44 163 667 6734; Email: petermansfield@ln118tf.fsnet.co.uk)

Summary

Since 1996 a small call centre has been operated to provide instant positive, self-help, non-medical advice to members. Non-clinical advisers work under a medical director. The scheme grew to 1200 member-families from a regional catchment area, peaking at 2500 across the country. About 30-50 phone calls are received each day and up to 1000 web visits per day; about 20-50 postal items are sent out daily to members. In a telephone poll during 2001, half of our current members said that they used the National Health Service about 70% less than before they joined, but one third said that they used complementary and alternative medicines 80% more. Half had gained in confidence by about 50% in managing their own health. Members most often join for alternative medical help with a specific problem, but stay if they begin to appreciate the help we can give them in regaining and keeping health in the round. In practice, our retention of new members for a second year is only 10-20%. The "barefoot" profession of Telehealth Adviser appears to meet a community need.

Introduction

In 1970, during my training as a General Practitioner in the National Health Service (NHS), I was introduced to the Pioneer Health Centre[1], an experiment in London between 1935-1951 to examine scientifically the nature of human health. Their findings[2] inspired me to transform my practice of medicine against disease into one of encouragement for health. At various times between 1973-1996 I ran in parallel an NHS medical practice, a charitable think-tank (teachers, doctor, dentist and priest) to develop ideas and practices, and a health cultivation club open to everyone. By 1990 the tide of NHS policy was running strongly against this kind of innovation, and I was advised to go it alone. I retired early from medicine and incorporated Good HealthKeeping (GHK) as a private company.

Methods

The Pioneer Health Centre (PHC) made use of a purpose-built, transparent leisure building and proposed the construction of these in every community. I proposed to cast a virtual umbrella over all the social facilities in my community, including my medical centre, and offer a health-respecting culture to integrate them. Part of the result was a large body of leaflets and pamphlets, reinterpreting common situations from the health point of view and stating my vision of health. This became a book[3] and eventually a website.

After 1996 I was free of medical constraints, had 500 memberships in a subscription scheme, and realised that most of the people seeking my advice did so by telephone. I introduced a small call centre to provide instant positive, self-help, non-medical advice to members, and trained two cohorts of advisers. Nurses proved very reluctant to adopt this approach. We have had most success with sensible, experienced and successful mothers and grandmothers, usually aged 35-60 years.

The scheme grew to 1200 member-families from a regional catchment area, peaking at 2500 across the country during a spell of intense public dissatisfaction with official policy on MMR vaccine. Subscription for a small family costs around £70 per year, plus supplies at cost.

We now service our membership from purpose-built premises in modern office accommodation, using modern IT, website and telecommunications equipment. We receive 30-50 phone calls and up to 1000 web visits per day, and send out 20-50 postal items daily. Our aim is to broaden our members' vision of health, help them appreciate their own health situation and to take steps in favour of their health. This seldom interferes with the medical advice they may also receive, but reduces their need for medical services.

Our semi-automatic HealthScore questionnaire is available by post, enabling members to estimate how healthy they are and check their progress at intervals. After computer input this generates a series of scores, which I check and base recommendations on. These scores are arbitrary, but a series give a useful indication of improvement over time. Hair mineral analysis is also offered by post, since it is a commonly-requested service. Client satisfaction surveys are conducted annually.

Results

Successes

It was easier to evaluate the effects of GHK membership when they could be compared with non-beneficiaries in other standard medical settings. Medical prescription rates and costs in my previous medical practice were compared with local or national averages, using official prescribing audit statistics. In a practice offering general health advice as an alternative, drug prescribing dropped to about half of the national average, Table 1. This was due to diminished demand, not any attempt to restrict supply.

Table 1. Family practice. Cost of medicines dispensing

Sample month	No of patients	A: Cost of natural items per patient (% of all prescriptions in this practice)	B: Total prescribing cost per patient (% of regional average)	Cost per patient of drugs only (% of regional average, $B[100-A]/100$)
July 1978	702	8	70	65
July 1980	941	12	60	53
June 1982	1066	17	55	46
October 1985	1374	30	82	57
March 1989	2008	33	91	60

There were also changes in other standard items of general medical care. In particular, the demand for emergency visits out of hours in my previous practice was always strikingly less than local norms, Table 2. These percentages relate to the average costs across Lincolnshire.

Table 2. Family practice. Benefits of health-oriented practice for the year ending 31 March 1986

Item	Relative to average*
Night visits (own patients)	50% below
Emergencies (other doctors' patients)	150% above
Preventive medical procedures	30% above

*taken from percentile rankings for Lincolnshire, 106 practices

Since separating from the NHS and relying on realistic subscriptions, we find that members most often join for alternative medical help with a specific problem, but stay if they begin to appreciate the help we can give them in regaining and keeping health in the round. In practice, our retention of new members for a second year is only 10-20%. Once members have stayed a second year, however, they tend to be very loyal. They recognise that we are truly independent, have no marketing bias or vested interests, are free to tell the truth as we see it, and operate only for their benefit.

In a telephone poll during 2001, half our current members said that they used the NHS about 70% less than before they joined, but a third said that they used complementary and alternative medicines 80% more. Half had gained in confidence by about 50% in managing their own health. Half of the members felt that their health had improved by about 50% during their membership – twice as many as recent ex-members. Several ex-members said that they had become self-reliant enough not to need us.

Failures

We have hardly dented the prevailing medical culture, which encourages fear of disease and reliance on professional help. Society is not yet willing to consider simple, radical changes to life maintenance. This has made marketing health very hard. Low client retention is a direct consequence of this hostile culture. We would like to improve it, but we are selling a radically new outlook, not just a product.

During our existence, complementary and alternative medicine (CAM) has come from the fringe to near-mainstream acceptance. This has, unfortunately, been misunderstood as health-related. "Healthcare" (oxymoron) and "integrated health" (tautology) betray sloppy thinking about health – by definition it needs no care, and is hyper-integrated. Healthy people use *less* medicine of any kind than sick people.

Health practice does not provide a living for a medically trained director although GHK covers its other costs. On a more personal note, I have yet to establish any clear line of succession when I retire. We hope to find a partner who will develop what we have learnt – a health supplement manufacturer, perhaps, or a health insurance company. Meanwhile I have begun to set out in a variety of publications what GHK has taught me, in the hope that this may save others from having to rediscover the same material.

Discussion

The 20th century was dominated by a synergy between medicine and pharmaceuticals, which created the "health" culture we have today. Justified though this was in the aftermath of two world wars, it could not be sustained indefinitely. That era is coming to an end. The pharmaceutical giants are not prospering as they did and they are short of new ideas.

In the 21st century the medical industry must settle for a smaller role, over-arched by a new health culture that undermines unbounded consumption of medical resources. Health, an insight-led appetite for living, is the natural partner for telecommunications and IT. This new synergy has yet to come of age, but it can still help to save us from the insanity that could otherwise destroy human life.

Acknowledgements

I am grateful to Celia Monument, Maureen Robinson and Pamela Mansfield for support.

References

- 1 Pearse IH, Crocker LH. *The Peckham Experiment: a study of the living structure of society*. London: George Allen and Unwin Ltd, 1943
- 2 Williamson GS, Pearse IH. *Science, Synthesis and Sanity*. Edinburgh: Scottish Academic Press, 1980
- 3 Mansfield PJ. *The Good Health Handbook*. London: Grafton Books, 1988

Auto TeleCare – understanding the failures and successes of small business in telehealth

David McMahon

Compvice Pty Ltd, Ashmore, Australia

Correspondence:

David McMahon
Compvice Pty Ltd
26 Mualla Drive
Ashmore 4214
AUSTRALIA
(Fax: +61 7 5527 9677; Email: dcmahon@compvice.com.au)

Summary

Auto TeleCare provided an automatic daily telephone service for people living alone. The business used an IVR (Interactive Voice Response) system to call clients at a set time each day. The clients were required to press a button on their telephone to listen to a message (e.g. joke of the day), thereby indicating that they were alright. If the client did not respond, staff would call the given list of contacts to check on the client's welfare. The service was first offered in December 2003 and there was a lot of interest from clients and health care groups. Although the technology was sophisticated, it was very simple for the clients to use. However it was the marketing and advertising costs of the business that in the end proved to be too costly. The number clients required for commercial viability was calculated to be 3000, and after nearly 15 months of business, it was decided that Auto TeleCare was not commercially viable.

Introduction

Many elderly people wish to "age in place", i.e. to remain in their own home rather than moving into a retirement home. At the 2001 census[1] there were 675,000 people aged 65 years and over living alone in Australia, more than half of whom were aged 75 years and over. Government and consumer spending on home-based care is expected to grow by 8-10% over the next few years. This makes home care very attractive to business. However, the mean weekly household income of those aged 65 years and over is \$156-300 per week,[2] which represents a limitation in working with this group.

Auto TeleCare provided an automatic daily telephone service for people living alone. The target group of the business was people aged 65 years and over, who were living by themselves. The main reason that customers purchased the AutoTeleCare service was the fear of growing frail, old and being all alone. This feeling is complex and confusing for the client as they do not want to admit that they need assistance or become a burden on their loved ones and society, while at

the same time they realise that they are no longer independent. These complex emotions are major challenges for any business working with this group.

Auto TeleCare provided two services - the "Start the Day Pack" (to home telephones) costing \$20 per month and the "Freedom Pack" (to mobile phones) costing \$40 per month. The only difference between the two packs was the telephone line type. The motives for clients using the service included:

- not wanting to be a burden on family or loved ones
- to have a laugh and be involved in something
- to obtain in-home assistance services at an affordable price to those on low income
- to reduce worry and obtain a sense of security
- to remove the fear of dying alone and no one finding them until days later
- to reduce the fear of having an accident, not being able to get to the phone and no-one noticing for days
- to lessen the fear of something happening to them and no one being there to look after their pets.

Other motives for family members were:

- to obtain reassurance, i.e. to know that someone was checking on the client
- to be notified (having a simple system already in place) when something was wrong
- to have a third party check the client daily when they themselves do not have the time to do so.

Technology

In an Interactive Voice Response (IVR) system a person can use a touch-tone telephone to interact with a computer to acquire information from or enter data into a database. The technology does not require human interaction over the telephone as the user's interaction with the database is predetermined by what the IVR system will allow the user access to. IVR technology can be used to gather information, as in the case of media surveys in which the user is prompted to answer questions by pushing the numbers on a touch-tone telephone, without having to speak directly to a person.

Each day, using an IVR system, Auto TeleCare provided the clients with a choice of - "Make me laugh" (joke of the day), "Inspirational thoughts" (uplifting quotes and stories) or "Have your say" (daily poll). The IVR system was based on a server (Windows 2000, Microsoft) with a voice modem board (Dialogic DIALOG/4, Intel). The four-port voice board is a half-size ISA form. The voice platform was directly linked to a client database management software program designed by Auto TeleCare to manage daily call tracking, customer details and monthly billing functionality.

Clients would listen to the daily content based on their selection. The act of the client pressing either 1, 2 or 3 on their telephone provided an acknowledgement that the client was alright. Should they not respond by pressing any button after two separate calls (15 minutes apart) the system would automatically alert staff. The staff attempted to manually call the client and if unable to make contact would

call the first of the nominated contacts asking them to check on the client. If unable to get in touch with any of the nominated family members, Auto TeleCare would then contact the local police station to inform them of the failed response. All attempted calls by staff were tracked and recorded against the client's history, while the computer system kept records of all attempted automatic calls and responses. At any time a complete history of client responses could be obtained, quickly and easily.

Other advantages of this technology were:

- no installation of equipment was required in the client's home, as the service used the existing telecommunication infrastructure. This reduced costs to the client and the worry of strangers entering their home, as all details were taken over the phone and no home visit was required
- no need to rely on donations or volunteers providing the service. Thus there was a high level of reliability and reassurance for clients and contacts
- mobility to client when travelling through the use of a mobile phone.

Setting up the service over the phone eliminated the need for paperwork. This made it simple and easy for the clients, reduced the time required to sell the service, and made it easier for clients to sample the service before signing up (they could try the service for the first 7 days free of charge).

Results

The service was first offered in December 2003. It represented a new idea for the public. For this reason getting "the word out" was difficult at first, but once contact was made with different healthcare groups we had a lot of interest and assistance. Most health care and senior groups were happy to hand out brochures and notify their members, although often it was to "young seniors". We had some useful media coverage, including national and local newspapers and radio stations. When surveyed, our clients gave only positive feedback with most stating that they enjoyed the joke of the day, and that it gave them a good feeling knowing that they could remain safely in their own home.

In one marketing campaign we offered our services to 100 elderly people on a 30-day free trial. After the trial over 90% of clients discontinued the service. When we further surveyed the group to obtain reasons, we found that those clients that stayed with us were aged 75 years and over. The main response from clients aged below 75 years was that they saw themselves as "young seniors" and not in need of our service, but would be happy to use the service in the future. This young seniors group had mixed feelings about any in-home help services. They were torn between not wanting to be a burden on family and friends, while finding it hard to accept that they might need help to live at home. These mixed feelings were hard to face for most people and if feeling pressured they avoided the problem totally. This meant there could be a long interval between the client requesting information and them actually signing up. This long lead time had a negative effect on the profitability of the business.

For people living alone we found that three main emotions affected the group: worry, depression and fear of dying alone. It was because of these worries that clients signed up with us. They felt that Auto TeleCare could help ease their

worry and in the event of death their family would be contacted quickly. Also our clients were worried about strangers (hence the sign-up by telephone), but were very open and friendly to people who cared for them and assisted them.

The problem for the business was generating this trust in a very short period of time, so after 15 months the decision was made to close the business. Finding people aged 75 years and over living alone proved to be very costly and would have required advertising on TV and in national newspapers, which was outside the initial advertising budget. Combined with the long lead-time in the sales process, the investment of capital required to keep the business operational was eventually too high for the business owner. In the initial business plan the required number clients for commercial viability was calculated to be 3000 clients.

Other contributing factors were:

- *Direct selling.* The aim was to get potential customers to call Auto TeleCare on the 1300 number (i.e. for the cost of a local call) to obtain additional information on services and to sign-up for a free 7-day trial. This style of advertising was the most successful, and popular with our clients
- *Referral programme.* The aim was to encourage clients to refer the service to friends. This programme gave poor results, mainly because older clients had a very small social group, and tended to be less socially active
- *Developing a dealer network.* The aim was to develop joint ventures with different healthcare, religious or “older people” organizations to develop a long-term dealer network. In the end this did not work, for two reasons. First, most “senior groups” tended to attract a lot of “young seniors”, people who did not see the need for themselves in the short term. Second, health care groups or agencies often tended to refer people who needed a higher level of care (i.e. in-home care). Staff had to spend a considerable time reviewing the client’s needs and requirements before ascertaining this need, thereby increasing the operating cost of the business.

Thus although the Auto TeleCare service was successful in the technical sense, it was not ultimately successful in the commercial sense.

References

- 1 Australian Institute of Health and Welfare. *Older Australia at a Glance*. 3rd edn. Canberra, ACT: Australian Institute of Health and Welfare, 2002
- 2 Australian Bureau of Statistics. *Year Book Australia 2003* (Income and welfare household expenditure). See <http://www.abs.gov.au>. Last checked 15 July 2005

Case management and adherence to an online disease management system

Lucy Robertson, Michael Smith and Dennis Tannenbaum

Sentiens Pty Ltd, Perth, Australia

Correspondence:

Dr Lucy Robertson
Sentiens Pty Ltd
PO Box 842
West Perth
WA 6872
AUSTRALIA
(Fax: + 61 8 9481 1952; Email: lucyr@sentiens.com)

Summary

Non-adherence to treatment presents a significant obstacle to achieving favourable health outcomes. We have studied consumers' adherence to an online disease management system for depression, called Recovery Road. Recovery Road was implemented on a pilot basis for mental healthcare in Western Australia. Recovery Road was available for use by consumers and clinicians to augment usual treatment. One hundred and forty consumers who had been diagnosed with major depression were enrolled. Consumers were provided with education, progress monitoring, e-consultation, e-diary and online evidenced-based therapy. Consumers received varying levels of adherence reminders, ranging from no reminders to case management, which included personalised email and telephone follow-up in response to non-adherence. After the first seven sessions, the adherence was 82% in the case management group, 65% in the automatic reminders group and 70% in the no reminders group. The results suggest that case management increases adherence to online disease management systems.

Introduction

The management of chronic diseases has become an international health problem.[1. Disease management is a proactive, coordinated approach to the management of chronic illness across the continuum of care.[2]. Disease management aims to enhance health outcomes whilst maintaining costs and focuses on health promotion, treatment adherence, self-management and the prevention of health complications and illness exacerbation.

Disease management systems have been used successfully for chronic diseases such as asthma[3], diabetes[4] and heart failure.[5] Internet-facilitated disease management systems (e-DMS) can increase the dissemination of information, extend treatment options, increase accessibility to healthcare consumers and optimise the application of limited resources.[6-9]

Despite the benefits of e-DMS, such systems have been slow to diffuse within the Australian health sector. Individual components of such systems have been introduced, such as Internet-based therapy in mental healthcare. However, adherence to such interventions can be very low. Adherence to computerised mental health interventions seems to increase as the level of contact with service personnel increases. For instance, adherence to purely Internet-based interventions for depression and anxiety can be as low as 0.5-1.0% after 5-12 sessions (up to 12 weeks)[10,11], whereas adherence to computer-based interventions completed within a clinic with a facilitator can be as high as 62% after 8 months.[12]

In the present research, an e-DMS for depression, called Recovery Road, was implemented as an addition to usual treatment within public and private mental healthcare in Western Australia. We have examined the effect of adherence reminders on adherence to Recovery Road.

Methods

One hundred and forty consumers were referred to Recovery Road for depression as an adjunct to usual treatment. Most consumers (n=112) were referred from private psychiatric practices, 25 were referred from public psychiatric services and 3 were from general practice. All public mental health consumers were participants in a government-funded research trial. Private mental health consumers were either participants in a formal research trial or were paying consumers. One hundred and sixteen consumers used Recovery Road (aged 19-64 years; 71 female).

Participating consumers were referred by their clinician. Consumers gave informed consent and were sent via email a password, personal logon and instructions on how to use Recovery Road. They were then able to use Recovery Road without supervision. Selection criteria were as follows:

- previously or currently satisfying the diagnostic criteria for a major depressive episode
- access to a computer and the Internet
- willing to use the Internet as part of treatment
- willing to provide informed consent
- sufficient cognitive functioning and proficiency in English
- at least 18 years of age.

Recovery Road provided consumers with 12 progress monitoring and treatment sessions over 12 months. Consumers received progress monitoring questionnaires, progress graphs and summary progress reports. Additional online features included online evidence-based therapy, systematic education, a secure e-consultation system, an e-diary and a record of currently and previously prescribed medications.

Clinicians had access to progress monitoring outcomes and summaries of patients. Consumers received one of three types of adherence reminders:

- no reminders for sessions 1 to 5 and standard, automated email reminders for sessions 6 to 12 (n=53)
- standard, automated email reminders for all sessions and in response to non-adherence (n=49)
- case management, consisting of standard, automated email reminders for all sessions, and email and telephone follow up by a case manager in response to non-adherence (n=38, including all consumers in the public and private pilot studies). Case managers contacted consumers who had been non-adherent for approximately one week. Such contact was initiated via email and followed up with one or two additional email messages and/or a telephone call if the email was not replied to. The personalised messages reminded consumers to complete overdue Recovery Road sessions, offered technical assistance and encouraged them to persevere with Recovery Road.

The outcome measure was Recovery Road adherence.

Results

After the first seven sessions, the adherence was 82% in the case management group, 65% in the automatic reminders group and 70% in the no reminders group, Figure 1. For all groups, adherence tended to decline gradually over time. The size of the difference in adherence rates between case management and the other types of adherence reminders increased across the sessions.

Discussion

The results provide preliminary evidence that case management, in the form of personalised reminders, technical support and encouragement in response to non-adherence, increases consumers' adherence to Recovery Road. The adherence advantage of consumers who received case management increased over the sessions, which suggests that the adherence advantage would continue to increase as the sessions progressed. The findings failed to show a clear advantage of standard, automated reminders over no reminders.

Relative to other Internet-based mental health interventions (e.g. [10,11]), adherence to Recovery Road was very high for all types of adherence reminders. The most likely reasons for this difference are the higher levels of consumer contact and support, and the fact that consumers who used Recovery Road did so in conjunction with a treating clinician. Furthermore, unlike these interventions, Recovery Road provided many features in addition to the online therapy (e.g. progress monitoring, systematic education, e-consultation facility and e-diary). It remains to be seen how adherence rates to Recovery Road in the case management group compare to an adherence rate of 62% at 8 months.[12] While Proudfoot *et al.*'s adherence rates were high[12], the fact that consumers were required to complete the computerised intervention at a clinic in the presence of a facilitator increased the cost of the intervention and reduced its accessibility (and suitability for rural and remote populations) relative to completing the treatment sessions via the Internet.

It should be noted that differences in adherence rates across types of adherence reminders found in the present research cannot be solely attributed to this variable. Other factors differed between the groups (e.g. whether consumers were part of a formal research trial) and as such further research is needed to conclusively determine the effect of case management on adherence to online disease management systems. In addition, the cost-effectiveness of case management (and indeed the cost-effectiveness of the disease management system itself) requires investigation.

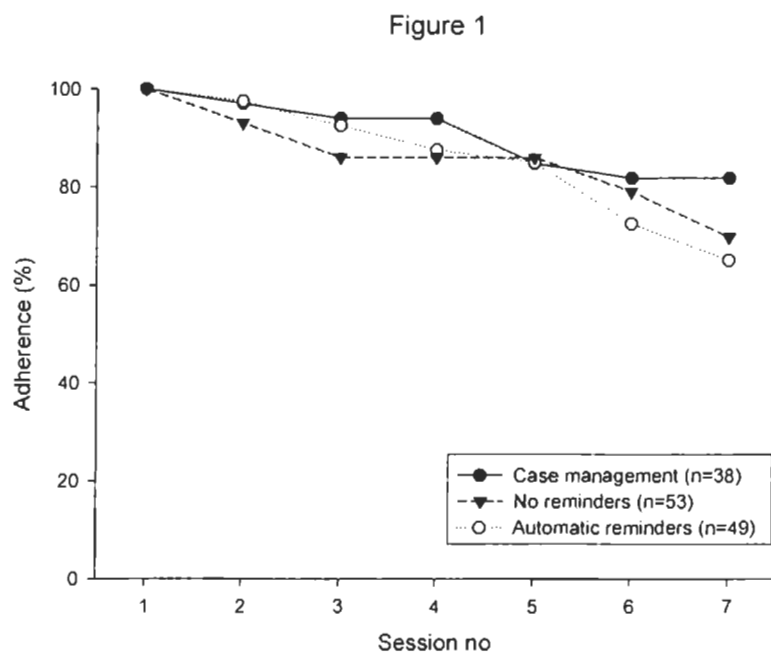
Acknowledgements

We thank the Office of Mental Health, Western Australian Department of Health and the Commonwealth Department of Health and Ageing for their financial contribution to the research. The views expressed are those of the authors and do not necessarily reflect the opinions of the Office of Mental Health or the Commonwealth Department of Health and Ageing.

References

- 1 World Health Organization. Chronic conditions: the global burden. 2004. See http://www.who.int/chronic_conditions/burden/en/index.html. Last checked 13 July 2005
- 2 Weingarten SR, Henning JM, Badamgarav E, *et al.* Interventions used in disease management programmes for patients with chronic illness - which ones work? Meta-analysis of published reports. *BMJ* 2002; **325**: 925
- 3 Glykas M, Chytas P. Technological innovations in asthma patient monitoring and care. *Expert Syst Appl* 2004; **27**: 121-31
- 4 Dimmick SL, Burgiss SG, Robbins S, Black D, Jarnagin B, Anders M. Outcomes of an Integrated Telehealth Network Demonstration Project. *Telemed J E Health* 2003; **9**: 13-23
- 5 LaFramboise LM, Todero CM, Zimmerman L, Agrawal S. Comparison of Health Buddy with traditional approaches to heart failure management. *Fam Community Health* 2003; **26**: 275-88
- 6 Houston TK, Cooper LA, Vu HT, Kahn J, Toser J, Ford DE. Screening the public for depression through the Internet. *Psychiatr Serv* 2001; **52**: 362-7
- 7 Kellen AS, Van Kuiken S. Health on-line: the best will get better. *McKinsey Quart* 2000; **4**: 131-5
- 8 Proudfoot JG. Computer-based treatment for anxiety and depression: is it feasible? Is it effective? *Neurosci Biobehav Rev* 2004; **28**: 353-63
- 9 Taylor CB, Jobson KO, Winzelberg A, Abascal L. The use of the Internet to provide evidence-based integrated treatment programs for mental health. *Psychiat Ann* 2002; **32**, 671-677
- 10 Christensen H, Griffiths KM, Korten AE, Brittliffe K, Groves C. A comparison of changes in anxiety and depression symptoms of spontaneous users and trial participants of a cognitive behavior therapy website. *J Med Internet Res* 2004; **6**: e46
- 11 Farvolden P, Denisoff E, Selby P, Bagby RM, Rudy L. Usage and longitudinal effectiveness of a Web-based self-help cognitive behavioural therapy program for panic disorder. *J Med Internet Res* 2005; **7**: e7
- 12 Proudfoot J, Ryden C, Everitt B, *et al.* Clinical efficacy of computerised cognitive-behavioural therapy for anxiety and depression in primary care: randomised controlled trial. *Br J Psychiatry* 2004; **185**: 46-54

Figure 1. Adherence to Recovery Road with time as a function of type of adherence reminders (no reminders, automated reminders or case management). Note that consumers in the 'no reminders' group received automated reminders in sessions 6 and 7.



Telemedicine for rural and remote child and youth mental health services

Ven-nice Ryan¹, Stephen Stathis¹, Anthony C Smith², Denisse Best¹ and Richard Wootton²

1 Child and Youth Mental Health Service, Royal Children's Hospital and Health Service District, Queensland, Australia

2 Centre for Online Health, University of Queensland, Australia

Correspondence:

Ven-nice Ryan
Child and Youth Mental Health Service
PO Box 1507
Fortitude Valley 4006
AUSTRALIA
(Fax: +61 7 3832 5642; Email: Ven-nice_Ryan@health.qld.gov.au)

Summary

The E-Child and Youth Mental Health Service (E-CYMHS) was designed to provide children and adolescents in Queensland with access to specialist mental health consultations using telemedicine. A project officer provided a single point of contact for referral management and clinic coordination, thereby reducing barriers of access to the service. Over a six-month period from November 2004, 42 point-to-point videoconferences were conducted to nine sites in Queensland. Three multipoint conferences were also conducted. Eleven videoconferences (24%) were arranged for administrative purposes, and 34 (76%) were conducted for the delivery of clinical services (30 patients). The referral and consultation activity suggests an improvement in the capacity of rural and remote mental health service providers to deliver specialist services for children and adolescents.

Introduction

In Queensland there are inequities in access to sub-specialist health care from rural areas. The Australian Institute of Health and Welfare has identified a critical shortages of psychiatrists in rural and remote areas[1], so it is reasonable to assume that children and adolescents in these regions who suffer from mental health problems experience difficulties in accessing specialist mental health opinion and care.

In delivering specialist mental health services to child and adolescent patients with complex psychological, behavioural and emotional needs it is considered best practice to have input from a child psychiatrist.[2] As a consequence, the E-Child and Youth Mental Health Service (E-CYMHS) was designed to provide children and adolescents with access to specialist mental health consultations using telemedicine. The service uses a full-time co-ordinator and a pre-booked routine clinic, to enhance access for the rural clinician. Previous research has identified the need for a co-ordinated service to reduce barriers to access to e-health services for the rural health professional.[3,4]

We have reviewed the first six months' use of the service.

Methods

The E-CYMHS telepsychiatry clinic was offered to four community mental health service centres, located at South Burnett, Moranbah, Charters Towers and Mt Isa. Sites were given access to a one hour, weekly telepsychiatry videoconference with the E-CYMHS team based at the Royal Children's Hospital in Brisbane. Additional sites could also access the service on an ad hoc basis. Seven specialists were involved in providing the service: three child psychiatrists, a clinical nurse, a social worker, a speech pathologist and a psychologist. The E-CYMHS coordinator participated in consultations to provide a multi-disciplinary dimension to the telepsychiatry services delivered. The co-ordinator also oversaw referral management and liaised with rural clinicians to improve access and to ensure that high-quality telepsychiatry services were delivered.

The majority of videoconferencing took place at a bandwidth of 128 kbit/s using standard videoconferencing equipment (Sony and Polycom) over the ISDN network. Activity records (including videoconference usage data) were used to analyse the type and frequency of activity that took place.

Results

Over a six-month period from November 2004, 42 point-to-point videoconferences were conducted to nine sites in Queensland. Three multipoint conferences were also conducted. Eleven videoconferences (24%) were arranged for administrative purposes, and 34 (76%) were conducted for the delivery of clinical services, see Table 1.

Table 1. Videoconference activity

Location	Videoconferences (total)	Administrative meetings	Clinical consultations	Total videoconference time (min)
Blackall	1	0	1	70
Cairns	1	1	0	60
Charters Towers	12	0	15	665
Kingaroy	9	3	13	565
Longreach	2	0	2	60
Moranbah	11	2	9	600
Mt Isa	4	1	4	200
Toowoomba	1	1	0	60
Winton	1	0	1	60
Multipoint*	3	3	0	180
Total	45	11	45	2520

*sites were: Mackay, Moranbah and Brisbane; Cairns and two sites in Brisbane; Moranbah, Charters Towers and Brisbane)

The number of consultations increased from 3 cases in November 2004 to 14 cases by April 2005 (Figure 1).

Discussion

Studies on paediatric telepsychiatry report that videoconferencing is an effective way of delivering specialist mental health services to children and adolescents' living in rural and remote areas.[5] This implies that the E-CYMHS programme has a useful role in providing a specialist mental health service to rural and remote locations that are likely to have a shortage of professional expertise. A critical element to uptake is ease of access to the service.[3,6,7] The results from our first six months of activity are promising and suggest that access barriers identified in previous studies have been minimised.[4,7,8] During the initial six month period, the ECYMHS project delivered 45 clinical consultations, compared to a previous mental health pilot study which generated a total of 17 e-health consultations in its first six months of operation.

Active participation of stakeholders in the design and delivery of telehealth contributes to successful and sustainable programmes.[3,9] We believe that the professional expertise of the coordinator is an important aspect of the service. The coordinator contributes to building effective relationships with stakeholders and ensures appropriate referral and case management. Our experience suggests that regular liaison with rural and remote health professionals and their service managers will ensure delivery of a flexible and appropriate service. This in turn enhances existing rural and remote mental health care, and allows children and adolescents with complex needs to benefit from rapid access to a child psychiatrist or other allied health specialists. It also obviates the need for travel, and mitigates against the "go without" attitude that rural patients may experience. Telepsychiatry is therefore an effective means for addressing workforce and service gaps, and providing clinical services where the relevant support and appropriate expertise was previously unavailable.

Challenges

Evaluating the effectiveness of telepsychiatry for improving patient outcomes is difficult. The present service only addresses a specific aspect of the patient's overall treatment, so an evaluation tool is being incorporated into the service model to examine this issue. Staff turnover in rural mental health services has implications for clinician confidence with the e-health medium. A strategy has been implemented to engage service managers who then orient new staff into the role of clinical champions and further drive the service. Access to sufficient child psychiatrist hours is a human resource challenge and expansion of the service will depend on further psychiatrist availability.

Conclusion

Preliminary data indicate that the service has been well accepted by the targeted districts, as evidenced by increasing referrals during the study period. The issue of an accessible service that is clinically responsive to the rural mental health professional remains a top priority.

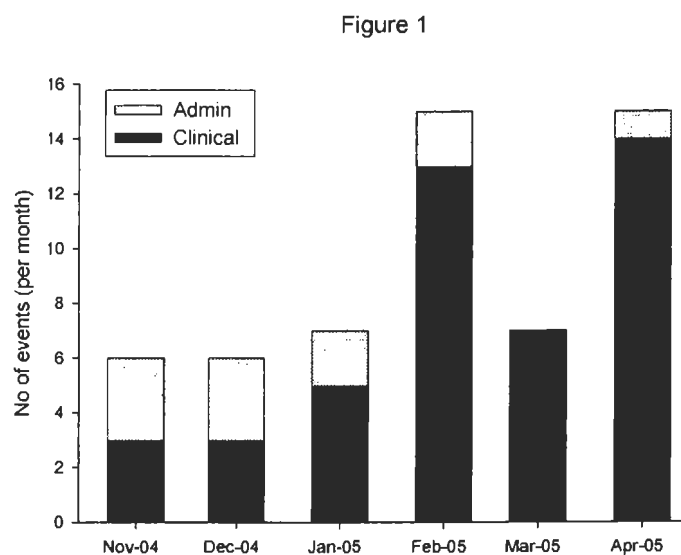
Acknowledgements

This project was funded by the Royal Children's Hospital Health Service District, the Northern Zone Mental Health Unit and the Mental Health Unit of Queensland Health. The Centre for Online Health at the University of Queensland and Statewide Telehealth Services Queensland Health provided advice.

References

- 1 Australian Institute of Health and Welfare. *Mental Health Services in Australia 1999–2000*. Canberra: AIHW, 2002. See <http://www.aihw.gov.au/publications/index.cfm/title/7434>. Last checked 18 July 2005
- 2 National Mental Health Working Group. *National Standards for Mental Health Services*. Canberra: Commonwealth Department of Health and Ageing, 1996
- 3 Smith AC, Isles A, McCrossin R, *et al.* The point-of-referral barrier--a factor in the success of telehealth. *J Telemed Telecare* 2001; **8** (suppl. 2): 75-8
- 4 Hockey AD, Yellowlees PM, Murphy S. Evaluation of a pilot second-opinion child telepsychiatry service *J Telemed Telecare* 2004; **10** (suppl. 1): 48-50
- 5 Pesamaa L, Ebeling H, Kuusimäki ML, Winblad I, Isohanni M, Moilanen I. Videoconferencing in child and adolescent telepsychiatry: a systematic review of the literature. *J Telemed Telecare* 2004; **10**: 187-92
- 6 Stanberry B. Telemedicine: barriers and opportunities in the 21st century. *J Intern Med* 2000; **247**: 615-28
- 7 Yellowlees P. Successful development of telemedicine systems – seven core principles. *J Telemed Telecare* 1997; **3**: 215-22
- 8 Anonymous. Telemedicine: fad or future? *Lancet* 1995; **345**: 73-4
- 9 Dossetor DR, Nunn KP, Fairly M, Eggleton D. A child and adolescent psychiatric outreach service for rural New South Wales: a pilot telemedicine study. *J Paediatr Child Health* 1999; **35**: 525-9

Figure 1. Videoconference activity during the first six months



Striving for evidence in e-health evaluation: lessons from health technology assessment

Marie-Pierre Gagnon and Richard E Scott

Global e-Health Research and Training Program, Health Telematics Unit,
University of Calgary, Canada

Correspondence:

Richard E Scott
Health Telematics Unit
University of Calgary
Health Sciences Centre G204
3330 Hospital Drive NW
Calgary
Alberta T2N 4N1
CANADA
(Fax: +1 403 270 8025; Email: rescott@ucalgary.ca)

Summary

Evaluation is crucial to the integration of e-health applications into the healthcare system and their ultimate sustainability. However, e-health evaluation is often criticised for the poor quality of research design, the lack of common outcome indicators and the absence of an agreed theory. Health Technology Assessment (HTA) could offer a sound methodological basis for e-health evaluation. However, there have been major concerns about the applicability of the HTA approach to the evaluation of e-health initiatives. Evaluators – and decision-makers – must accept that telehealth evaluation may serve different purposes for different stakeholders, and therefore concede that no single evaluation framework or methodology, even an RCT, is totally objective. To address the complex environment of telehealth evaluation, a participatory strategy is useful, whereby stakeholders are involved in the study design and definition of evaluation questions at each phase. This will also build confidence between the evaluation team and the stakeholders, facilitating informed decision-making through an integrated knowledge mobilisation activity.

Introduction

e-health encompasses a wide range of information and communication technologies (ICTs) applied to the health sector,[1] and includes the concept of 'borderless' health education and healthcare across geographical, time, social and cultural barriers.[2] Telehealth – or telemedicine – is one component of e-health. Recent systematic reviews[3,4] have identified evidence for the benefits of telehealth in certain applications, and policy-makers have recognised its value for patients, providers, organizations and the health care system.[5] However, the diffusion and integration of telehealth has been slow, due to the lack of scientific evidence of benefits to guide decision-making.[6,7] It is acknowledged that

integrated evaluations are essential to every telehealth project,[7-10] yet there is a dearth of literature about the actual contribution of telehealth evaluation to informed decision-making.

A general understanding of what constitutes 'evidence', and an agreement on how to judge it, is needed.[8] Furthermore, there is a lack of consensus on what constitutes appropriate methodology for evaluating telehealth.[11] Compounding this situation, telehealth is a field of clinical activity and technical development that must also meet many political imperatives.[12] To influence decision-making, evaluations should provide a sound description of the technical, clinical, economic, ethical, legal and organizational issues involved.[13]

Health technology assessment

Health technology assessment (HTA) is a multidisciplinary field of research directed at the production of scientific evidence about the efficacy and utility of health technologies, practices, and modalities of health care delivery.[14] HTA aims to produce policy relevant information about the efficacy, effectiveness, and cost-effectiveness of health technologies as well as the ethical and social implications of their use.[15,16] e-health can be considered as a broad category of health technologies.[17]

HTA typically includes: (1) an exhaustive summary of published literature on a given technology; (2) critical evaluation of the available information using meta-analysis techniques; (3) assessment of the effectiveness, security, and efficiency of the technology; (4) estimates of the key parameters (if published evidence is lacking); and (5) consideration of the ethical, social, cultural, organizational, and economic repercussions.[18] Ultimately, HTA should inform decision-making, but such reports have not led to the knowledge transfer hoped for.[19]

Telehealth evaluation models

Many evaluation frameworks, models, or guidelines have been suggested.[12,20] We present a selection of models, focusing on Canadian experience. Scott *et al.* [21] proposed an approach for the development of common outcome indicators for telehealth evaluation, and outlined a four-stage process for developing outcome indicators based on consensus building. They also argued that application of evidence-based medicine principles can lead to better definitions for outcome indicators, and presented a core set of indicators for telehealth evaluation.[22]

Economic evaluations are highly valued within the decision-making sphere. Hailey *et al.* [3,13,23] proposed a framework to assess the cost-benefits of telehealth applications based on systematic review of the literature. A general observation was the lack of good quality designs in primary research.[3]

The National Initiative for Telehealth Guidelines (NIFTE) cover a range of telehealth-related issues and provide a basis for an understanding of telehealth indicators and policy in Canada.[24,25] However, their impact on telehealth evaluation practices and policy-making is not yet known.

Discussion

Williams *et al.* discussed the challenges of integrating telehealth evaluation into the wider HTA field.[12] Some important contrasts between HTA and telehealth evaluation are shown in Table 1.

Table 1. Contrasts between HTA and telehealth evaluation

HTA	Telehealth evaluation
Hard technologies	Hard and soft technologies
Evaluation is stable and relies on a set of validated forms of measurements	Unstable nature, uncertain impact on healthcare organisation and professional structures
Agreed knowledge formed around shared rules about effectiveness (e.g. RCTs)	Lack of agreed knowledge about what constitutes effectiveness
Belief that evaluation is a purely apolitical activity to produce neutral facts	Political imperatives to produce high quality quantitative data about telehealth

For instance, Randomized Controlled Trials (RCTs) appear to be the most valued design to assess an intervention in HTA. As Williams *et al.* have noted,[12] decision-makers therefore expect RCTs. However, RCTs are not always the most appropriate research method.[26] Telehealth evaluation is a complex task. It must not only address the effects of technology itself on costs and health outcomes, but also the many human engineering (technology, functionality, workflow, structure) and socio-political interactions. It must also embrace the networked nature of telehealth, and associated interactions between different institutions with varying expectations and levels of responsibility. Furthermore, a central and confounding issue is: What (and whose) objective does an evaluation address? It is clear that different stakeholders will search for answers relevant to their specific focus.

Conditions for successful telehealth evaluation

Clearly, telehealth projects present features that determine the type of evaluation needed to inform decision-making. Desirable conditions for successful telehealth evaluations include:

- evaluating throughout the whole life cycle of projects
- establishing an agreed framework for needs assessment and priority-setting
- reaching common evaluation principles according to a consensual approach
- adopting rigorous methods from the biomedical, ICT, management, social, economic and political sciences
- involving stakeholders in the design and definition of evaluation questions
- addressing complex human factors engineering and interactions with stakeholders (governments, healthcare system, professional groups, providers, patients, communities, populations).

Telehealth, as an emerging and evolving field, requires time before its effects can be measured, requiring evaluation throughout the whole life cycle of projects.[7] What constitutes 'success' or 'failure' may vary between stakeholder groups,[8] thus the definition of agreed evaluation criteria constitutes a complex, but essential, task. Furthermore, despite important efforts, there remains no widespread consensus about what indicators should be used to assess telehealth outcomes. Similarly, there is no widespread consensus on evaluation designs and methods that ensure scientific quality and relevance for decision-making. However, evaluators – and decision-makers – must accept that telehealth evaluation may serve different purposes for different stakeholders, and therefore concede that no single evaluation framework or methodology, even an RCT, is totally objective.[16] For example, a qualitative, theory-driven evaluation permits a rational and valuable explanation of observed phenomena.

To address the complex environment of telehealth evaluation, a participatory strategy[27] is useful, whereby stakeholders are involved in the study design and definition of evaluation questions at each phase. This will also build confidence between the evaluation team and the stakeholders, facilitating informed decision-making through an integrated knowledge mobilisation activity.

Conclusion

Because telehealth applications are embedded in a specific context, generic and uniform evaluation methods are not applicable. Several telehealth specific evaluation models have been proposed, although the extent of their usage and their influence on decision-making are unknown. Learning from successful evaluation strategies and approaches of other disciplines fosters a culture of increased evaluation rigour. In that sense HTA, and other disciplines, could offer a basis for incorporating rigorous methods to develop and diffuse a multifaceted, comprehensive, participatory, and adaptable telehealth evaluation framework. Lessons learned from this would have an increased probability of being translated into policy decisions.

References

- 1 Mitchell J. Increasing the cost-effectiveness of telemedicine by embracing e-health. *J Telemed Telecare* 2000; **6** (suppl. 1): 16-9
- 2 Reid J. *A Telemedicine Primer: Understanding the Issues*. Billings, MT: Innovative Medical Communications, 1996
- 3 Hailey D, Ohinmaa A, Roine R. Study quality and evidence of benefit in recent assessments of telemedicine. *J Telemed Telecare* 2004; **10**: 318-24
- 4 Jennett PA, Affleck Hall L, Hailey D, *et al*. The socio-economic impact of telehealth: a systematic review. *J Telemed Telecare* 2003; **9**: 311-20
- 5 Jennett PA, Scott RE, Affleck Hall L, *et al*. Policy implications associated with the socio-economic and health system impact of telehealth: a case study from Canada. *Telemed J E Health* 2004; **10**: 77-85
- 6 May C, Williams TL, Mort M, Mair FS, Gask L. *What factors promote or inhibit the effective evaluation of telehealthcare interventions?* Final report to the Department of Health of Grant ICT/032. <http://www.disco.port.ac.uk/ictri/projects/reports/May.pdf>. Last checked 12 July 2005

- 7 Ammenwerth E, Graber S, Herrmann G, Burkle T, König J. Evaluation of health information systems – problems and challenges. *Int J Med Inform* 2003; **71**: 125-35
- 8 Wootton R, Hebert MA. What constitutes success in telehealth? *J Telemed Telecare* 2000; **7** (suppl. 2): 3-7
- 9 Kreps GL. Evaluating new health information technologies: expanding the frontiers of health care delivery and health promotion. *Stud Health Technol Inform* 2002; **80**: 205-12
- 10 Scott RE, Coates K, McCarthy GF. The value of evaluation framework for telehealth initiatives. *Stud Health Technol Inform* 1999; **64**: 39-45
- 11 May C, Mort M, Williams T, Mair F, Gask L. Health technology assessment in its local contexts: studies of telehealthcare. *Soc Sci Med* 2003; **57**: 697-710
- 12 Williams T, May C, Mair F, Mort M, Gask L. Normative models of health technology assessment and the social production of evidence about telehealth care. *Health Policy* 2003; **64**: 39-54
- 13 Hailey D, Ohinmaa A, Roine R. *Recent Studies on Assessment of Telemedicine: Systematic Review of Study Quality and Evidence of Benefit*. Working Paper 03-04. Edmonton: Institute for Health Economics Working Papers Series, 2003
- 14 Woolf SH, Henshall C. Health technology assessment in the United Kingdom. *Int J Technol Assess Health Care* 2000; **16**: 591-625
- 15 Lehoux P, Blume S. Technology assessment and the sociopolitics of health technologies. *J Health Polit Policy Law* 2000; **25**: 1083-120
- 16 Leys M. Health care policy: qualitative evidence and health technology assessment. *Health Policy* 2003; **65**: 217-26
- 17 Lehoux P, Battista R. Évaluation des technologies de la santé au Québec: Bilans et défis. [Health technology assessment in Quebec] In: Lemieux V, Bergeron P, Bégin C, Bélanger G, eds. *Le système de santé au Québec: Organisations, acteurs et enjeux*. Quebec: Presses de l'Université Laval, 2003: 435-64
- 18 Agence d'Évaluation des Technologies et des Modes d'Intervention en Santé [Agency for Health Services and Technology Assessment]. Quebec. http://www.aetmis.gouv.qc.ca/en/mod.php?mod=userpage&menu=23&page_id=27. Last checked 12 July 2005
- 19 Lavis JN, Ross SE, Hurley JE, et al. Examining the role of health services research in public policymaking. *Milbank Q* 2002; **80**: 125-54
- 20 Health Canada. *Office of Health and the Information Highway. Evaluating Telehealth 'Solutions'. A Review and Synthesis of the Telehealth Evaluation Literature* 2000. http://www.hc-sc.gc.ca/ohih-bis/pubs/2000_tele/tele_e.html. Last checked 12 July 2005
- 21 Scott RE, McCarthy GF, Jennett P, Perverseff T, Palacios M, Rush B. *National Telehealth Outcome Indicators Project (NTOIP). Project information document and a synthesis of telehealth outcomes literature*. Health Telematics Unit, University of Calgary, 2003. http://www.md.ucalgary.ca/Medicine/Centres/TeleHealth/NTOIP/_resources/InformationDocument.pdf. Last checked 12 July 2005
- 22 Rush B, Scott RE. *Approved telehealth outcome indicators guidelines: Quality, access, acceptability, and cost*. Health Telematics Unit, University of Calgary, June 2004. <http://www.canarie.ca/funding/ehealth/publications/NTOIP.pdf>. Last checked 12 July 2005

- 23 Hailey D, Jennett P. The need for economic evaluation of telemedicine to evolve: the experience in Alberta, Canada. *Telemed J E Health* 2004; **10**: 71-6
- 24 National Initiative for Telehealth Framework of Guidelines (NIFTE). Canada: National Initiative for Telehealth (NIFTE), September 2003. <http://cst-sct.org/resources/FrameworkofGuidelines2003eng.pdf>. Last checked 12 July 2005
- 25 MacDonald-Rencz S, Craddock T, Parker-Taillon D. The national initiative for telehealth guidelines. *Telemed J E Health* 2004; **10**: 113-4
- 26 Eisenberg JM. Ten lessons for evidence-based technology assessment. *JAMA* 1999; **17**: 1865-9
- 27 Greene J. Stakeholder participation in evaluation design: Is it worth the effort? *Eval Program Plann* 1987; **10**: 379-94

An e-health needs assessment of medical residents in Cameroon

Richard E Scott¹, Peter Ndumbe² and Richard Wootton³

¹Global e-Health Research and Training Program, Health Telematics Unit,
University of Calgary, Alberta, Canada

²Faculty of Medicine and Biomedical Sciences, Yaounde I University, Cameroon

³Centre for Online Health, University of Queensland, Australia

Correspondence:

Dr Richard E Scott
Health Telematics Unit
University of Calgary
G204 Health Sciences Centre
3330 Hospital Drive NW
Calgary T2N 4N1
Alberta
CANADA
(Fax: +1 403 270 8025; Email: rescott@ucalgary.ca)

Summary

Medical residents from Yaounde I University in Cameroon are required to spend periods of time in rural or remote locations to complete their training. To determine if e-health might lessen their isolation and enhance patient care, a needs assessment of the residents was performed using a brief questionnaire (five items) about the situation in which residents found themselves outside their medical school environment. We gave the questionnaires to 45 residents. Seventeen questionnaires were returned, a response rate of 38%. Most residents indicated that the ability to contact a mentor would have either made them feel more confident (16 or 94%) or altered their handling of recent cases (15 or 88%). All residents had access to a mobile phone, and many (11 or 65%) had used it to contact a medical colleague for guidance. A low cost and technologically simple telemedicine solution that maximized use of mobile phone capability, provided access to medical and healthcare information, and permitted exchange of images would be an appropriate response to the identified needs.

Introduction

Cameroon, population 15 million, ranks 141st of 177 on the UN Human Development Index. The doctor to patient ratio is 1:12,500, infant mortality exceeds 6% and only half the population has access to safe drinking water. Health services are provided by both the government and the private sector. Healthcare reform was initiated by the government in 1998 and formally adopted in 2001 through the Health Sector Strategy document that included implementation of benchmark measurement for evaluation[1]. There are roughly 250 hospitals in

Cameroon, but access to facilities is extremely limited outside of the major cities (Yaounde and Douala). This is due, in part, to the inability of most people to pay for treatment.

Experience with telemedicine in Cameroon has been very limited. A PubMed search linking 'Cameroon' with 'telemedicine', 'telehealth', or 'e-health' revealed no articles or reports. Internet searching identified only one study but no report[2]. This lack of experience was confirmed during a visit and meetings with officials from the Cameroon Ministry of Health in Yaounde during the summer of 2004 by two of the investigators. Of note was the growing interest in, and early planning stages for, implementation of broad 'e-health' (telehealth / telemedicine + health informatics) initiatives, and a recently developed 'Health Strategy' to 2007. Information and communications technology (ICT) infrastructure remains an issue, e.g. there are just 6 telephone lines per 1000 people in Cameroon (compared with about 700 in Canada). Cameroon's relative political, social, economic and religious stability is of value, minimising the risk of disruption by civil unrest or political turmoil, and permitting research and implementation of low-cost e-health solutions to develop and grow with some security.

We have conducted a study to identify e-health options based on local healthcare needs.

Methods

We developed and reviewed for face validity a simple survey tool (Appendix 1). The questionnaire was designed to be brief, and to highlight the 'real-life' situation in which residents found themselves when completing their residency training in locations outside their medical school environment. Residents were first asked to relate two of their most significant clinical encounters experienced during the past 5 weeks, and to then respond to questions designed to assess if virtual access to mentors or medical information would have been useful or changed the way in which they handled these clinical situations. This qualitative approach was intended to provide an understanding of the potential for telemedicine to affect their provision of care. In addition, the availability and use of cellular telephones, electricity and the Internet were assessed, and finally residents were questioned about the value of sharing pictures of clinical encounters. All residents going outside Yaounde were given a questionnaire and asked to complete and return it after 5 weeks of placement.

Results

We gave the questionnaires to 45 residents. Seventeen questionnaires were returned, a response rate of 38%. Eight were in English and nine in French – French responses were translated into English before analysis. All residents provided two short case descriptions. The clinical experiences represented in the residents' case studies covered a wide variety of clinical fields (general medicine, obstetrics and gynaecology, paediatrics, oncology, surgery, trauma, suicide attempts, mental health issues and poisonings). Patients ranged in age from 2 months to 87 years.

Question 2: Most residents indicated that the ability to contact a mentor would have either made them feel more confident (16 or 94%) or altered their handling of the cases described (15 or 88%). All responses centred on the desire to confirm or improve patient management decisions. One resident commented "... I had done all in my capacity, hence I really needed assistance to continue the patient's management ... the help of a consultant would have been of immeasurable value". However, another noted "But I would have trembled and (have been) less confident in the presence of a consultant at Yaounde" highlighting the need to address appropriate development of any virtual consulting service.

Question 3: All residents indicated that access to information would have made them feel more confident, but only 14 (82%) indicated that this would have altered their handling of the cases described. One profound case described treatment of neonatal meningitis in a 2-month infant. One physician initiated treatment using 3 antibiotics plus 10% glucose in Ringers Lactate, but a second physician soon changed the treatment and discontinued the glucose infusion. The infant subsequently died from suspected hypoglycemia. The first physician believed that ready access to medical information would have permitted him to successfully challenge the second physician's management, potentially saving the infant's life. He commented "... more especially, the ready availability of a treatment protocol would enable a uniform way of managing patients' problems generally though specificities may vary ... This could also help most of the foreign trained doctors in managing local diseases". Another resident stated "Nowadays the talk in medicine is 'Evidence-Based Medicine' or EBM, so having access to such information would make one feel so confident and able to (do) more with the time as the world changes". In contrast, one resident noted "In this case we required practical experience, rather than knowledge from books".

Question 4: Most felt that access to healthcare information would make them feel more confident (14 or 82%). As one resident noted "In the field we notice that many practices now outdated and inadvisable are still anchored in people's habits. Information that is dependable and that can be demonstrated (would allow) medical and paramedical staff, and the community, to fight against these archaic practices". Another commented "What we could say in several sentences, sometimes difficult or incomprehensible by the population, is often explained in a language that is easily accessible to everyone and certain images speak by themselves". The potential for generally improved care was highlighted in the comment "... I would have to manage only more complicated problems, my personnel will avoid silly errors in my absence or before my arrival and the community will do everything to prevent disease and will thus save the time and money spent while in the hospital".

Questions 5: All residents had access to a mobile phone, and many (11 or 65%) had used it to contact a medical colleague for guidance. Most had regular electricity (15 or 88%), but only one (6%) had access to the Internet. Most (14 or 82%) agreed that sharing an image with a colleague would have been useful for a consultation. In a response to an earlier question, one resident noted the value of having available a consultant's review of X-rays.

Discussion

The potential value of telemedicine applications for developing countries has been documented.[3] Furthermore, it is clear from the medical resident's comments about improved patient management, healthcare provider education, and community education and surveillance, that the potential of e-health solutions is fully appreciated. Of note were additional comments describing a lack of other technological solutions, such as laboratory and radiology tests, which also affects healthcare in Cameroon. Despite the recognised potential, application of e-health solutions in developing countries remains low or non-existent. Some possible reasons discussed during the site visit to Cameroon in 2004 included concern over a perceived lack of ICT infrastructure. However, sustainable low cost, low technology solutions have been implemented.[4] A second reason was concern over the relative priority of e-health solutions versus more fundamental and immediate public health needs. But the risk for developing countries in not introducing viable e-health solutions has been noted.[5] A final reason, and perhaps the most significant, was the confusing range of opportunities – there was a lack of a clear and simple healthcare need that could be accommodated through an e-health application. Needs assessment is a recognised prerequisite for appropriate use of such solutions.[6] While many 'health needs assessment' strategies and tools exist, there are few suitable 'e-health needs assessment' strategies and tools within this overall framework. Proponents of e-health solutions could provide a service to developing countries by establishing and validating such strategies and tools.

Conclusion

A low cost and technologically simple telemedicine solution that maximised use of mobile phone capability, provided access to medical and healthcare information, and permitted exchange of images would be an appropriate response to the identified needs of medical residents providing care in rural and remote Cameroon.

Acknowledgements

We thank the Medical Residents of Yaounde I Medical School for contributing their time, and sharing their experiences and opinions, and also acknowledge the Canadian Institutes for Health Research for their support through an International Development Planning Grant.

References

- 1 Ndumbe PM, Daniels N, Bryant J. The utilisation of 'benchmarks' in the evaluation of health sector reforms in Cameroon. 131st Annual Meeting of American Public Health Association. November 2003. See http://www.hsph.harvard.edu/benchmark/pdf/Cameroon_report.pdf#search=Cameroon%20health%20strategy. Last checked 20 July 2005
- 2 International Telecommunication Union. Telemedicine in Cameroon (formerly: Remote monitoring of pregnant women). See <http://www.itu.int/ITU-D/projects/projectdetailsp.asp?project=9CMR98010>. Last checked 20 July 2005
- 3 Wright D. Telemedicine and developing countries: A report of Study Group 2 of the ITU Development Sector. *J Telemed Telecare* 1998; 4 (suppl. 2): 1-85

- 4 Swinfen R, Swinfen P. Low-cost telemedicine in the developing world. *J Telemed Telecare* 2002; **8** (suppl. 3): 63-5
- 5 Scott RE, Palacios MF. e-Health - Challenges of going global. In: Scott CM, Thurston WE, eds. *Collaboration in Context*. Institute for Gender Research and Health Promotion Research Group, University of Calgary, 2003: 45-55
- 6 Doolittle GC, Cook DJ. Defining the needs of a telemedicine service. In: Wootton R, Craig J, eds. *Introduction to Telemedicine*. London: Royal Society of Medicine Press, 1999: 79-92

Appendix 1. Survey questions

Question 1: Please briefly describe the TWO most significant clinical problems you have had to deal with during the last 5 weeks. Explain what led up to the situation, what you were able to do for the patient, and what else you may have wished to have done for the patient, but were unable to do.

Question 2: Imagine if you had the ability to contact a mentor or consultant at Yaounde to seek their guidance while you were in the field. 2a: Would this make you feel more confident? 2b: Would this have made a difference in how you handled either of the situations you described above? If 'Yes' to 2b – please describe how it might have helped.

Question 3: Imagine if you had the ability to access any information you wanted (e.g. textbook, journal article, treatment protocol, clinical practice guideline) while you were in the field. 3a: Would this make you feel more confident? 3b: Would this have made a difference in how you handled either of the situations you described above? If 'Yes' to 3b – please describe how it might have helped.

Question 4: Imagine if you had access to simple healthcare information that you could share with your patients or with other healthcare workers in the field. 4a: Would this make you feel more confident? 4b: How do you think this might help you, your patients, and the community where you work? Please briefly describe.

Question 5: While you are in the field: 5a: Do you have access to a mobile 'phone? Yes/No. 5b: If yes, have you used it to contact a medical colleague for guidance? Yes/No. 5c: Do you usually have electricity? Yes/No. 5d: Do you have access to the Internet? Yes/No. 5e: Would sharing a picture (e.g. of a wound) with a colleague in Yaounde have been useful for a consult? Yes/No.

Real-time telemedicine for paediatric ENT pre-admission screening

Anthony C Smith¹, Judy Williams², Julie Agnew³, Stephen Sinclair², Karen Youngberry¹ and Richard Wootton¹

1 Centre for Online Health, University of Queensland, Australia

2 Bundaberg Base Hospital, Queensland, Australia

3 Royal Children's Hospital, Queensland, Australia

Correspondence:

Anthony C Smith
Centre for Online Health
Level 3, Foundation Building
Royal Children's Hospital
Herston 4029
AUSTRALIA
(Fax: +61 7 3346 4705; Email: a.smith@pobox.com)

Summary

We conducted a feasibility study to examine whether a paediatric patient at a regional hospital could be assessed by an ear, nose and throat (ENT) specialist via videoconference, therefore saving at least one journey to the tertiary hospital for a pre-admission appointment. A video-otoscope was used with standard videoconference equipment and real-time images were transmitted at a bandwidth of 384 kbit/s. 13 telepaediatric ENT clinics were conducted between November 2003 and April 2005 and 98 consultations were facilitated for 64 patients. The main reasons for referral were recurrent tonsillitis (25%) and obstructive sleep apnoea (23%). Of the 64 patients examined by telemedicine, 42 (66%) were recommended for surgery and placed on the surgical waiting list. 12 patients (19%) required travel to the tertiary centre for further investigations and tests not available locally, whilst four patients (6%) were reviewed via videoconference during a scheduled clinic. Six patients (9%) required no further follow-up after their initial telepaediatric consultation. Videoconferencing is an effective method of assessing ENT conditions of paediatric patients and for pre-screening potential surgical admissions to a tertiary hospital. Careful consideration of a number of economic and logistical factors needs to be made before serious investment to expand the service.

Introduction

Most specialist paediatric health services in Queensland are centralised in the south-east corner of the state. This results in extensive travel for patients living in regional and remote areas who are referred for specialist treatment. A review of admission and outpatient data at the Royal Children's Hospital (RCH) for the 12-month period until June 2004 showed that 5134 outpatient appointments were for children attending for pre-surgical assessment and/or review by an ear, nose and throat (ENT) specialist. 205 of these appointments (4%) were for children referred from Bundaberg hospital, which is situated about 400 km north of Brisbane.

Children attending an outpatient appointment who are then recommended for surgery normally return home and wait for a scheduled operation date. Depending on the level of urgency, the waiting period is 4-16 weeks. Thus children who require ENT surgery travel to Brisbane at least twice: the first time for assessment and the second time for elective surgery. Additional appointments are usually required for post-operative outpatient care.

Specialist ENT health services can be delivered to patients in a number of ways. The conventional method is for the patient to see the specialist in person at the tertiary hospital or at the local hospital during an outreach clinic. Less commonly, the patient may be able to meet with the specialist via videoconference (real-time telemedicine) or alternatively have clinical information recorded and sent to the specialist for review (pre-recorded telemedicine). There has been limited experience of ENT telemedicine reported in the literature.[1-3]. Pioneering work in this field was done by Pedersen who described the use of endoscopic cameras and videoconferencing systems in Norway.[4,5] Other reports of tele-ENT have described specific services related to military medicine [6,7] the use of pre-recorded still images for clinical assessments [8-10], diagnostic accuracy [11] and cost-effectiveness.[12] There appear to have been no previous reports of tele-ENT in Queensland.

The present study was designed to confirm whether an ENT surgeon could pre-screen and make a decision regarding the clinical management of children seen via videoconference.

Methods

Starting in November 2003, monthly videoconference clinics were arranged, involving the regional paediatrician, the patient and family in Bundaberg, and the ENT specialist in Brisbane. Patients in Bundaberg who needed referral to an ENT specialist were given an appointment to the next available telepaediatric clinic and seen via videoconference instead of automatically travelling to Brisbane.

All consultations involved the paediatrician in the regional hospital and the ENT surgeon at the Royal Children's Hospital in Brisbane. Telepaediatric coordinators provided technical support at both sites during each clinic. A video-otoscope (Flexiscope Microvision ENT Camera, Inline Systems) was connected to the videoconference system (ViewStation FX, Polycom) so that images of the ear, nose and throat could be transmitted in real time to the ENT surgeon based in Brisbane (Figure 1). Consultations were conducted via videoconference at a bandwidth of 384 kbit/s using digital lines (ISDN).

A review of all telepaediatric records was conducted to identify all patients who had an ENT consultation at Bundaberg Hospital between November 2003 and April 2005. Clinic records were collected including date of clinic, duration and number of consultations per clinic. Outcomes were recorded by the telepaediatric coordinator after each consultation and chart records were also examined for information related to follow-up and pre-surgical arrangements.

We also conducted a follow-up telephone survey of the families involved in the study to assess their level of satisfaction and the main benefits to the family, in order to discover if there were savings in time, money or stress. Permission for the study was granted by the appropriate ethics and hospital committees.

Results

During the study period, 13 telepaediatric ENT clinics were conducted. Five clinics were cancelled in advance due to the anticipated absence of either the regional paediatrician or the ENT specialist. A total of 98 consultations were facilitated for 64 patients. The patients were aged from 14 months to 15 years old (median 7; IQR 4-9). The median number of consultations per clinic was 8 (IQR 6-9), see Figure 2. The median duration of each clinic was 120 min (IQR 90-135). The main reasons for referral of the 64 patients to the clinic were recurrent tonsillitis (25%) and obstructive sleep apnoea (23%), see Figure 3.

Consultation outcomes

In all cases presented via videoconference the ENT surgeon was able to make a decision regarding appropriate management. Of the 64 patients seen, 32 (66%) were recommended for surgery and placed on the surgical waiting list. 12 patients (19%) required travel to the RCH for further investigations and tests (not available in Bundaberg) whilst four patients (6%) were recommended for local treatment and reviewed via videoconference during a scheduled clinic. Six patients (9%) required no further follow-up after their initial telepaediatric consultation.

Patient satisfaction

We were able to contact 21 of the families of the 64 patients (33%) and all of them agreed to participate in the telephone survey. Feedback overall was very positive (Table 1).

Table 1. Proportion (%) of parents' responses related to satisfaction of consultations conducted via videoconference (n=21)

	SA	A	N	D	SD
I could see the specialist clearly	100	0	0	0	0
I had trouble hearing what was said	0	5	0	10	86
I was able to say what I wanted	67	29	0	5	0
I was worried that others might have been listening	0	0	0	14	86
The TV camera made me feel uncomfortable	0	5	0	19	76
The appointment saved me money	76	24	0	0	0
The appointment saved me time	86	14	0	0	0
The appointment saved me stress	71	19	5	5	0
I was confident that my condition could be sorted out via videoconference	62	24	5	10	0
The appointment was not as good as 'face to face'	0	10	0	29	62

SA-Strongly agree; A-Agree; N-Neutral; D-Disagree; SD-Strongly disagree

All families strongly agreed that they could see the specialist clearly on the screen. Only one family had difficulty in hearing the specialist, but this was due to the parent having a significant hearing impairment. The majority of families (96%) felt that they had an opportunity to say everything that they wanted. One family felt that their appointment was rushed and therefore would have liked to spend more time discussing other aspects of their child's health. No family reported that they were worried about others listening during their consultation, and 95% of families agreed that the camera did not make them feel uncomfortable. All families agreed that the videoconference appointment saved them money and time. 90% of families agreed that the appointment saved them stress. 86% of families said that they were confident that their child's condition could be sorted out via videoconference. The other three families maintained a neutral position or disagreed because they still had to travel to Brisbane for more comprehensive tests before a decision could be made regarding treatment. 91% of families disagreed with the statement "The appointment was not as good as face-to-face". Many families described how they would normally have had to drive all the way to Brisbane and then all the way home just for a ten minute appointment in Brisbane.

Discussion

We believe that there were a number of factors which contributed to the success of the ENT telemedicine work. First, it was well supported by an ENT specialist and a regional paediatrician. Second, all clinics were coordinated and supported by a telepaediatric coordinator, which meant that all technical aspects related to the videoconferencing and operation of the video-otoscope were managed so that the clinicians could focus on the consultation with the family.[13] Third, clinics were established on a routine basis to help with the referral of patients in the regional hospital and to ensure the availability of specialist and regional staff.

Should expansion of the work be contemplated, careful consideration must be given to the logistics, such as the availability of specialist staff in Brisbane and

ongoing funding to ensure sustainability. Providing adequate technical support is also essential. This permits both the consultant and regional paediatrician to participate in consultations without worrying about the technical aspects of the videoconference. Availability of the specialist is another important factor. Technically, equipment could be set up in a large number of hospitals, but without the specialist available to make the diagnosis and recommend treatment, this would be a wasted investment.

The present study showed that with experience, consultations between the regional paediatrician and the ENT specialist became more efficient and better organised. This was mainly due to the increasing poise of the regional paediatrician in using the equipment and the growing confidence of the ENT surgeon in making decisions based on images seen via videoconference. Technically the service worked extremely well, with only one technical problem occurring during the early months of the study. In this case, we had difficulties establishing a videoconference connection and noticed that the ISDN outlet for the regional system had been damaged. Fortunately, repairs were made just before the start of the clinic, avoiding delay.

Image quality at a bandwidth of 384 kbit/s was adequate for assessment by the ENT specialist, confirming the results of Pedersen [4] and Patricoski.[11] In about 10% of cases, the build up of wax in the patient's ear canal prevented a clear view of the ear drum and therefore the clinical history and opinion of the regional doctor were used to formulate a management plan. The specialist found that the majority of cases presented via videoconference could be dealt with appropriately, saving at least one trip to Brisbane. The service was not intended to replace all trips to Brisbane. As reported, at least two families had to travel to Brisbane for further tests and investigations not readily available in Bundaberg.

The economics of tele-ENT require further study. If each videoconference appointment saved families at least one potential journey to Brisbane, there would have been savings from avoided travel. We also know from previous work that the costs incurred by families having to travel to Brisbane for an appointment are substantially greater than the costs for families who are able to see a specialist via videoconference at their local hospital.[14] Against these potential savings, there are additional costs in using telemedicine compared with conventional management.

Videoconferencing is an effective method of assessing otorhinolaryngological conditions of regional paediatric patients and for pre-screening potential surgical admissions to the tertiary hospital. Our feasibility study showed that the technique is feasible and useful. However, careful consideration of a number of economic and logistical factors needs to be made before serious investment in videoconference and video-otoscope equipment to expand the service.

Acknowledgements

Funding was provided by the Commonwealth Department of Health and Ageing (Medical Specialist and Assistance Programme). We thank the nursing staff in the Bundaberg paediatric unit for their assistance with the coordination of families and clinic appointments.

References

- 1 Burgess LP, Holtel MR, Syms MJ, Birkmire-Peters DP, Peters LJ, Mashima PA. Overview of telemedicine applications for otolaryngology. *Laryngoscope* 1999; **109**: 1433-7
- 2 Eikelboom RH, Atlas MD. Tele-otology for children with chronic ear disease. In: Wootton R, Batch J, eds. *Telepediatrics: Telemedicine and Child Health*. London: The Royal Society of Medicine Press, 2005: 163-74
- 3 Goldenberg D, Wenig BL. Telemedicine in Otolaryngology. *Am J Otolaryngol* 2002; **23**: 35-43
- 4 Pedersen S, Hartviksen G, Haga D. Teleconsultation of patients with otorhinolaryngologic conditions. A telendoscopic pilot study. *Arch Otolaryngol Head Neck Surg* 1994; **120**: 133-6
- 5 Pedersen S, Holand U. Tele-endoscopic otorhinolaryngological examination: preliminary study of patient satisfaction. *Telemed J* 1995; **1**: 47-52
- 6 Melcer T, Hunsaker D, Crann B, Caola L, Deniston W. A prospective evaluation of ENT telemedicine in remote military populations seeking specialty care. *Telemed J E Health* 2002; **8**: 301-11
- 7 Melcer T, Crann B, Hunsaker D, Deniston W, Caola L. A retrospective evaluation of the development of a telemedicine network in a military setting. *Mil Med* 2002; **167**: 510-5
- 8 Eikelboom RH, Atlas MD, Mbao MN, Gallop M. Tele-otology: planning, design, development and implementation. *J Telemed Telecare* 2002; **8** (suppl. 3): 14-7
- 9 Eikelboom RH, Weber S, Atlas MD, Dinh Q, Mbao MN, Gallop MA. A tele-otology course for primary care providers. *J Telemed Telecare* 2003; **9** (suppl. 2): 19-22
- 10 Mbao MN, Eikelboom RH, Atlas MD, Gallop MA. Evaluation of video-otoscopes suitable for tele-otology. *Telemed J E Health* 2003; **9**: 325-30
- 11 Patricoski C, Kokesh J, Ferguson AS, *et al*. A comparison of in-person examination and video otoscope imaging for tympanostomy tube follow-up. *Telemed J E Health* 2003; **9**: 331-44
- 12 Bergmo TS. An economic analysis of teleconsultation in otorhinolaryngology. *J Telemed Telecare* 1997; **3**: 194-9
- 13 Smith AC, Isles A, McCrossin R, *et al*. The point-of-referral barrier-a factor in the success of telehealth. *J Telemed Telecare* 2001; **7** (suppl. 2): 75-8
- 14 Smith AC, Youngberry K, Christie F, *et al*. The family costs of attending hospital outpatient appointments via videoconference and in person. *J Telemed Telecare* 2003; **9** (suppl. 2): 58-61

Figure 1. (a) video-otoscope being used by the regional paediatrician to transmit images of the ears, nose and throat to the specialist in Brisbane; (b) images being reviewed via videoconference in Brisbane by the ENT surgeon and her registrar as part of the consultation with the referring doctor and family.

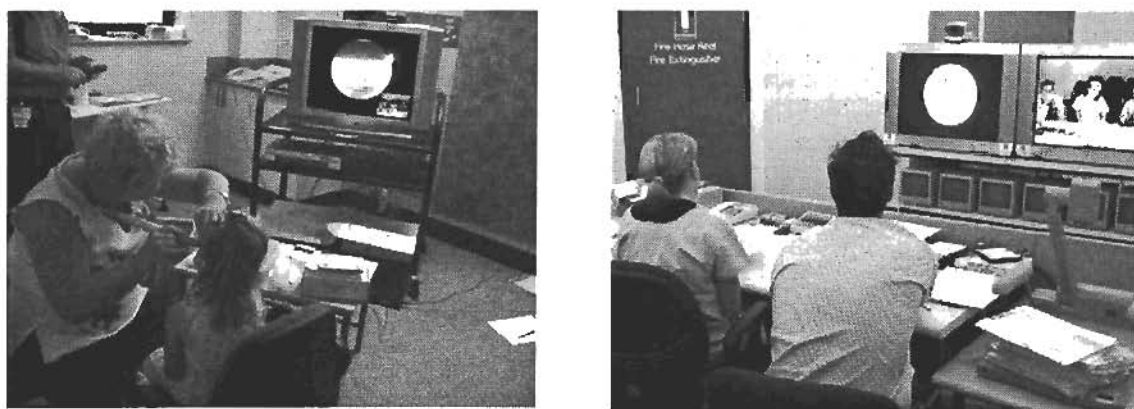


Figure 2. Number of consultations per clinic

Figure 2

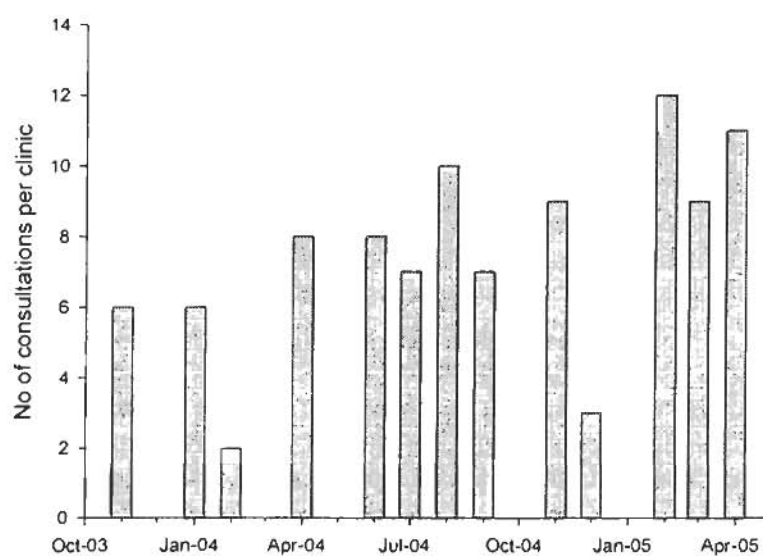
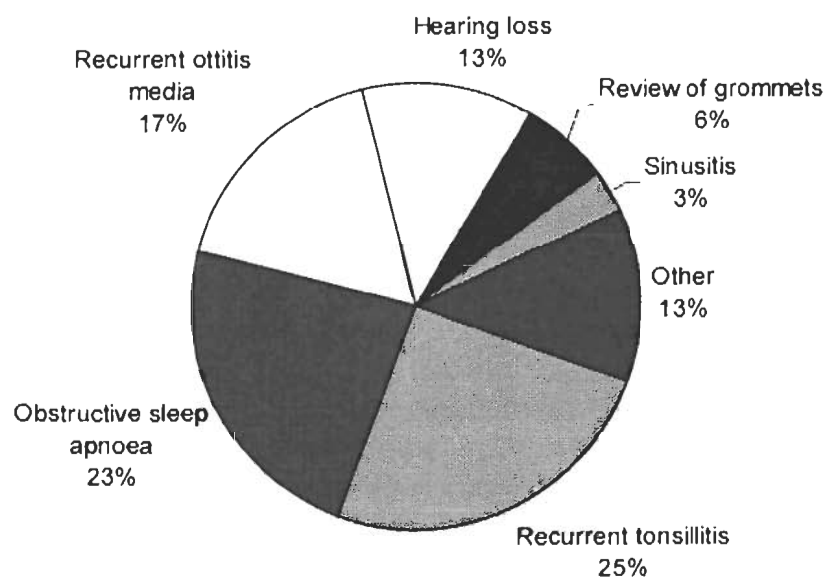


Figure 3. Primary diagnosis at time of telepaediatric consultation (n=64)



Wireless telemedicine for the delivery of specialist paediatric services to the bedside

Anthony C Smith¹, Mark Coulthard², Ron Clark², Nigel Armfield¹, Shauna Taylor³, Robyn Goffe³, Ian Mottarelly³, Karen Youngberry¹, Alan Isles² and Richard Wootton¹

1 Centre for Online Health, University of Queensland, Australia

2 Royal Children's Hospital, Queensland, Australia

3 Gladstone Base Hospital, Queensland, Australia

Correspondence:

Anthony C Smith

Centre for Online Health

Level 3 Foundation Building

Royal Children's Hospital

Herston 4029

AUSTRALIA

(Fax: +61 7 3346 4705; Email: a.smith@pobox.com)

Summary

A mobile interactive online health system was used to conduct virtual ward rounds at a regional hospital without a specialist paediatrician. The system was wireless, which allowed telepaediatric services to be delivered direct to the bedside.

Between December 2004 and May 2005, 43 virtual ward rounds were coordinated between specialists based in Brisbane and local staff at the Gladstone Hospital. A total of 86 consultations was provided for 64 patients. The most common conditions included asthma (27%), chest infections (12%), gastroenteritis (10%) and urinary tract infections (10%). In the majority of cases, there were partial (67%) or complete changes (11%) in the clinical management of patients.

Specialist services were offered by a team of 13 clinicians at the Royal Children's Hospital, including general paediatricians (10), physiotherapists (2) and a registered nurse (1). Feedback from all consultants involved in the service and local staff in Gladstone was extremely positive. In 43 videoconference calls there were three technical problems, probably due to an intermittent mains power supply at the regional hospital. There appears to be potential for other rural and regional hospitals to adopt this model of service delivery.

Introduction

In Queensland, the majority of rural hospitals and some regional hospitals have no paediatricians on staff. We have developed a mobile interactive online health system for use in paediatric wards in regional hospitals. The system is wireless, which means that it can be positioned conveniently next to the patient in a hospital bed. It was designed to allow senior paediatricians based at the Royal Children's Hospital (RCH) in Brisbane direct bedside access to patients admitted to the paediatric ward at Gladstone Hospital, about 500 km north of Brisbane. In

conventional circumstances, patients who need referral to a paediatrician have to travel to the closest regional hospital, which is about 100 km from Gladstone.

The aim of the present study was to investigate the feasibility of the new method of service delivery and discover its effect on clinical management.

Methods

We built a casing which resembled the shape of a robot, capable of being wheeled around the ward and directly up to the bedside (see Figure 1). The robot contained a videoconference codec (PCS-11, Sony), a 51 cm LCD TV monitor (TX-20LA1Q, Panasonic) and two battery packs (1 kVA, Powerware). The Ethernet output of the videoconferencing codec was connected to a wireless bridge (Aironet, Cisco).

At Gladstone Hospital, the paediatric ward was equipped with two wireless access points (Aironet, Cisco) to provide network coverage for the mobile unit. The access points were connected via a private wired Ethernet network to a router (1700 series, Cisco) which was in turn connected to the ISDN network.

At the RCH, a similar ISDN router was connected to the ISDN network and to a studio-based videoconferencing system. Connectivity over the ISDN network between Gladstone and the RCH was established on-demand by the Gladstone-end router when it detected IP traffic from the mobile unit. The system aggregated traffic over two ISDN links giving a total bandwidth of 256 kbit/s in each direction (Figure 2). The communications aspects of the system were transparent to the operator and no technical skills were required to establish or to manage the videoconferencing calls.

A viewing box was also installed in the paediatric ward for the display of X-ray images if required. The robot could be wheeled up in front of the viewing box for the transmission of X-ray images via videoconference.

Referrals were managed by a telepaediatric coordinator based in Brisbane.[1] Each day, the coordinator telephoned the Gladstone paediatric ward to check whether there were patients in the ward who required review by an RCH paediatrician. If a videoconference was considered appropriate, the telepaediatric coordinator liaised with staff at the RCH and facilitated the link-up (Figure 3). The coordinator was also responsible for the technical aspects of the videoconference, assisting with near- and far-end camera control for convenient viewing.

We conducted a chart review of all patients seen via Roy the Robot, to determine if any changes had occurred as a result of the video consultation. The doctor responsible for presenting each of these cases to the paediatrician was asked to state whether there were any changes in diagnosis, clinical management of the patient and clinical practice in general (i.e. methods of history taking and patient examination) as a consequence of the videoconference appointment. Staff satisfaction was measured three months after the service began. A survey was circulated to 11 staff working in the paediatric ward. Patient satisfaction was measured with a telephone survey conducted after the consultation. Survey questions were randomly put in either a positive or negative sense.

Results

Between December 2004 and May 2005, 43 virtual ward rounds were coordinated. A total of 86 consultations were provided for 64 patients, i.e. there was an average of two patients per ward round. The average number of consultations conducted per week was four (Table 1).

Table 1. Telepaediatric activity

	Consultations	Videoconference time (min)	Average time per consultation (min)
Dec-04	5	121	24
Jan-05	13	195	15
Feb-05	16	310	19
Mar-05	24	415	17
Apr-05	11	140	13
May-05	17	210	12
<i>Total</i>	<i>86</i>	<i>1391</i>	<i>17</i>

Specialist services were provided by 13 clinicians at the RCH, including general paediatricians (10), physiotherapists (2) and a registered nurse (1). A broad range of clinical conditions were managed. The most common conditions included asthma (27%), chest infections (12%), gastroenteritis (10%) and urinary tract infections (10%) see Table 2. Two patients with chronic health conditions and who regularly travelled to the RCH for follow-up were able to be reviewed by their specialist via videoconference, saving at least one trip to Brisbane. The ages of patients seen by the paediatrician via videoconference varied from 2 days to 16 years (median 4 y; IQR 2-8).

Table 2. Consultations

Diagnosis	Number of consultations
Asthma	17
Chest infection	10
Gastroenteritis	9
Urinary tract infection	9
Respiratory illness - unspecified cause	7
Tonsillitis	6
Bronchiolitis	4
Cystic fibrosis	4
Vomiting, suspected viral meningitis	3
Allergic reaction	2
Constipation	2
Fever, irritability	2
Diabetes	1
Failure to thrive	1
Fainting episode	1
Febrile convulsion	1
Headaches/migraine	1
Ingestion	1
Malaria	1
Neonatal review, advice re: medications and lactation	1
Nephrology follow-up	1
Skin lesions	1
Withdrawal syndrome	1
<i>Total</i>	<i>86</i>

Medical survey

A chart review was conducted on all 45 patients seen between December 2004 and March 2005. The diagnosis of most (77%) of the patients seen via videoconference remained unchanged following the videoconference consultation, Table 3. In seven cases (16%), there were modifications made to the diagnosis, and in three cases (7%) a completely different diagnosis was established. The majority of these cases related to suspected bacterial infections which were more likely to be viral infections, not requiring antibiotic therapy.

Table 3. Proportion (%) of responses to a post-consultation medical survey (n=45)

As a result of the consultation did you:	No	Partially	Completely
change your diagnosis?	77	16	7
change your clinical management?	22	67	11
change your way of thinking:			
- history taking	89	11	0
- examination	84	16	0
- new protocols	76	22	2

In the majority of cases, there were partial (67%) or complete changes (11%) in the clinical management of patients. The main changes related to a new choice of antibiotic or the decision to cease antibiotic therapy altogether. There was evidence that the interaction with a senior paediatrician had partial influence on the local doctor's way of thinking, i.e. related to history taking (11%), examination criteria (16%) and ward-based protocols (22%). New protocols related to radiological examinations (guidelines for a paediatric chest X-ray) and antibiotic therapy were developed as a result of discussions between ward staff in Gladstone and RCH paediatricians.

Since decisions related to tests and investigative procedures were usually postponed until consultation with the paediatrician there were only a few situations where specific tests had been arranged and cancelled as a result of the videoconference, Table 4.

Table 4. Proportion (%) of responses to a post-consultation medical survey (n=45)

As a result of the consultation:	No	Yes
were planned tests or investigations cancelled?	89	11
were additional tests or investigations arranged?	71	29

In one case, a repeat X-ray examination was avoided. In two cases a lumbar puncture was avoided. There was a slightly higher proportion of cases which warranted additional tests or investigations following the videoconference. Additional tests were arranged for 13 (29%) patients. The most common test included a nasopharyngeal aspirate (NPA) for the identification of respiratory viruses. In one other case, the paediatrician recommended a lumbar puncture to rule out the possibility of a meningococcal infection.

Staff satisfaction

Nine surveys were completed and returned (82% response rate). Overall, staff satisfaction was very high (Table 5). Doctors directly involved in the unit described the service to be very useful and appreciated the opportunity of liaising directly with a senior consultant during a dedicated ward round rather than waiting for a junior registrar to respond intermittently in between cases.

Table 5. Proportion (%) of staff responses to satisfaction statements regarding the use of Roy the Robot (n=9)

Statements	SA	A	N	D	SD	DK
I know how to operate Roy the Robot	33	56	11	0	0	0
I do not know who to contact if I need any technical assistance	0	22	0	44	33	0
The patients in the unit enjoy the link-ups with Roy the Robot	67	33	0	0	0	0
The robot is difficult to mobilise around the ward	11	0	22	56	11	0
Roy the Robot is a useful service for patients in my unit	67	33	0	0	0	0
Roy the Robot is a useful service for staff in my unit	89	11	0	0	0	0
I do not feel comfortable talking to the paediatrician during a link-up	0	0	22	56	11	11
This service improves access and the delivery of specialist services to rural and remote areas	67	33	0	0	0	0
This service does not facilitate communication between regional and metropolitan health professionals	0	0	0	33	67	0
This service provides professional development opportunities for health professionals	44	56	0	0	0	0

SA—Strongly agree; A—Agree; N—Neutral; D—Disagree; SD—Strongly disagree; DK—Don't know

The majority of staff (89%) in Gladstone knew how to operate Roy the Robot and who to contact if they needed technical support (78%). All respondents agreed that patients enjoyed the link-ups using the robot and that the service was beneficial for both staff and patients in the ward. 67% of staff thought that the robot was easy to mobilise throughout the ward. One staff member had concerns that the robot was too heavy and awkward to move without the assistance of another staff member. None of the staff expressed discomfort related to the discussion cases with the paediatrician during a videoconference. All staff agreed that the telepaediatric service improved access to specialist services to regional and remote areas, facilitated communication between regional and metropolitan health professionals and provided a useful opportunity for professional development.

Family satisfaction

Telephone surveys were carried out for the 45 families who had received one or more consultations with Roy the Robot. A total of 24 families (53%) were contacted and all agreed to participate in the brief survey. The remainder of families were not contactable at the time of the telephone contact. Three attempts were made to contact each family. The overall feedback from this survey was very positive (Table 6).

Table 6. Proportion (%) of parents' responses to satisfaction statements regarding the use of Roy the Robot (n=24)

Statements	SA	A	N	D	SD	DK
I/We could see the paediatrician clearly during the consultation	63	33	4	0	0	0
I/We had trouble hearing the paediatrician during the consultation	0	0	0	54	66	0
I/We had an opportunity to ask questions and discuss concerns with the paediatrician	67	33	0	0	0	0
I/We had no major concerns that others might be listening or watching	46	38	17	0	0	0
The TV camera made me/us feel nervous or uncomfortable about speaking	0	17	17	46	21	0
I/We agree that appropriate medical decisions could be made and useful advice given during the appointment with the paediatrician	63	25	13	0	0	0
I would be happy to participate in another appointment with Roy the Robot	67	33	0	0	0	0

SA-Strongly agree; A-Agree; N-Neutral; D-Disagree; SD-Strongly disagree; DK-Don't know

No family had any difficulty in viewing or hearing the paediatrician during a videoconference. All families strongly agreed or agreed that they had an opportunity to ask questions and discuss concerns with the paediatrician. 84% of families said that they had no major concerns that others might be listening or watching. When asked if the TV camera made them feel nervous or uncomfortable only four (17%) agreed. 88% of families were confident that appropriate medical decisions could be made during the appointment. All families strongly agreed (67%) or agreed (33%) that they would be happy to have another appointment with Roy the Robot.

Technical problems

In 43 videoconference calls, we experienced three technical problems which caused the temporary disconnection of the call. Following investigation, these faults were found to be related to an intermittent mains power supply problem at the regional hospital. The problems were easily rectified by re-establishing the videoconference call and caused less than a two minute delay during each videoconference.

Discussion

The use of mobile videoconference systems has been reported in a US trial where a self-powered robot is being used in a Californian hospital, allowing doctors to interact with patients from a remote location.[2] This technique has mainly been used for the follow-up of patients after surgery. Apart from this work, there appear to be few other reports.

The videoconferences directly to the paediatric unit in Gladstone hospital have proven to be both feasible and useful for patients and staff. In a regional hospital which does not have a paediatrician, this service has shown that specialist paediatric services can be delivered efficiently direct to the patient bedside, allowing communication between the family, local staff and specialist staff at a tertiary hospital. The service has provided valuable guidance and reassurance to staff and families regarding diagnosis and clinical management. We were pleasantly surprised by the small number of technical problems encountered during the study.

Although the economics of this service require formal evaluation we suspect that the costs would be similar or less than the costs of paying a full-time paediatrician to be on-site. There appears to be potential for other rural and regional hospitals to adopt this model of service delivery.

Acknowledgements

We thank the ward staff at Gladstone Hospital for their support, especially Di Lucas for her administrative assistance. We also thank the staff at the Royal Children's Hospital for their time during videoconference consultations. We are grateful to Queensland Health for some financial support.

References

- 1 Smith AC, Isles A, Mc Crossin R, *et al.* The point-of-referral barrier-a factor in the success of telehealth. *J Telemedicine Telecare* 2001; 7 (suppl. 2): 75-8
- 2 Gizmag. *Robotic Doctor Marks Breakthrough in Telemedicine.* See <http://www.gizmag.com.au/go/3459/>. Last checked 6 July 2005

Figure 1. Roy the Robot (under development). (a) front view; (b) rear view – the removable back lid allows easy access to components

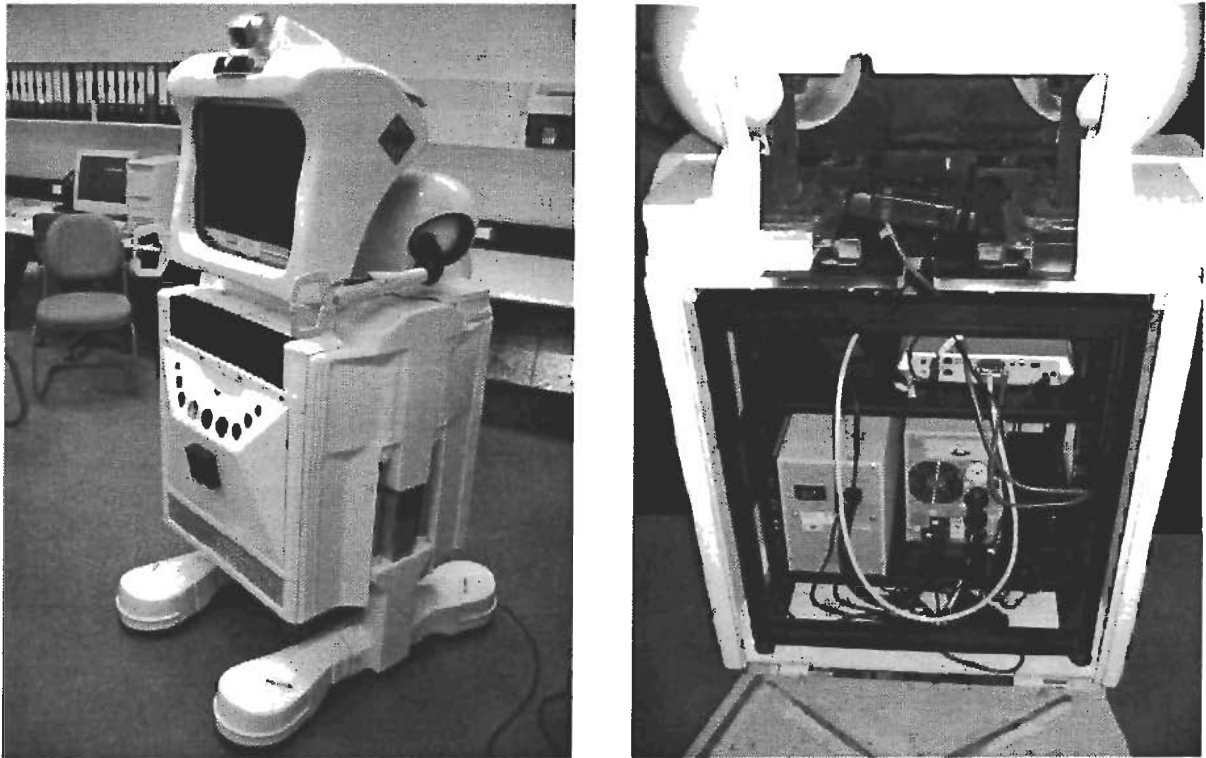


Figure 2. Telecommunications architecture

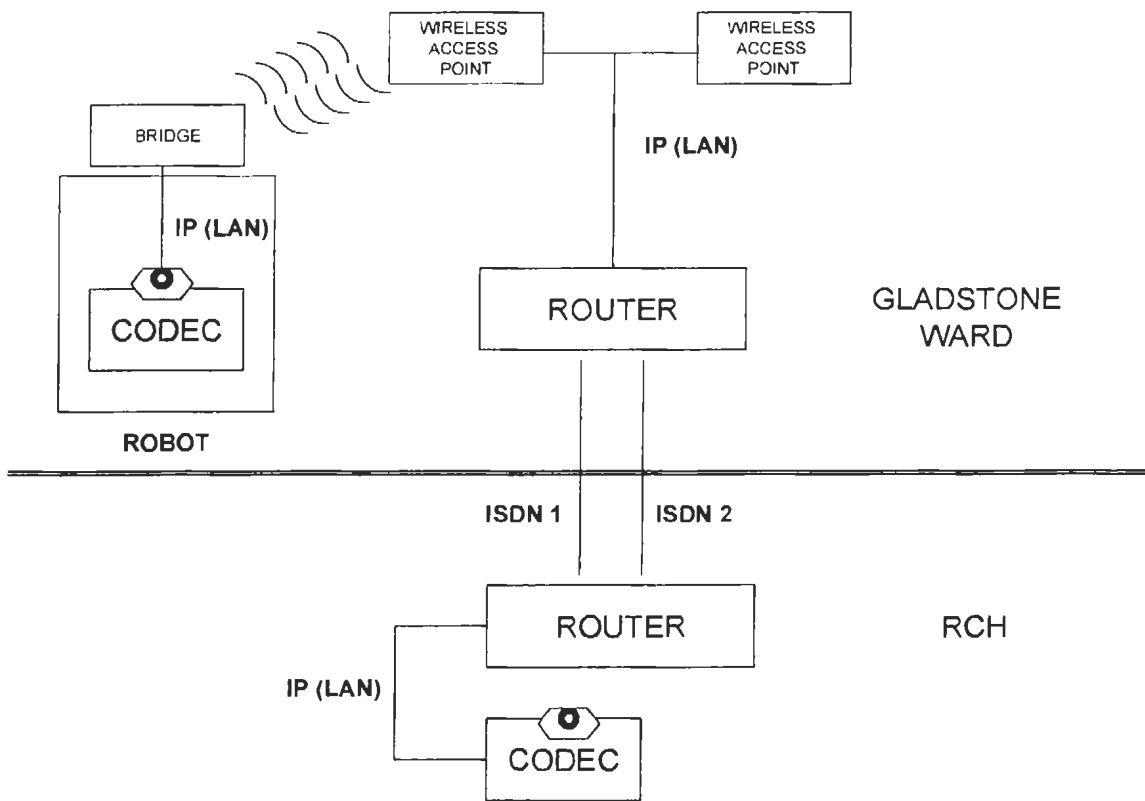


Figure 3. Roy the Robot – in the ward and during a consultation



A survey of e-mentoring amongst New Zealand midwives

Sarah Stewart and Richard Wootton

Centre for Online Health, University of Queensland, Australia

Correspondence:

Sarah Stewart
School of Midwifery
Forth Street
Otago Polytechnic
Dunedin
NEW ZEALAND
(Fax: +64 3 474 8486; Email: sarahs@tekotago.ac.nz)

Summary

Mentoring is a strategy that may assist the midwifery profession to support new graduates and midwives working in rural and remote areas. We conducted a survey of 1577 New Zealand midwives about their opinions and experiences of mentoring. The questionnaire comprised 33 questions, nine of which were open questions. There was a 44% response rate. Whilst the telephone was commonly utilised by mentors (37%) and mentored midwives (37%), the Internet and email only played a small part. Participants acknowledged the potential of these avenues for communication, but midwives felt that mentoring could only be provided by immediate, face-to-face contact. Nevertheless, e-mentoring could be a viable option and requires further investigation. About one-third of midwives identified geographical isolation as a barrier to being a mentor (38%) and being mentored (36%). The use of e-mentoring could remove the barrier of location and allow the student to choose a mentor who meets her needs rather than because she is the only mentor available.

Introduction

Mentorship is a relationship between mentor and student that encourages growth and development in a respectful and collegial environment.[1] Mentoring helps the mentored practitioner to solve problems and learn from reflection, as well as facilitating career development.[2] The benefits for the mentors are interpersonal skill development, collegiality and collaboration, which all contribute to the mentor's own career development.[3] Mentoring requires a considerable time and emotional commitment, which may lead to a scarcity of mentors.

Traditional mentoring is usually carried out in a face-to-face context. "E-mentoring" includes the use of the telephone, online bulletin boards, discussion lists, Internet chat and email.[4] E-mentoring overcomes professional and geographical isolation, and provides national and international mentoring opportunities for people who may normally be disadvantaged because of the lack

of mentors in their locale.[5,6] Whilst e-mentoring still requires a time commitment, there is greater flexibility which allows people to communicate outside normal working hours at a time that is convenient to them.[7] There has been little research into e-mentoring, especially in the health field. Nevertheless, there is increasing recognition that e-mentoring is an option that should be explored further.[6,8,9]

Midwives in New Zealand (NZ) are autonomous practitioners who care for women from conception to six weeks postpartum without the supervision of doctors.[10] The New Zealand College of Midwives (NZCOM) consider that a national mentoring framework will "strengthen the midwifery workforce" [11] especially at a time when the profession is faced with problems of recruitment and retention; increasing medicalisation and rise in intervention rates which impacts on the development and maintenance of skills; support of new graduates and sustaining rural midwifery.[12-15]

The present study was designed to find out about mentoring practice amongst NZ midwives and to discover whether e-mentoring might be useful to them in future.

Methods

A descriptive survey was conducted using an anonymous postal questionnaire. Approval was obtained from the appropriate ethics committee. The questionnaire and method of analysis were tested in a pilot study. The data were analysed using the Statistical Package for Social Science (SPSS).

The questionnaire comprised 33 questions, nine of which were open questions. The remaining questions were closed, although 14 of them invited respondents to write other comments. The questionnaire took 10-20 min to complete, depending on the respondents' experiences and how much they wanted to divulge. The questionnaire was made up of four sections: (1) personal demographic information; (2) opinions of mentoring; (3) experience of being a mentor; (4) experience of being mentored.

The sample was a group of registered midwives who worked in NZ and belonged to NZCOM (n=1577). The study did not survey the total population of practising midwives in NZ, which was 2440 in 2004. [16]

Results

There were 684 respondents, a response rate of 44%. Analysis showed that respondents were most likely to be self employed Lead Maternity Carers (LMCs) (49%) practising in an urban setting (70%). They were mainly European (76%) and had been practising for five to 14 years (36%), see Table 1.

Table 1. Demographics of the respondents

Main job	n	%	Years of practice		
Core	167	24	Less than one	30	4
Employed LMC	100	15	1-4	112	16
Self-employed LMC	334	49	5-9	126	18
Research	2	0.3	10-14	123	18
Lecturer	16	2	15-19	74	11
Manager	26	4	20-24	93	14
Not practising	15	2	25-29	49	7
Missing	24	4	30-34	45	7
			35 and over	24	4
			Missing	8	1
<i>Total</i>	<i>684</i>	<i>100</i>	<i>Total</i>	<i>684</i>	<i>100</i>
Ethnicity			Main setting		
NZ European	519	76	Urban	480	70
NZ Maori	33	5	Rural	153	22
Samoan	4	0.6	Remote	15	2
Cook Island Maori	1	0.1	Missing	36	5
Niuean	2	0.3			
Other Pacific	4	0.6			
Chinese	5	0.7			
Other	100	15			
Missing	16	2			
<i>Total</i>	<i>684</i>	<i>100</i>	<i>Total</i>	<i>684</i>	<i>100</i>

Achievement of mentoring

Respondents were mostly likely to think that mentoring could be achieved through face-to-face contact in the clinical setting (85%), see Table 2.

Table 2. How mentoring could be achieved

How mentoring can be achieved	n	%
Formal, pre-arranged meetings	516	75
Informal meetings when the need arises	542	79
Face-to-face contact in clinical setting	580	85
Face-to-face contact away from clinical setting	523	77
Hui/marae based meetings	140	21
Telephone contact	546	80
Fax	102	15
Mail	76	11
Email	212	31
Video-conferencing	75	11
Internet chat	82	12

Role of the mentor

Respondents considered that the role of the mentor was mainly to provide professional support (n=662/684, 97%); a safe environment for the mentored midwife to reflect on her practice (n=626/684, 92%); hands-on clinical support (n=554/684, 81%); and to provide hands-on clinical teaching (n=457/684, 67%).

Experience of being a mentor

Of 684 respondents, 350 (51%) had been mentors. The most likely barriers to being a mentor were a lack of time (n=554/684, 81%); lack of training (n=378/684, 55%); and financial constraints (n=316/684, 46%). Mentors communicated with the mentored midwives mainly by telephone contact (37%), see Table 3.

Table 3. Communication with mentored midwife

How communication took place with mentored midwife	n	%
Formal, pre-arranged meetings	217	32
Informal meetings when the need arises	275	40
Face-to-face contact in clinical setting	301	44
Face-to-face contact away from clinical setting	231	34
Hui/marae based meetings	13	2
Telephone contact	254	37
Fax	6	0.9
Mail	11	2
Email	28	4
Videoconferencing	1	0.1
Internet chat	3	0.4

Experience of being mentored

About half of the respondents had been mentored (n=349, 51%). The most likely barriers to being mentored were unavailability of mentor (n=439/684, 64%); financial constraints (n=312/684, 46%); and lack of time (n=297/684, 43%). The most common ways that communication occurred with the mentor were face-to-face contact in a clinical setting (41%) and informal meetings when the need arose (41%), see Table 4.

Table 4. Communication with mentor

How communication took place with mentor	n	%
Formal, pre-arranged meetings	145	21
Informal meetings when the need arises	283	41
Face-to-face contact in clinical setting	278	41
Face-to-face contact away from clinical setting	210	31
Hui/marae based meetings	9	1
Telephone contact	255	37
Fax	9	1
Email	15	2
Internet chat	1	0.1

Midwives choose their mentor for a variety of reasons including a respect of the mentor's midwifery practice (n=195/684, 29%); felt 'safe' with her mentor (176/684, 26%); and had the same midwifery philosophy (n=161/684, 24%).

Discussion

The present study suggests that e-mentoring is not commonly practised by NZ midwives. Although these results cannot be generalised to the whole midwifery population of NZ, they are applicable to the majority of midwives in NZ.

Whilst the telephone was commonly utilised by mentors (37%) and mentored midwives (37%), the Internet and email both played small part. There was some interest in the potential of electronic avenues of communication in particular the telephone (80%) and fax (15%) as well as email (31%), videoconferencing (11%) and Internet chat (12%). Nevertheless, respondents generally thought that mentoring should be carried out by face-to-face contact in formal pre-arranged meetings (75%); informal meetings when the need arises (79%), face-to-face contact in the clinical setting (85%); face-to-face contact away from clinical setting (77%). This may have been because mentors believed their role was to provide hands-on clinical support (81%) and clinical teaching (67%). Nonetheless, the other elements identified as part of a mentor's role could be provided by e-mentoring [7], including providing professional support (97%), and a safe environment for the mentored midwife to reflect on practice (92%). It is unnecessary for the mentor to provide hands-on clinical guidance or support: the midwife can seek any immediate face-to-face help required from the midwives working along side her in her every day practice.

About one-third of midwives identified geographical isolation as a barrier to being a mentor (38%) and being mentored (36%). With 168 (24%) midwives identifying themselves as either rural or remote midwives, e-mentoring may be an effective strategy for increasing the availability of mentors.[5] Time constraints were another large barrier to being a mentor (81%) and being mentored (43%). Whilst e-mentoring does not necessarily reduce time constraints, it does increase the flexibility of communication.[7] This should suit midwives because they work unpredictable and unsocial hours.

A number of respondents felt that it was important to midwives to have a mentor who they respected (29%), with a similar philosophy (24%). E-mentoring facilitates the choice of mentor, allowing the mentored midwife to choose a mentor because she meets the mentored midwife's needs rather than because she is the only one available. This will increase the effectiveness of the mentoring relationship and makes mentoring a national, even international option for midwives.

Mentoring appears to be an important strategy for the midwifery professional development in NZ. Whilst e-mentoring is not commonly used by midwives in NZ, it may be a viable option especially as it breaks down the barriers of location and encourages freedom of choice for the student. The potential of e-mentoring deserves further investigation, not only for midwives but for all health professionals.

References

- 1 Vance C, Olson R. Mentorship and nursing. In: *The Mentor Connection in Nursing*. Vance C, Olson R, eds. New York: Springer Publishing Company, 1998: 3-10
- 2 Northcott N. Mentorship in nursing. *Nurs Manag (Harrow)* 2000; **7**: 30-2
- 3 Ehrich L, Tennent L, Hansford B. A review of mentoring in education: some lessons for nursing. *Contemp Nurse* 2002; **12**: 253-64
- 4 Frederick J. E-mentoring: a sign of the times. *Nurse Leader*, 2003. **May/June**: p. 29. See <http://authors.elsevier.com/JournalDetail.html?PubID=646196&Precis=DESC>. Last checked 17 July 2005 – subscription required
- 5 Waters D, Clarke M, Ingall AH, Dean-Jones M. Evaluation of a pilot mentoring programme for nurse managers. *J Adv Nurs* 2003; **42**: 516-26
- 6 Short J. Mentoring. Career enhancement for occupational and environmental health nurses. *AAOHN J* 2002; **50**: 135-41
- 7 Hamilton B, Scandura TA. E-mentoring: implications for organizational learning and development in a wired world. *Organ Dyn* 2003; **31**: 388-402
- 8 Shaffer B, Tallarico B, Walsh J. Win-win mentoring. *Dimens Crit Care Nurs* 2000; **19**: 36-8
- 9 Ensher E, Heun C, Blanchard A. Online mentoring and computer-mediated communication: new directions in research. *J Vocat Behav* 2003; **63**: 264-88
- 10 Holland D. Mentoring: a personal analysis. *New Zealand College of Midwives Journal* 2001; **23**: 15-18
- 11 New Zealand College of Midwives. *NZCOM Strategic Plan for 2004-2006 (March04 to Dec06)*. Christchurch: New Zealand College of Midwives, 2004
- 12 Panettiere M, Cadman T. Do new graduate midwives need extra support? *Nurs N Z* 2002; **8**: 18-9
- 13 Patterson J. Rural midwifery: challenges of the last decade, and where to from here? *New Zealand College of Midwives Midwifery News*, 2000; **20**: 1-6 <http://www.midwife.org.nz/index.cfm/Newsletter>. Last checked 17 July 2005 – subscription required
- 14 Surtees R. Midwifery partnership with women in Aotearoa/New Zealand: a post-structuralist feminist perspective on the use of epidurals in 'normal' birth. In: Stewart M. *Pregnancy, Birth and Maternity Care: Feminist Perspectives*. Oxford: Butterworth-Heinemann, 2004: 169-84
- 15 Rolston L. The issue of midwife self preservation. *New Zealand College of Midwives Journal* 1999; **20**: 25-6
- 16 New Zealand Health Information Service. *Health Statistics*. See <http://www.nzhis.govt.nz/stats/nursestats.html#03>. Last checked 17 July 2005

User acceptance of integrated web-based RIS/PACS distribution of radiology services in regional and remote centres of Western Australia

Peter Tually^{1,4}, Chris Stavrianou² and John Walker³

- 1 Imaging The South, Department of Nuclear Medicine, WA, Australia
- 2 Imaging The South, Department of Information Technology, WA, Australia
- 3 Global Diagnostics Ltd, London, UK
- 4 University of Sydney, School of Medical Radiation Sciences, Australia

Correspondance:

Peter Tually
Department of Nuclear Medicine
Imaging the South
5 Randell St
Mandurah
WA 6210
AUSTRALIA
(Fax: +61 8 9535 7069; Email: p.tually@imagingthesouth.com.au)

Summary

A large scale, web browser-based radiological information system integrated with a picture archive and communication system (RIS/PACS) has been installed in regional and remote radiology centres of Western Australia. This provides patients in rural areas with local access to advanced medical imaging. User attitudes to the changes were surveyed in a six-week period in March 2005. A total of 53 people completed the survey (62% response rate). Respondents were eight radiologists, 21 medical imaging technologists, 10 administration officers and 14 reception staff. All groups gave average ratings of the system's quality. All staff rated the information quality of the system as good. On-site IT support was judged to be reliable, professional and empathic towards user concerns. There was a broad range of opinion between groups, but on average they were satisfied. The lack of a modern network, comparable to what is available in the metropolitan areas, has impeded the full potential of RIS/PACS in the smaller rural centres.

Introduction

Advances in digital medical imaging technologies such as multislice computed tomography (MSCT) and digital radiography have led to a dramatic increase in the number of diagnostic images created.[1] Large, complex datasets need to be analysed. In order to improve workflow efficiency and to more easily share information between medical specialties, there has been widespread incorporation of radiological information systems integrated with picture archival and communication systems (RIS/PACS).[2] More recently, web-browser based distribution systems have become available. These permit instant access to

reports, images and patient information, and enable secondary consultation by a sub-specialist without the need for proprietary software.[3]

Our radiology practice provides medical imaging services to remote and regional communities of Western Australia. In 2004 we established an integrated web-based RIS/PACS. This system replaced software applications that separately handled image presentation, transcription, patient information management, report transfer and billing. Individual PACS servers were installed at each of our eight imaging sites while the RIS system was centralised and located in Bunbury. There are over 90 workstations, linked via a high-bandwidth network. This connects five on-site radiologists, eight off-site specialists and 41 medical imaging technologists (MIT) conducting general computed radiography (CR) and interventional procedures, MSCT, ultrasound (US), magnetic resonance imaging (MRI) and nuclear medicine (NM) examinations. In operational terms, the implementation of RIS/PACS has led to a significant change in work practice in our organisation. The present study was designed to assess user attitudes to the changes.

Methods

We employed aspects of an evaluation method proposed by Pare *et al.*[4] making use of the techniques described in recognised information systems research.[5,6] Approximately 6 months after first use, four interconnected categories of the RIS/PACS were examined: Information quality (4 questions), System quality (7 questions), Service quality (7 questions) and User satisfaction (4 questions). Responses were recorded on a modified, five point Likert scale (from 1=strongly disagree/dissatisfied to 5=strongly agree/satisfied) and open-ended comment via an on-line survey. The first category queried user assessment of information completeness, precision, format and timeliness in making data available. System quality topics included views on reliability, ease of use, security and integration functions. Service matters related to the support provided by the information technologists, examining issues such as its adequacy, consistency and efficiency. Finally, users were asked to consider whether the system had met expectations and to rate overall performance. The survey was made available to 86 users in the organisation over a six-week period starting in March 2005.

Results

A total of 53 people completed the survey (62% response rate). Respondents were eight radiologists, 21 MITs, 10 administration officers and 14 reception staff. 41 of the surveys (79%) included open-ended comments. The data were analysed using the SPSS program.

System quality

All groups gave average ratings of the system's quality, see Table 1. Across all groups, the most common remark regarding this category related to the speed of the system. Responses on this were varied with radiologists and most MITs indicating very positive assessments whilst the reception and administration groups, predominately from the smaller, outlying centres, identified a need for more rapid display of patient appointment and demographic data. There were observations describing episodes of prolonged image display. However this was limited to the very large data files, such as digital CT angiography (e.g. >10 s), and believed to be due to hardware performance rather than inadequate bandwidth.

Such events were not considered to compromise diagnostic standards. Under optimum conditions all groups stated that the system was easy to use and that the integration between the RIS and PACS was very good, but this was dependent on correct data entry at the time of booking and scan set-up. There were also concerns raised about the transfer mechanism for uploading CR images to the PACS server as it could stall, necessitating a system reset. Integration between the RIS and the billing software was perceived to be less stable and some frustration was noted.

Table 1. Ratings of system quality.

	Proportion of respondents (%)					Mean score (SD)
	1	2	3	4	5	
Radiologist (n=8)	0	4	25	55	16	3.8 (1.0)
MIT (n=21)	7	22	32	35	4	3.1 (1.5)
Administration (n=10)	0	28	24	40	9	3.3 (1.3)
Reception (n=14)	12	19	23	34	12	3.2 (1.8)

(1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Information quality

All staff rated the information quality of the system as good, see Table 2. Image display on the reporting LCD monitors was rated as 'exceptional' by radiologists across all modalities and the ease in correlating images from one examination with another was a particular point of commendation. Occasional failures in the reporting status of cases caused workflow disruptions for a short period after the system came into operation. However this problem became less common over time. Reception staff reported instances where general patient information failed to save onto the server.

Table 2. Information quality

	Proportion of respondents (%)					Mean score (SD)
	1	2	3	4	5	
Radiologist (n=8)	0	0	22	51	27	4.0 (0.5)
MIT (n=21)	1	19	11	58	11	3.6 (1.1)
Administration (n=10)	0	3	18	66	13	3.9 (1.0)
Reception (n=14)	0	4	25	67	5	3.7 (1.0)

(1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

Service quality

On-site IT support was judged to be reliable, professional and empathic towards user concerns, see Table 3. Maintenance of the more complex application issues, which was provided by a 24 hour off-site support network, was deemed to need strengthening. Some respondents outlined the need for a more efficient method of disseminating technical announcements such as routine upgrades and repair status broadcasts in the event of unplanned outages.

Table 3. Service quality

	Proportion of respondents (%)					Mean score (SD)
	1	2	3	4	5	
Radiologist (n=8)	0	0	2	68	30	4.3 (0.5)
MIT (n=21)	0	12	23	62	3	3.6 (0.7)
Administration (n=10)	0	9	27	47	17	3.7 (1.0)
Reception (n=14)	3	14	11	50	21	3.7 (1.1)

(1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

User satisfaction

There was a broad range of opinion between groups, but on average they were satisfied, see Table 4. One member of the radiology group stated that the RIS/PACS had been a significantly positive influence on working life and that speed, accuracy and confidence in image interpretation had increased. The voice recognition software was considered far less daunting and much more reliable than had been expected. The summary by the MITs was quite mixed with some claiming that the processes were too complex. However, an equal proportion considered it a much easier and a more streamlined practice. Similarly, although the level of IT assistance was rated as good, a proportion complained that not enough training was provided whilst others felt the system was self-explanatory and intuitive. Given its web-based platform, all believed that bandwidth restrictions were the greatest threat to good RIS/PACS performance. There were some remarks that it had been designed predominately for radiologists and that other components of the workflow had been overlooked and needed refinement. Many were impressed with the time from scan completion to report dispatch and the fact that turnaround for emergency MSCT cases could be achieved within a very short time, especially when employing voice recognition. A number of respondents were also impressed with the availability of scan images on the physician PCs in real time.

Table 4. User satisfaction

	Proportion of respondents (%)					Mean score (SD)
	1	2	3	4	5	
Radiologist (n=8)	0	0	0	71	29	4.3 (0.4)
MIT (n=21)	6	14	33	40	6	3.3 (1.0)
Administration (n=10)	0	19	31	34	16	3.5 (1.0)
Reception (n=14)	9	3	39	33	15	3.4 (1.1)

(1=strongly dissatisfied, 2=dissatisfied, 3=neither satisfied or dissatisfied, 4=satisfied, 5=strongly satisfied)

Discussion

The results of the present study provide data for comparing user satisfaction in subsequent reviews. The study had certain limitations, since no internal validity or reliability tests were conducted. Furthermore, participants may not have been fully honest and responded according to what they believed was expected of them.

Implementation of new technology will inevitably encounter challenges. Some users enter data more rapidly via certain keys used on previous applications and can find navigating through graphical user interfaces quite frustrating. Improvements in web browser design following user consultation will be important to acceptance and will reduce negative attitudes. In our experience, the most important factors in achieving good performance and success is a strong emphasis on training, investment in equipment and bandwidth. Currently, the more regionalised centres of Western Australia do not have sufficient network infrastructure to meet our requirements. Despite novel techniques to maximise the use of current services, the lack of a modern network, comparable to what is available in the metropolitan areas, has impeded the full potential of RIS/PACS in the smaller rural centres.

References

- 1 Andriole KP, Morin RL, Arenson RL, *et al.* Addressing the coming radiology crisis - the Society for Computer Applications in Radiology transforming the radiological interpretation process (TRIP) initiative. *J Digit Imaging* 2004; **17**: 235-43
- 2 Reed G. Beyond Radiology. *Journal of Imaging Technology Management*. See <http://www.imagingeconomics.com/library/200302-04.asp>. Last checked 24 June 2005
- 3 Bennett WF, Tunstall KM, Skinner PW, Spigos DG. Delivering images to the operating room: a web-based solution. *J Digit Imaging* 2002; **15** (suppl. 1): 137-9
- 4 Pare G, Aubry D, Lepanto L, Sicotte C. Evaluating PACS success: a multidimensional model. *Proceedings of the 38th International Conference on System Sciences*, 2005: See <http://portal.acm.org/toc.cfm?id=1042437&type=proceeding>. Last checked 17 July 2005
- 5 DeLone WH, McLean ER. Information systems success: the quest for the dependent variable. *Inform Syst Res* 1992; **3**: 60-95
- 6 DeLone WH, McLean ER. The DeLone and McLean model of information systems success: a ten-year update. *Journal of Management Information Systems* 2003; **19**: 9-30

Supporting community carers via telehealth

Penny Van Ast

WA Country Health Services, Midwest Murchison, Australia

Correspondence:

Penny Van Ast
Health Service Development
PO box 22
Geraldton
WA 6531
AUSTRALIA
(Fax: +61 8 9956 2340; Email: Penny.VanAst@health.wa.gov.au)

Summary

We provided support, practical advice and networking opportunities for carers in rural and remote areas of Western Australia through the use of videoconferencing. The first videoconference for carers occurred in June 2004. In the next 12 months there were 11 videoconferences with 11 rural towns. Some sessions were point-to-point and some were multipoint. Over 90 carers participated in the sessions. A facilitator with expertise on stress in carers delivered the sessions from Perth. The acceptance of videoconferencing as a support medium by the carers attending was positive and there were requests for the sessions to be continued. The skills of the facilitator to connect in a very personal way with each person were important to the success of the programme. The level of sharing of person issues was amazing and the groups worked together to support each other.

Introduction

Carers in Western Australia represent 11% of the State's population with around 200,000 people providing care to people of all ages.[1] Carers play a vital role in providing for the daily needs of their loved ones, saving the Australian economy million of dollars in health related costs each year. As our population continues to age and live longer and as the health budget continues to increase, the role of carers becomes even more important. Yet the services provided for carers remains ad hoc and highly inadequate. Carers remain mostly isolated as they are on-call 24 hours per day, 7 days per week with limited support. They often place their own health at risk through chronic stress and burnout. Carers in rural areas are more likely to suffer from this isolation because they are further removed from many support services that their city counterparts are able to access.

In June 2004 a project began to provide support, assistance, practical advice and networking opportunities for carers in rural and remote areas of Western Australia through the use of videoconferencing.

Videoconferencing

Care coordinators were contacted in the participating towns and the concept was explained to them. They were provided with invitations to give to carers through their networks. The first videoconference for carers occurred in June 2004. In the next 12 months there were 11 videoconferences with 11 rural towns. Some sessions were point-to-point and some were multipoint. Over 90 carers participated in the sessions.

Via the use of videoconference, the carers were linked up for a two hour session with Dr Judy Esmond, at the Independent Living Centre in Perth. She was assisted by Dawn Anderson, an occupational therapist. In the initial session Dr Esmond guided carers through a series of steps to identify the stressors in their lives and to develop simple strategies to deal with some of the areas that they had highlighted. She urged carers to value their roles and told them that many carers were consumed with feelings of guilt for taking time out for themselves or enjoying life away from their care recipient. She emphasised that carers must find time for themselves and provided the carers with 10 ideas for dealing with stress, based on her previous research on carers and stress.[2]

Carers attending the sessions had no previous exposure to videoconferencing so a brief introduction to the technology occurred before the sessions commenced. Most carers were aged over 60 years with some participants in their 80s. Those attending expressed that they found the link with Dr Esmond a positive and valuable experience. They stated that they realised they were not alone in dealing with stressors as carers. The carers were able to gain many useful ideas from Dr Esmond and each other on how to deal with some of the stressors they face daily.

Feed back from carers was collected verbally after the initial sessions included the following comments:

- "I have never been thanked before for being a carer"
- "It was good to be told to have time for yourself"
- "...telling how you feel (was good)"
- "It not only gets us together but others in other areas too"
- "It helps you realise that you are not alone – that is really important."

A health professional wrote, "The feedback to me was that the session was great. It has prompted one of the carers to take a much needed break, with her mother coming to the hostel for respite. Even though there is still some degree of guilt, I think the session has helped her deal with this situation a little better."

For some carers the sessions brought painful issues to the surface and ongoing support was arranged for these people. Staff from the Independent Living Centre assisted carers with information about additional resources.

Christmas Capers

Carers who participated in the initial sessions expressed a desire for further link ups with Dr Esmond. Health professionals in contact with the carers also requested further sessions. We responded to these requests by holding *Carers Christmas Capers* via videoconference.

The Christmas Capers sessions were intended as a way of showing appreciation of the carers, as well as providing an additional session on managing the increased stress that often accompanies the festive season. Some towns combined to hold joint Christmas Capers, providing the opportunity for carers from inland towns to visit the coast. Health centres offered respite to the person for whom the carer was responsible. This was greatly appreciated by the carers as it allowed them to participate in the videoconference and then enjoy a Christmas lunch together after the session.

The extra session enabled carers to share and learn from each other. Their valuable role as carers was reinforced as was the acknowledgement of the challenge that carers often face in taking time out for themselves or enjoying life away from their care recipient.

Discussion

Judging from the reactions of carers, the project has been a success. Their requests have resulted in sessions being continued during 2005 and extended to the Gascoyne towns of Exmouth and Carnarvon. The collaboration between the care coordinators, the health services and the Perth-based organisations were essential to running both the regular sessions and Christmas Capers. Partnerships with all providers enabled clear communication and understanding of the role of each person or agency. Good participation from carers is very dependant on the contacts at the rural sites. The outcomes were positive where HACC coordinators were actively engaged and ensured that carers received invitations and were supported to attend.

The technology did not present any significant problems. This was partly due to the willingness of the facilitator to use the technology and her ability to adapt to the medium and engage with participants.

The anecdotal evidence from carers who have continued to attend and are requesting more sessions indicates that these sessions represent a valuable source of support for carers. The sessions continue to develop, with the level of honest sharing between participants growing. Carers are expressing the value of the linkups and have stated how they have used some of the shared ideas. However, at present the project has not been evaluated and therefore it is difficult to offer clear direction for other rural communities considering such a project.

Acknowledgements

I thank the following people: Margaret Denton, Phyllis Dunstone, Dr Judy Esmond, Dawn Anderson and the HACC coordinators and telehealth champions in the Midwest Murchison region. I am also grateful to the carers who attended the sessions.

References

- 1 Delaney Woods and Associates. *Overview of Literature and Research into Aged Care Caregivers*. Perth: Carers WA, 2004. See <http://www.carerswa.asn.au/uploadedfiles/Overview%20of%20aged%20care%20research%20Jan04.pdf>. Last checked 19 July 2005
- 2 Esmond J. *101 Ways to Stress Less*. Perth: Newseason Publications, 2005

Successes and failures: what are we measuring?

Sue Whetton

University Department of Rural Health, Tasmania, Australia

Correspondence:

Sue Whetton
Locked Bag 1372
Launceston
Tasmania 7250
AUSTRALIA
(Fax: +61 3 6324 4040; Email: Sue.Whetton@utas.edu.au)

Summary

In telemedicine and telehealth, the perception of success is complex, varies according to time and context, and depends on the perspective of the observer. Several reviews of the evaluation literature have been undertaken in recent years. These reviews identify common methodological shortcomings. Telehealth services continue to be funded as short-term projects. While it is essential to address methodology issues, it is important to understand that studies of pilot projects provide only interim findings about the feasibility of such applications, not how well they operate as mature applications. This represents something of a conundrum: evaluation is expected to establish the long-term value of telehealth using criteria which are specific to short-term projects. A useful approach would be to develop frameworks enabling all similar studies (e.g. diabetic homecare) to be examined in order to extract commonalities and differences. This would enable us to draw conclusions about where telehealth is effective as well as what variables demonstrate 'success'.

Introduction

Early projects in telemedicine and telehealth were generally funded for specific periods in the expectation of proving their worth before becoming part of mainstream services. Despite many years of telehealth activity, funding continues to be largely short term. Reviews of the literature suggest that perceived shortcomings in telehealth evaluation is one factor in the reluctance of services to make longer-term commitments.[1-3] The success of telehealth is linked to broader health goals of equity, efficiency and high quality care. Within these broad aims, indices of success are diverse, ranging from technology performance, economic and organisational feasibility, to user satisfaction.[4,5] Evaluations tend to focus on a limited number of success variables and/or a specific aspect of telehealth. This has drawn criticism that evaluation has not been sufficiently broad and systematic. 'Good quality studies are still scarce and the generalisability of most assessment findings is rather limited'.[6]

The context of success or failure

Perceptions of success are complex.[7] The view of a particular project varies over time and depends upon the perspective of the observer.[8] A pilot project or project in the establishment phase will have different goals and success criteria than an established, mainstream programme. In addition, the telehealth environment comprises different stakeholder groups with different interests, perceptions and views on success and failure. As Horsfield and Peterson noted, "one person's discourse of e-health development may be another person's discourse of deterioration in the quality of regional health services".[9] Since telehealth evaluation is undertaken for specific audiences, these different views will inevitably influence success criteria. For example, since telehealth is one of many services seeking scarce healthcare resources in a competitive environment, success criteria will of necessity be shaped to meet the expectations of the funding body. There is a view that current evaluation methodologies do not account for these human, cultural, and political factors.[3]

Evaluation methodologies

Several reviews of telehealth evaluation literature have been undertaken in recent years, see Table 1.

Table 1. Analyses of telehealth evaluations

Authors	Analysis
Hailey D, Crowe B [14]	A profile of success and failure in telehealth – evidence and opinion from the SFT conferences
Hailey D, Roine R, Ohinmaa A [15]	Systematic review of evidence for benefits of telemedicine
Health Canada [2]	Evaluating telehealth 'solutions'
KPMG Consulting [16]	Review of the literature on evaluation in telehealth
Lewin Group [11]	Assessment of approaches to evaluating telemedicine
Roine R, Ohinmaa A, Hailey D [13]	Assessing telemedicine: a systematic review of the literature

These reviews identify methodological shortcomings which include:

- weak study design
- insufficient or inadequate data to substantiate claims
- a focus on pilot projects and/or short-term perspectives, with limited analysis of long-term or routine use
- lack of information on broad health outcomes
- an emphasis on qualitative user-satisfaction studies
- problems with the measurement of costs
- a focus on descriptive rather than analytical evaluation criteria
- few comparisons of telemedicine with conventional service delivery.

The conundrum of telehealth

Despite stated intentions to incorporate telehealth into mainstream health care [10], the trend continues towards short-term funding. Almost two-thirds of the papers at the 4th International Conference on Successes and Failures in Telehealth described short-term projects. Short term projects operate differently and deal with different issues than do established programmes. Telehealth evaluations which are linked to short-term funding, are likely to suffer various problems:

- it is difficult, if not impossible, to explore issues around longer-term, routine use or broader health outcomes
- pilot projects may have small numbers of participants resulting in insufficient or inadequate data
- evaluation outcomes may not be generalisable beyond the short term project, since 'data collected during pilot studies may not be comparable to services in full operation'[4]
- evaluation is likely to focus on the success criteria of the funding body. These are often simply cost and usage
- those who participate in short-term, pilot projects are more likely to have positive views. This may influence their perceptions and the final outcomes of an evaluation, particularly where user satisfaction is the variable
- the costs of operating a start-up telemedicine operation may not reflect the true, longer term running costs of the programme.[11]

While it is essential to address methodology issues, it is important to understand that 'studies of pilot projects provide only interim findings about the feasibility of such applications, not how well they operate as mature applications'.[11] This represents something of a conundrum: evaluation is expected to establish the long-term value of telehealth using criteria which are specific to short-term projects.

The complexity of telehealth

Telehealth evaluation has been criticised for limited generalisability of findings. Since telehealth includes a range of services dealing with different types of information in different organisational, social and geographical contexts, 'the number of potential variables poses many challenges for evaluation and for building a cumulative history of research'.[12] While individual studies may provide 'useful indicators to decision-makers in the health systems concerned,'[13] the diversity of service types makes it difficult to draw any general conclusions. Given this difficulty, perhaps evaluation should focus on "*specific conditions in narrowly concentrated applications*".[11] Hebert suggested that a useful approach would be to develop frameworks enabling "all similar studies (e.g. diabetic homecare) to be examined to extract commonalities and differences. This will enable us to begin drawing conclusions about where telehealth is effective as well as what variables demonstrate 'success' and begin investigating issues".[4]

Conclusion

Decision-makers are still not fully convinced of the contribution of telehealth to overall health care goals. Telehealth services continue to be funded as short-term projects. Narrowly focussed evaluations and methodological weaknesses have been identified as factors contributing to this. While there is some basis for these criticisms, the complexity of telehealth and its operating context need to be understood. The development of a more rigorous approach to telehealth evaluation should acknowledge and account for these factors.

References

- 1 Perednia DA, Wallace J, Morrissey M, *et al.* The effect of a teledermatology program on rural referral patterns to dermatologists and the management of skin disease. *Medinfo* 1998; **9**: 290-3
- 2 Health Canada, Office of Health and the Information Highway. *Evaluating Telehealth Solutions: a Review and Synthesis of the Telehealth Evaluation Literature*. 2000. See http://www.hc-sc.gc.ca/ohih-bis/pubs/2000_tele/tele_e.html. Last checked 17 July 2005
- 3 Klecun-Dabrowska E. Telehealth in the UK: a critical perspective. *Electron J Bus Res Methods* 2004; **2**: 37-46
- 4 Hebert M. Telehealth success: evaluation framework development. *Medinfo* 2001; **10**: 1145-9
- 5 Hu PJ-H. Evaluating telemedicine systems success: A revised model. *Proceedings of the 35th Hawaii International Conference on System Sciences*, 2002. See <http://csdl2.computer.org/comp/proceedings/hicss/2003/1874/06/187460174b.pdf>. Last checked 5 July 2005
- 6 Scott RE, Coates K, McCarthy GF. The value of an evaluation framework for telehealth initiatives. *Stud Health Technol Inform* 1999; **64**: 39-45
- 7 Wootton R, Hebert MA. What constitutes success in telehealth? *J Telemed Telecare* 2001; **7** (suppl. 2): 3-7
- 8 Bowns IR, Rotherham G, Paisley S. 1999, Factors associated with success in the implementation of information management and technology in the NHS. *Health Informatics Journal* 1999; **5**: 136-45
- 9 Horsfield B, Peterson C. 2000. The hierarchy of discourses in the current diffusion of e-health, telemedicine and telehealth in Australia. DCITA Communications Research Forum, 2000. See: <http://www.crf.dcita.gov.au/papers2000/horsfield.doc>. Last checked 17 July 2005
- 10 Parkinson C, Hudson L, Hornsby D, Madl R, Collins R. Telehealth: a national, sustainable approach. 7th National Rural Health Conference, Hobart 2003. See: http://www.nrha.net.au/nrhpublic/publicdocs/conferences/7thNRHC/Papers/general%20papers/parkinson_hudson.pdf. Last checked 17 July 2005
- 11 Lewin Group. Assessment of approaches to evaluating telemedicine: Final Report, December 2000: Section B. See: <http://aspe.hhs.gov/health/reports/AAET/aaet.htm>. Last checked 17 July 2005
- 12 Carson E, Cramp D, Morgan A. Some methodological issues in telemedicine: systems, modeling and evaluation. *International Conference on Information Technology Applications in Biomedicine, Amsterdam*, 1999: 11. See

<http://ieeexplore.ieee.org/iel5/6788/18221/00842308.pdf?arnumber=84230>

8. Last checked 12 July 2005

- 13 Roine R, Ohinmaa A, Hailey D. Assessing telemedicine: a systematic review of the literature. *CMAJ* 2001; **165**: 765-71
- 14 Hailey D, Crowe B. A profile of success and failure in telehealth – evidence and opinion from the Success and Failures in Telehealth conferences. *J Telemed Telecare* 2003; **9** (suppl. 2): 22-4
- 15 Hailey D, Roine R, Ohinmaa A. Systematic review of evidence for benefits of telemedicine. *J Telemed Telecare* 2002; **8** (suppl. 1): 1-30
- 16 KPMG Consulting. Review of the literature on evaluation and telehealth. Commonwealth Department of Health and Aged care/Australian and New Zealand Telehealth Committee, 1999

Referral patterns for a global store-and-forward telemedicine system

R Wootton¹, K Youngberry¹, R Swinfen² and P Swinfen²

1 Centre for Online Health, University of Queensland, Australia

2 Swinfen Charitable Trust, Canterbury, UK

Correspondence:

Professor R Wootton
Centre for Online Health
Level 3, Foundation Building
Royal Children's Hospital
Herston 4029
AUSTRALIA
(Fax: +61 7 3346 4705; Email: r_wootton@pobox.com)

Summary

We examined the nature of the referral patterns in the email telemedicine network operated by the Swinfen Charitable Trust (SCT) with a view to informing long-term resource-planning. Over the first six years of operation, 62 hospitals from 19 countries registered with the Trust in order to be able to refer cases for specialist advice; 55 of these hospitals (89%) actually referred cases during this period. During the first six years of operation, nearly 1000 referrals were submitted and answered, from a wide range of specialty areas. Between July 2002 and March 2005 the referral rate rose from 127 to 318 cases per year. The median length of time required to provide a specialist's response was 2.3 days during the first 12 months and 1.8 days during the last 12 months. Five hospitals submitted cases for more than four years (together sending a total of 493 cases). Their activity data showed a trend to declining referral rates over the four year period, which may represent successful knowledge transfer. There is some evidence that over the last three years the growth in demand has been exponential, while the growth in resources (i.e. specialists) has been linear, a situation which cannot continue for very long before demand outstrips supply.

Introduction

The Swinfen Charitable Trust (SCT) has operated a low-cost email telemedicine system to support doctors in developing countries since mid-1999.[1] The network is now in its seventh year of operation, making it one of the longest-running such telemedicine networks, i.e. operated for charitable purposes and dealing mainly with clinical work. During the first six years of operation, nearly 1000 referrals were managed. For the first three years, email messages were handled manually; subsequent operations have depended on an automatic message-handling system.[2,3]

We have previously described the overall performance of the network and the referring doctors' views about it [4]. To operate successfully, any telemedicine network – whether real-time or store-and-forward – must balance demand with supply, i.e. requests for clinical consultations must be met within an agreed time. There is a dearth of reports about methods for doing this in practice, and how well networks actually perform.[5] The present study was carried out to examine the nature of the referral patterns in the SCT network with a view to informing long-term resource-planning.

Methods

Data collected during the initial phase of network operation (when email messages were handled manually) and data collected automatically from the second phase (when message-handling was computerised) were collated in spreadsheet form for analysis.

Results

Over the first six years of operation, 62 hospitals from 19 countries registered with the Trust in order to be able to refer cases for specialist advice. A total of 55 of these hospitals (89%) actually referred cases during this period. The following statistics are based on referrals in the first 5y 9m of operation, i.e. from July 1999 to March 2005.

Referrals from the hospitals

Hospitals which had been members of the network for longer tended to have referred more cases (not unexpectedly). The correlation coefficient was significant ($r=0.73$), although the relationship was heavily influenced by the performance of four hospitals, which collectively provided 469 referrals (51% of the total), Figure 1.

At the time of the study in March 2005, seven of the 49 hospitals (14%) had not referred a case for more than one year and so they were classed as "inactive" and excluded from the present analysis. Thus there were 42 "active" hospitals which had continued to send cases (i.e. their most recent case had been referred less than one year ago at the time of the study). These 42 fell roughly into two groups, i.e. they could be divided into 18 hospitals (43%) which sent cases regularly (where "regularly" was defined as an average referral rate of one case per month or greater) and 24 hospitals (57%) which sent them less frequently.

In parallel with the growth in numbers of hospitals referring cases (Figure 2), there was a growth in the numbers of volunteer specialists who answered them, see Figure 3. At 31 March 2005, there was a total of 144 specialists from a wide range of health care disciplines. These specialists were located in 12 countries.

Operational performance of the network. During the period from 1 July 1999 to 31 March 2005 (2069 days) a total of 912 cases was referred. Detailed statistics were not available for the period before July 2002 when records were kept manually, so the following analysis is restricted to the epoch July 2002 to March 2005 (a total of 594 cases).

Demand. The annual referral rate was 127 during the first 12 months of automatic message-handling and had risen to 318 during the last 12 months, Figure 4. The distribution of case-arrival times is shown in Figure 5.

Supply. The median length of time required to provide a specialist's response was 2.3 days during the first 12 months and 1.8 days during the last 12 months, see Table 1. The distribution of case-answering times is shown in Figure 6.

Table 1. Network demand and supply – first 12 months of automatic message-handling and last 12 months

	DEMAND	SUPPLY	
	Referrals	Time to specialist's response (days)	
	n	Median	Interquartile range
First 12 months (1/7/02 to 30/6/03)	127	2.3	0.8–5.6
Last 12 months (1/4/04 to 31/3/05)	318	1.8	0.6–4.9

Pattern of referral from the five hospitals longest in the system. Five hospitals submitted cases for more than four years (together sending a total of 493 cases). These hospitals are located in Bangladesh (2), the Solomon Islands (2) and Nepal (1). Their activity data show a trend to declining referral rates over the four year period (Figure 7).

Discussion

Referral patterns

Five hospitals continued to submit cases for more than four years. One may conclude that they did so because they found the service useful,[4] rather than because of the novelty effect of telemedicine. The reasons for the long-term decline in referral rate are not easily defined, but probably include staff turnover and telecommunication problems. Nonetheless, a fall in referral rates from a given hospital may not represent a failure. On the contrary, it may actually reflect success, if the drop in referrals results from local knowledge that has been gained as a result of using telemedicine.

Modelling demand and supply

Figure 5 shows that the distribution of case arrival times is approximately exponential, i.e. there is some evidence that arrival times are Poissonian. This would be expected if a large number of independent event streams were merged together, and if events in each stream occurred at a very low rate – the resulting stream would then be approximately a Poisson process with exponential intervals. Figure 6 shows that the distribution of case-answering times is also approximately exponential, i.e. there is some evidence that service times are also Poissonian.

By convention, the interrelation of demand and supply is analysed in a queuing model.[6] Such models assume that the arrival times and service times follow an exponential distribution – for which there is some evidence in the case of the SCT telemedicine network. This is important, because simple M/M/1 queuing models, for example, are well understood.[6] There are closed, analytic solutions which describe their performance. Unfortunately, the real situation is more complicated. At least an M/M/n model would be required to model the operation of the SCT network, for which an analytic solution has yet to be described. However, simulation is possible and this represents a fruitful area for future telemedicine research.

Planning network resources

A successful telemedicine network must balance supply and demand. In the present context, the SCT must balance the growth in the number of hospitals which request services with the growth in the number of specialists who can provide them. There is some evidence that over the last three years the growth in demand has been exponential (Figure 2), while the growth in resources (specialists) has been linear (Figure 3), a situation which cannot continue for very long before demand outstrips supply. There are signs that this is beginning to occur, see Figure 8. This has important implications for network planning.

Conclusion

The SCT operation is an example of altruistic telemedicine work; it uses a "low-tech" approach; it appears to be useful, cost-effective and sustainable. As it grows, it is crucial that network resources keep pace with network demands. There is some evidence that network demand is beginning to outstrip supply, a situation which cannot continue for very long before it will lead to trouble.

References

- 1 Swinfen R, Swinfen P. Low-cost telemedicine in the developing world. *J Telemed Telecare* 2002; **8** (suppl 3): 63-5
- 2 Wootton R. Design and implementation of an automatic message-routing system for low-cost telemedicine. *J Telemed Telecare* 2003; **9** (suppl 1): 44-7
- 3 Swinfen P, Swinfen R, Youngberry K, Wootton R. A review of the first year's experience with an automatic message-routing system for low-cost telemedicine. *J Telemed Telecare* 2003; **9** (suppl 2): 63-5
- 4 Wootton R, Youngberry K, Swinfen P, Swinfen R. Prospective case review of a global e-health system for doctors in developing countries. *J Telemed Telecare* 2004; **10** (suppl 1): 94-6

- 5 Krupinski E, Webster P, Dolliver M, Weinstein RS, Lopez AM. Efficiency analysis of a multi-specialty telemedicine service. *Telemed J* 1999; **5**: 265-71
- 6 Gross D, Harris CM. *Fundamentals of Queueing Theory*, 2nd ed. New York: J Wiley, 1985

Figure 1. Relation between the number of cases referred by a hospital and the length of time it had been a member of the network

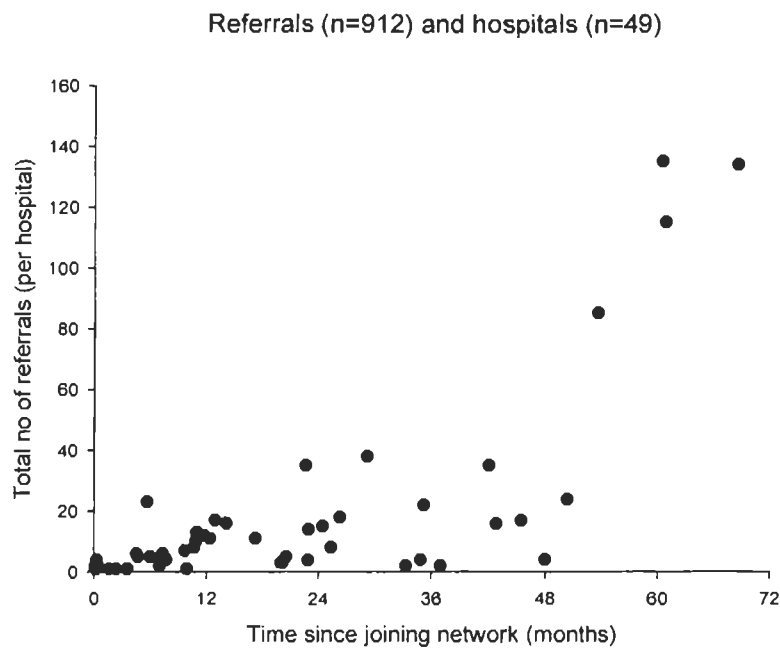


Figure 2. Hospitals and the dates on which they first referred cases

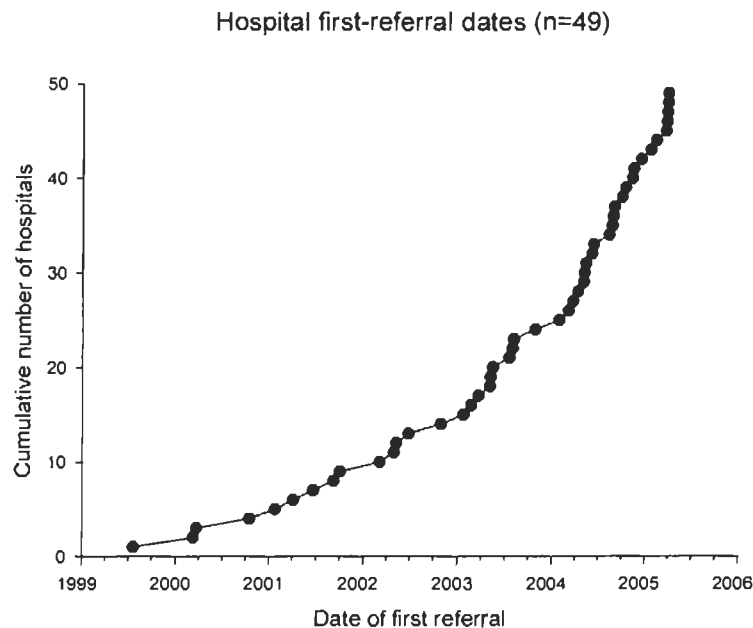


Figure 3. Specialists and the dates on which they first replied to referrals

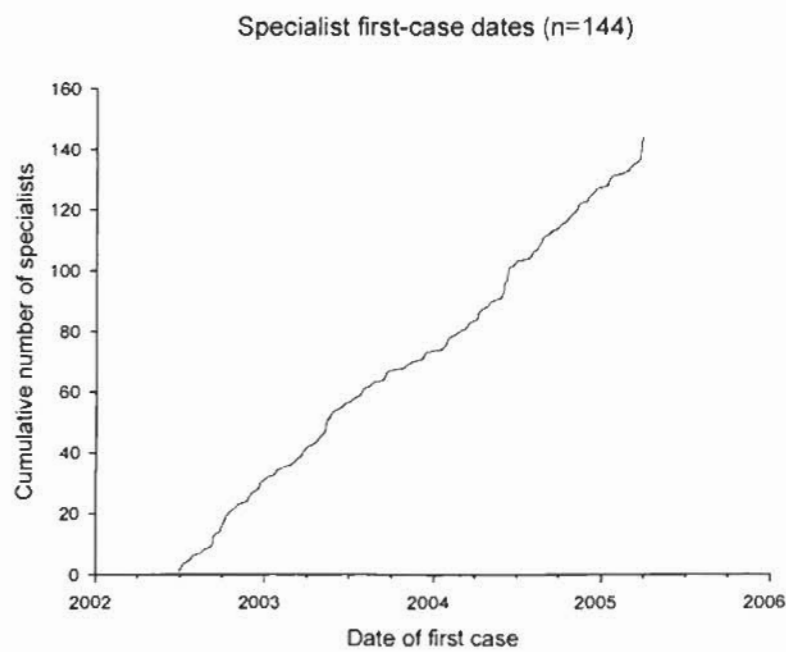


Figure 4. Referral rate

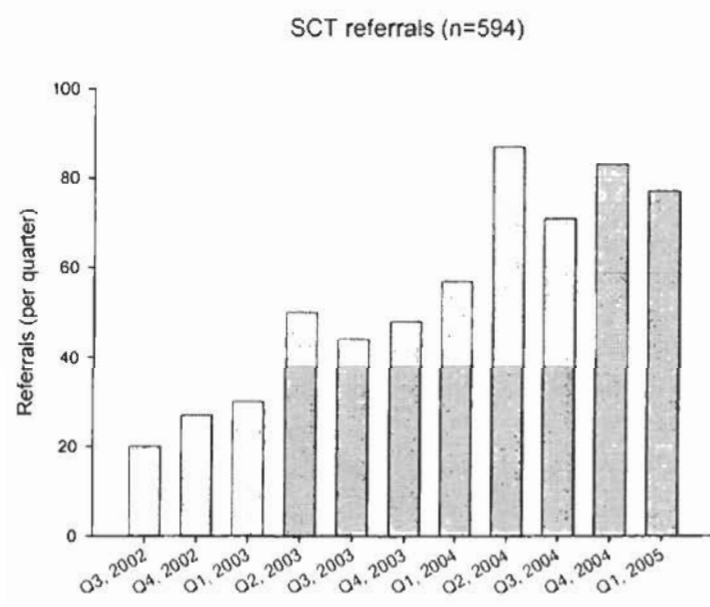


Figure 5. Frequency distribution of inter-case arrival times

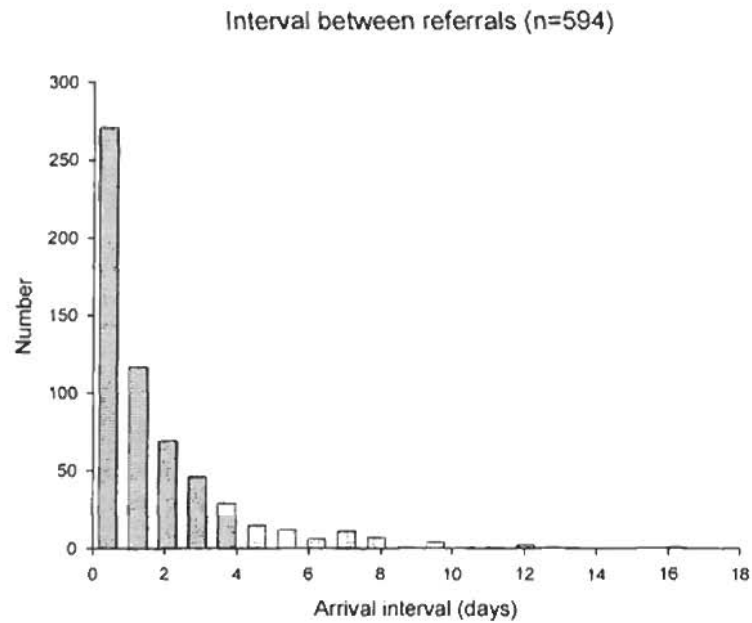


Figure 6. Frequency distribution of case-answering times

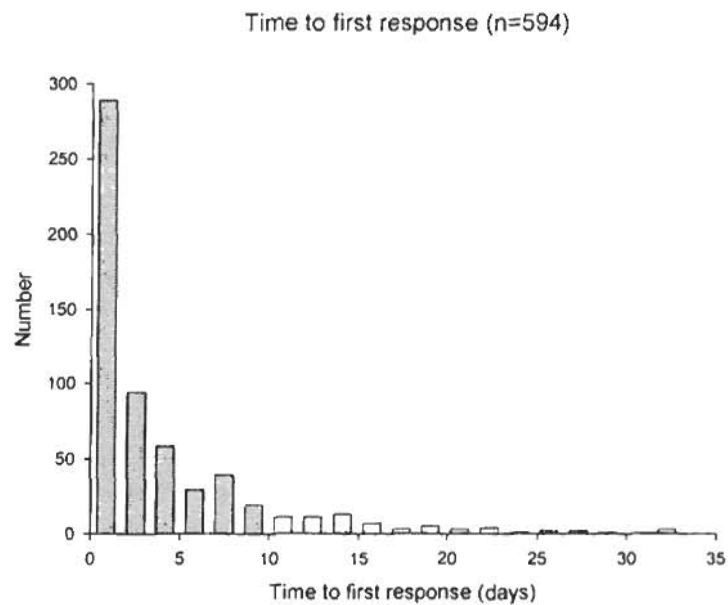


Figure 7. Referrals from the five hospitals longest in the system

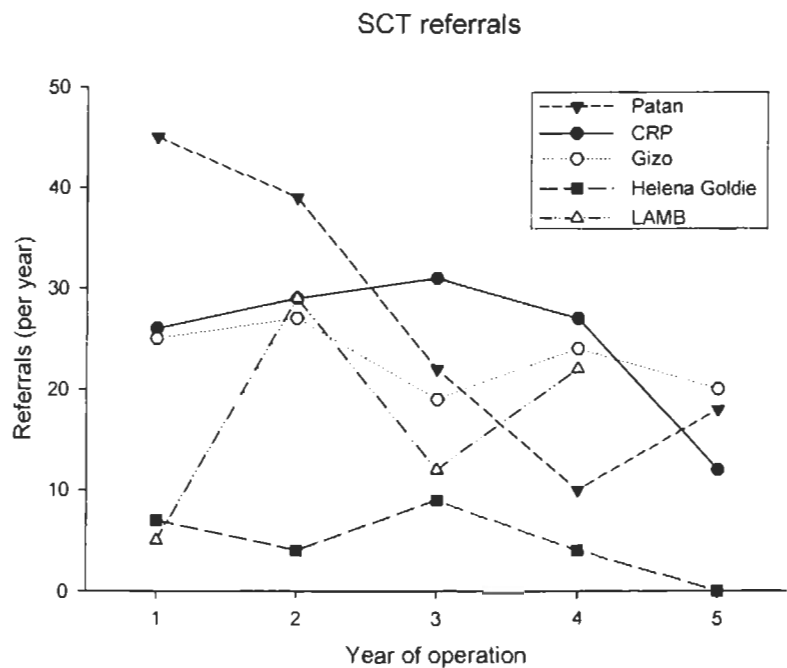
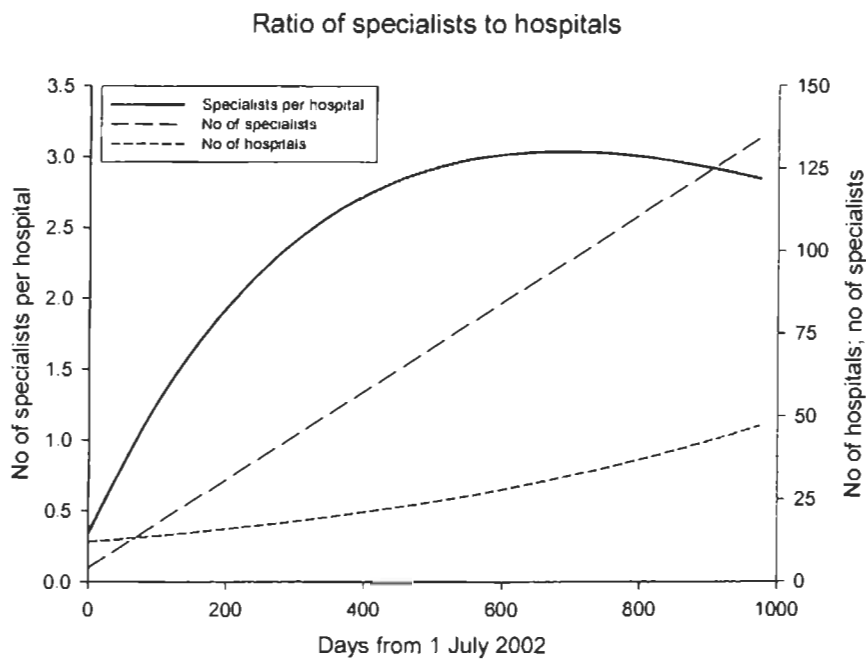


Figure 8. Numbers of specialists and numbers of hospitals, since 1/7/02



Evaluation of the Western Australian Department of Health telehealth project

Eric Dillon¹, Jozef Loermans¹, Dale Davis¹ and Cathy Xu²

1 Western Australian Department of Health, Perth, Australia

2 Centre for Online Health, University of Queensland, Brisbane, Australia

Correspondence:

Dr Cathy Xu
Centre for Online Health
Level 3, Foundation Building
Royal Children's Hospital
Herston 4029
AUSTRALIA
(Fax: +61 7 3346 4705; Email: cxu@coh.uq.edu.au)

Summary

In 1999, the WA Department of Health began a telehealth project, which finished in 2004. The 75 videoconferencing sites funded by the project were part of a total state-wide videoconference network of 104 sites. During the period from January 2002 to December 2003, a total of 3266 consultations, case reviews and patient education sessions took place. Clinical use grew to 30% of all telehealth activity. Educational use was approximately 40% (1416 sessions) and management use was about 30% (1031 sessions). The average overhead cost per telehealth session across all regions and usage types was \$192. Meaningful comparisons of the results of the present study with other public health providers was difficult, because many of the available web sites on telehealth were out of date. Despite the successful use of telehealth to deliver clinical services in WA, sustaining the effort in the post project phase will present significant challenges in the future.

Introduction

Western Australia (WA) is a large state, with an area of approximately 2.5 million square kilometres and a population of about 2 million people. Because of the low population density, telemedicine has been increasingly used to deliver health services. Telepsychiatry began in WA in 1996 and has been almost entirely self funded. It is managed by the Office of Mental Health. Teleradiology began in WA in 2001. It was also independently managed.

In 1999, the WA Department of Health began a telehealth project, which finished in 2004. The objective was to improve the quality and accessibility of health services for the people of WA, particularly those living in regional and rural areas. The project was managed by a Telehealth Development Unit (TDU). This paper reports the outcome of the WA telehealth project, based on the WA Department of Health Report 2004.[1]

Methods

Commercial videoconferencing equipment (largely Media Pro and Polycom) and digital lines (ISDN) were installed at project sites. Peripheral equipment included slit lamps, ophthalmology cameras, digital cameras and document cameras. Clinical consultations were mainly conducted at a bandwidth of 384 kbit/s and educational links were mainly at 128 kbit/s.

Data for the evaluation were collected from log-sheets of videoconference sessions in conjunction with a custom designed database, project reports and interviews.

Costs

A format for cost/benefit analysis of individual projects and telehealth services was developed from a model designed by the Midwest and Murchison Health Service. The cost of telehealth services is particularly sensitive to the level of activity because of the relatively high fixed component (i.e. the capital cost of the equipment and the cost of telehealth coordinating staff). As usage increases, the cost per session falls significantly. The threshold point, at which telemedicine becomes cheaper than the conventional alternative, is different for each region, depending on factors such as the equipment installed and the cost of travel.

The costs per session for sites in each region were calculated. The costs included an overhead for set up and operating costs for the provision of the service at that site/region. These costs consisted of:

- *set-up costs.* ISDN installation, cabling, room modifications for videoconferencing, equipment
- *operating costs.* estimated annual ISDN rental cost, total cost of staff training per year, estimated average cost for staff involved with telehealth development, coordinator costs and other personnel costs, depreciation.

Line and call costs received no discount, however bridging costs were provided at a reduced rate by agreement between the suppliers and the WA Department of Health.

Results

The 75 videoconferencing sites funded by the project were part of a total statewide videoconference network of 104 sites. The project funded telehealth equipment in 56 country towns and 14 metropolitan locations (Figure 1).

Activity

A total of 3266 consultations, case reviews and patient education sessions were recorded for the period from January 2002 to December 2003 (Figure 2). Clinical use grew to 30% of all telehealth activity. Educational use was approximately 40% (1416 sessions) and management use was about 30% (1031 sessions). When telepsychiatry and store and forward information transfer were included, there was a grand total of 5397 cases/sessions for the two-year period (Table 1).

Table 1. Clinical occasions of service, including telepsychiatry

Type	2002	2003	2002-2003
Videoconferences	1115	2151	3266
Telepsychiatry	530	1029	1559
Digital ophthalmology	21	115	136
Digital wound images	75	296	371
Other digital images	15	50	65
<i>Total</i>	<i>1756</i>	<i>3641</i>	<i>5397</i>

Teleradiology, which operates via a separate network, accounts for an additional 33,000 transmissions per year. Table 2 lists other clinical services conducted via telehealth between July 2002 and June 2003 and the number of occasions of service for each program. This includes many of the outpatient services conducted by the Royal Perth Hospital (e.g. neurology, pain medicine and the amputee clinic) and the paediatrics and child development programmes managed by the Women's and Children's Health service.

Table 2. Clinical services provided by videoconferencing (July 2002-June 2003)

Programme	Total no of sessions
Aged care assessments	94
Community health education	376
Dietetics and diabetes	280
Mental health	845
Occupational therapy/ rehabilitation.	74
Ophthalmology (including store and forward)	111
Outpatients and others	387
Renal medicine	74
Respiratory medicine/asthma	55
Speech pathology	124
Wound management, wound care/ostomy	208
<i>Total</i>	<i>2628</i>

Costs

The average overhead cost per telehealth session across all regions and usage types was \$192, Table 3. The cost of the TDU was not included because TDU costs were not expected to continue at the same level as during the development and evaluation phases.

Table 3. Site/region costs

Region/Site	Setup \$	Operational Costs	* Annualised Costs	Activity Level (Events) for 2003	Average Overhead per TH event \$
Metro					
Royal Perth Hospital	66800	124335	135315	402	\$337
Womens & Childrens	63191	142594	153814	317	\$485
Fremantle Hospital	37400	12722	19762	38	\$520
Sir Charles Gardiner Hospital	17500	8860	12160	73	\$167
Metro Average					\$377
NGOs					
Institute of Child Health Research	18200	6360	12960	48	\$270
Independent Living Centre	15250	8000	10825	55	\$197
Cancer Foundation (Palliative Care)	15889	5220	8109	47	\$173
Royal Flying Doctor Service	28000	6440	11240	50	\$225
NGO Average					\$216
Rural					
Central Great Southern	32581	17651	20648	101	\$204
Lower Great Southern	52856	39660	49272	290	\$170
Upper Great Southern	156990	30570	72299	253	\$286
Northern Goldfields	45871	47910	55909	450	\$124
South East Coast	49606	50130	59390	338	\$176
Rural Average					\$192
Pilbara/Gascoyne					
East Pilbara	97458	40130	75120	444	\$169
West Pilbara	81469	49900	64044	348	\$184
Camarvon	35010	42695	49023	156	\$314
Exmouth	16470	15246	18070	82	\$220
Pilbara/Gascoyne Average					\$222
Mid-West/Murchison	108757	179017	89520	718	\$125
Kimberley	123420	130005	150349	883	\$170
Avon	14050	18700	21105	127	\$166
Western Region	13050	10315	12620	184	\$69
	\$1,089,818	\$986,460	\$1,101,554	5,404	\$192

Discussion

There is a general lack of published information about telehealth costs.[2] This is also the case for telepsychiatry, which is arguably the most mature application of real-time telehealth.[3,4] Meaningful comparisons of the results of the present study with other public health providers was difficult, because many of the available web sites on telehealth were out of date.

Urness *et al.* claimed that there was no financial advantage in providing telepsychiatry sessions compared to traditional services.[5] On the other hand, Zaylor *et al.* found that telemedicine cost savings of up to 60% could be achieved compared to traditional delivery.[6] We found that the average overhead cost of each telehealth event (clinical or otherwise) was \$192 (not including TDU costs) which compares favourably with the average cost per trip of \$279. This study supports the findings of Zaylor *et al.* since significant savings were achieved in some areas, but more so in education and administrative sessions than in clinical sessions.[6] However, it was quicker and easier for a clinician to sign a Patient Assistance Travel Scheme (PATs) form than to set up a videoconferencing session

so the use of telehealth had not become established as the preferred option where appropriate. Similar experience has been reported in Queensland.[7]

Support from senior management is acknowledged to be crucial in ensuring stable funding for successful telehealth programmes.[5] These findings are entirely consistent with the WA experience. Coordinators were critical to the implementation of individual projects and made significant contributions to the overall success of the telehealth project. There needs to be continuing support for the coordinators' role for the program to be sustainable.

The implementation of telehealth in Australia is managed largely independently on a state by state basis. In a recent survey by Wootton *et al.*, it was found that hospitals in South Australia had the highest involvement, with 71% reporting telehealth activity of one sort or another, followed by WA with 62%, Queensland with 51% and Tasmania with 50%. Public hospitals were more likely to embrace the technique than private hospitals and it was found that the more remote the location, the higher the likelihood of telehealth use.[8]

Conclusion

The WA telehealth project achieved its objectives of significant clinical utilization, educational and training support, and improved information access. We found that not all clinical telehealth projects provided significant cost savings to the WA Department of Health. Some programmes represented a net cost to the health department and the savings offered by some others were only modest. However, most programmes offered significant qualitative and other longer term benefits than cost savings alone. Despite the successful use of telehealth to deliver clinical services in WA, sustaining the effort in the post project phase will present significant challenges in the future.

References

- 1 Loermans JG, Davis DA. *Evaluation of the Western Australian Department of Health Telehealth Project*. Perth: Western Australian Department of Health, 2004 (Unpublished report)
- 2 PricewaterhouseCoopers. *HealthCast Tactics: A Blueprint for the future*. 2002. See <http://www.healthcare.pwc.com/hctactics.html>. Last checked 19 July 2005
- 3 Wootton R, Yellowlees P, McLaren P, eds. *Telepsychiatry and e-Mental Health*. London: Royal Society of Medicine Press, 2003
- 4 Laxminarayan S, Stamm BH. *Technology, Telemedicine and Telehealth. Business Briefing - Global Healthcare 2002 vol. 2*. London: World Medical Association, 2002: 93-6
- 5 Urness D, Weisser L, Campbell, Hilty D. *Telepsychiatry in Canada and the United States*. In: Wootton R, Yellowlees P, McLaren P, eds. *Telepsychiatry and e-Mental Health*. London: Royal Society of Medicine Press, 2003: 97-111
- 6 Zaylor C, Spaulding A, Cook D. *Mental health correctional telemedicine*. In: Wootton R, Yellowlees P, McLaren P, eds. *Telepsychiatry and e-Mental Health*. London: Royal Society of Medicine Press, 2003: 137-47

- 7 Smith AC, Williams M, Van der Westhuyzen J, McCrossin R, Isles A, Wootton R. A comparison of telepaediatric activity at two regional hospitals in Queensland. *J Telemed Telecare* 2002; **8** (suppl. 3): 58-62
- 8 Wootton R, Blignault I, Cignoli J. A national survey of telehealth activities in Australia hospitals. *J Telemed Telecare* 2003; **9** (suppl 2): 73-5

Figure 1. Western Australian telehealth network

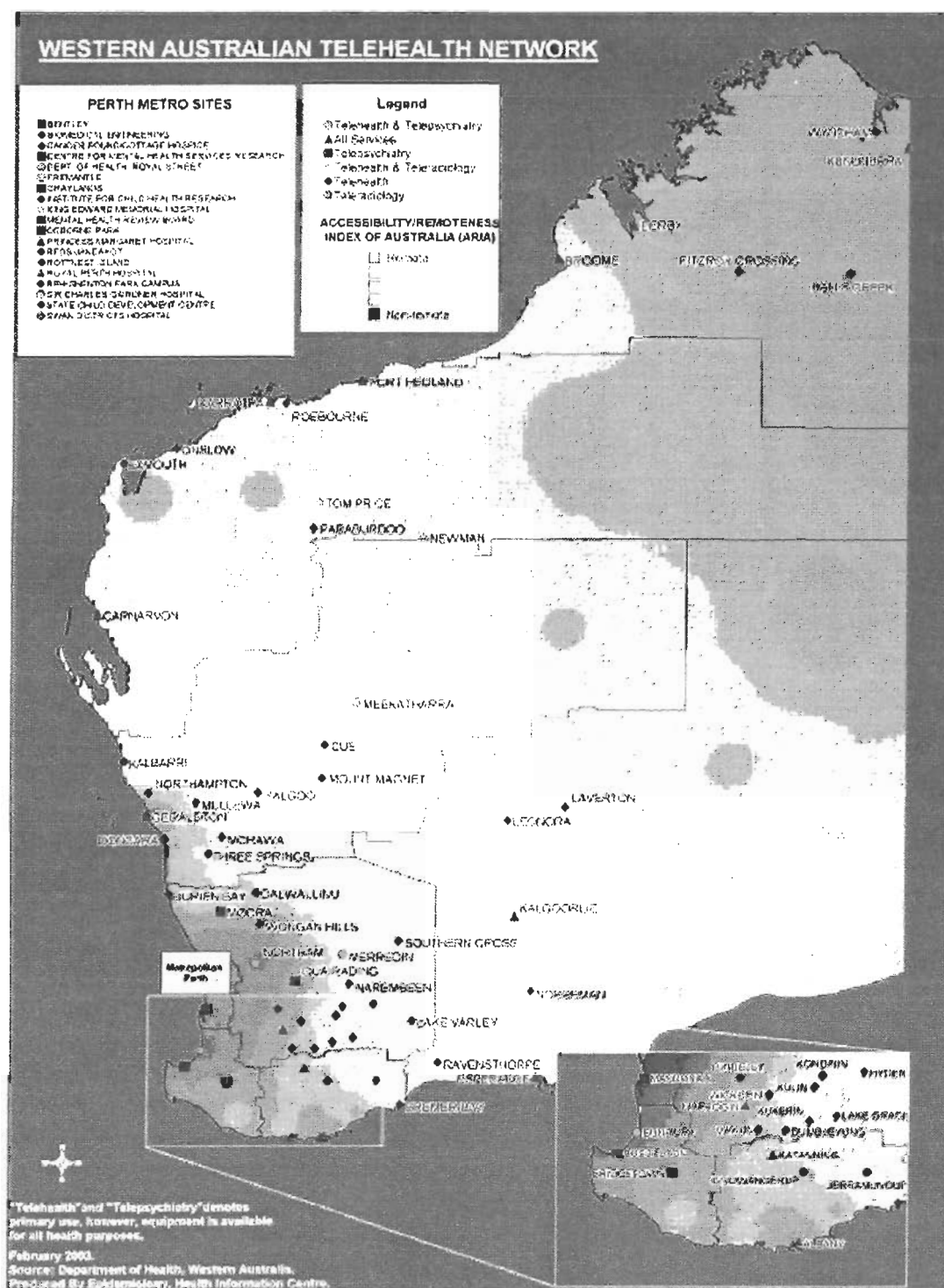
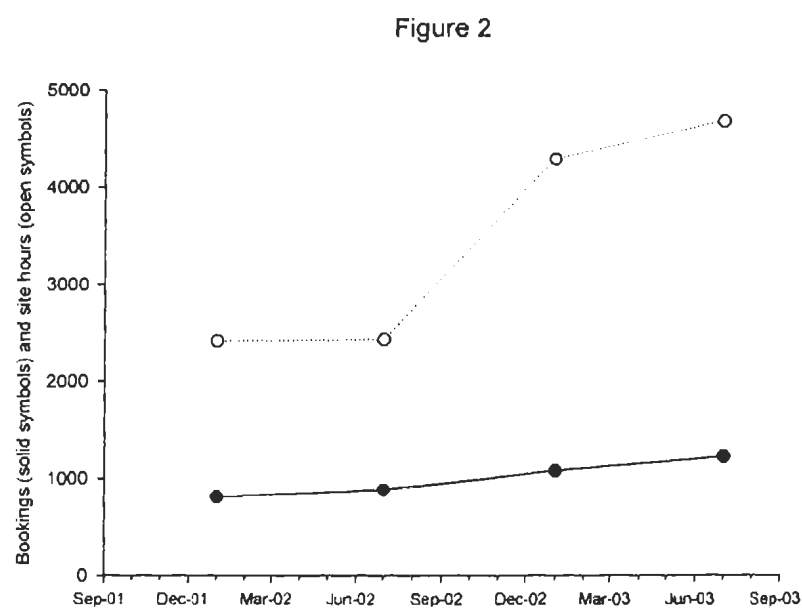


Figure 2. Numbers of bookings and videoconferencing hours



Work practice changes caused by the introduction of a Picture Archiving and Communication System (PACS)

Ping Yu¹ and Paul Hilton²

1 Health Informatics Research Centre, Faculty of Informatics, University of Wollongong, Australia

2 Metropolitan Health and Aged Care Services, Department of Human Services, Victoria, Australia

Correspondence:

Ping Yu
Health Informatics Research Centre
School of IT and Computer Science
University of Wollongong
Wollongong 2522
AUSTRALIA
(Fax: +61 2 4221 4170; Email: ping@uow.edu.au)

Summary

We studied the acceptance of work practice changes six months after the introduction of a Picture Archiving and Communication System (PACS) in New South Wales. A one-page questionnaire was developed to assess doctors' and nurses' acceptance of work practice changes. 100 subjects were surveyed and 76 responded. 92% of participants worked in the Intensive Care Unit (ICU) or the Emergency Department (ED). The results showed that the PACS had received a high level of acceptance. The respondents would not like to return to a film-based practice. They were happy with the accessibility of images, especially when patients returned from an X-ray examination. At the time of survey, the doctors still had difficulty in remembering their user name and password. The users rarely or only sometimes used their own usernames and passwords to log on the system. They were sometimes annoyed by the automatic time out function. Nurses were happy that the PACS relieved their burden of searching for X-ray images for doctors. However, they distanced themselves from accessing the PACS, which they regarded as a doctors' tool.

Introduction

In April 2002 the Illawarra Health (IH) organization started to implement a Picture Archive and Communication System (PACS) in New South Wales. The introduction of PACS has affected the work practices of many users, including radiologists, radiographers, nurses and doctors. A literature study[1-7] identified that understanding work practice changes and clinicians' acceptance of the changes is critical for the successful integration of the PACS system into clinicians' work practice. The rapid delivery of X-ray images to clinicians is

critical for timely diagnoses and treatment. Siegel *et al.*[5] reported that the rate of film loss can be reduced from 8% in a film environment to less than 1% using a PACS.

The aim of the present study was to determine what work practice changes occurred by the introduction of the PACS system and if the work practice changes for the high user group of clinicians were accepted. (A high-user clinician is one who makes diagnoses or acute clinical decisions from unreported X-ray images or performs operative procedures from X-ray images).

Methods

A cross-sectional, quantitative descriptive survey and qualitative interview was conducted. The study groups chosen were everyday users of radiology services, who could not function effectively without X-ray images. A de-identified questionnaire was developed to collect qualitative and quantitative data. Randomly-chosen staff were interviewed to clarify issues identified.

Likert scale questions were used ("Never, Rarely, Sometimes, Mostly to Always"). Face value and content value of the questionnaire were validated by eight radiology staff. Finally the questionnaire was piloted by three staff not related to the survey area to test the time it would take on average to complete the questionnaire. The average time taken was 25 min.

Results

76 out of 100 questionnaires were received, a response rate of 76%. The number of respondents in different clinical units is shown in Figure 1. 92% of participants worked in the Intensive Care Unit (ICU) or the Emergency Department (ED). Six participants worked in three other units (orthopaedics, urology and neurosurgery). The following analysis is based on the data collected from the ICU and the ED. The consultants, registrars and Junior Medical Doctors (JMD) were aggregated together as doctors to compare their responses against those of nurses, Figure 2.

Work practice changes

The work practice changes identified were:

- better access to films. In the film based practice, doctors or nurses had to go to the Radiology Department to obtain the hard copy films. With the PACS system, the images were readily available to authorised users at multiple locations once radiographers have processed them and checked their quality
- increased speed of access to X-ray images in multiple locations, including doctor's home through broadband connection
- different medium for viewing X-ray images. The viewing medium changed from hard-copy film to digital image on a screen. The user loses the freedom of moving X-ray images easily from one location to another
- the possible change of indicator that an X-ray image is waiting to be reviewed
- the user's comfort of using user name and password to log on to the PACS.

Timely availability of images in locations of clinicians' choice

There was no significant difference in answers to the questions (1) "Are you able to access PACS in a timely manner" and (2) "Can you access images electronically when you require them" between doctors and nurses. However, there were significant differences in answers to both questions between medical units ($P < 0.05$ for Question 1 and $P < 0.01$ for Question 2, respectively).

The staff in the ICU answered both questions more positively than those in the ED. There were two X-ray film viewing boxes in the old film system and two viewing computers in the PACS system in the ICU. There were 24 viewing boxes previously and six computers in the PACS environment in the ED. This might explain why staff in the ED were less happy than those in the ICU. Some clinicians commented that they would need the same number of PACS screens as there were viewing boxes in the acute areas, such as the ICU.

Ability to access images

The questions asked were (1) "Do you have access to PACS in your office within the IH network?" (2) "Do you have access to PACS from an office or from home through dial-in?" No significant differences in answers to the above questions were found between medical units. However, there were significant differences in answers given by doctors and nurses ($P < 0.05$ for Question 1, $P < 0.05$ for Question 2, respectively). The nurses were more positive in answering the above questions than the doctors. Discussion with nurses suggested that they were pleased that they did not have to search for hard copy films for doctors in the PACS environment. Discussion suggested that the nurses view the PACS as a tool for doctors and they did not themselves use the system. Doctors were "Sometimes" to "Mostly" happy with access to the PACS in their offices. However, they were not happy with access to the PACS through dial-in.

Ability to move images freely to access images from multiple locations

The clinicians were asked "Is the inability to move freely with X-ray images (film) from one location to another an issue in your daily practice?" There was no significant difference in answers to this question between clinical units or occupation. The average score of answers to this question was 2.9, close to "sometimes". This indicates that although the clinicians did feel the inability to move X-ray images freely inconvenient sometimes, their perceived advantage of the capability to access X-ray images in multiple locations outweighs the inability to move X-ray images freely.

Both the doctors and nurses answered the question "Are there enough PACS viewing stations in your area" quite positively, with the average score of 3.9, which was close to the answer of "mostly". There was no significant difference between occupations. However, there was a significant unit difference in answers to this question between the ICU and the ED. The staff in the ICU were significantly more happy ($P < 0.001$) than those in the ED about the number of PACS viewing stations in their work environment. This again was probably related to the number of viewing computers available in the ED.

Clinicians' acceptance of the PACS functionality

No significant differences in answers between clinical units and occupations were found for the questions asking "Do you use your own username and password to log on to the PACS" and "Is the automatic time out a hindrance to you in your patient care delivery?" The average score of the answers to both questions were slightly above "Sometimes". Interview investigation suggested that some clinicians did not log out when finishing reviewing X-ray images on computer. Some users mentioned that they did not have their own personal user name and password. The system was usually up and available when they went to look for images. Some clinicians said that not being able to walk up to a screen and use it was slightly annoying. Some clinicians were not happy with the automatic time out function. The above practice raises the issue of medical liability and patient confidentiality.

Nurses were significantly more positive than doctors ($P < 0.05$) in their answers to the question "Is your username and password easy to remember?" The average answer given by doctors to this question was between "Sometimes" and "Mostly", whereas the average answer given by nurses was between "Mostly" and "Always". The reason that nurses remembered their username and password more easily was that they used them frequently to retrieve and print laboratory results for doctors. As doctors did not use their username and password as frequently as nurses, they found it more difficult to remember them.

Integration of the PACS into clinical work practice

There were significant unit ($P < 0.01$) and occupational ($P < 0.05$) differences in answers to the question "Is the time from requesting an X-ray to image access faster using PACS system?" However, no unit or occupational difference was found for the answers to the question "Do you use the patient returning from radiology as the indicator that an X-ray may be waiting to be reviewed?", "Are you happy with the time it takes to load an image once you click the view image button?" and "Do you currently request hard copy films to be produced?"

To ICU staff, the time from requesting an X-ray image to access was generally faster using the PACS system. However, ED staff considered it faster sometimes in PACS environment. The nurses considered accessing the PACS image faster most of the time, whereas doctors only considered the PACS system faster sometimes. The reason was that some doctors did not want to use the system; some of them could not access the images due to the lack of training. The barrier here was attitude toward work practice change.

Most of the clinicians tended to use the patient returning from the radiology department as the indicator that an X-ray image might be waiting to be reviewed. Accessing images were longer initially in the PACS environment. In the old film-based practice, the indicator (X-ray films in the box) could be seen easily, whereas in the PACS environment, a user had to look at the screen to see that an X-ray image was awaiting review.

The clinicians were mostly happy with the time it took to load an image in the PACS (mean score = 3.8). They only rarely or sometimes requested hard copy films to be produced (mean score = 2.6). These responses suggested that the

clinicians were familiar with PACS system and used to making diagnoses by viewing digital images on screen.

Discussion

Both doctors and nurses were happy with access to the PACS system. The clinicians were satisfied with their ability to access X-ray images in multiple locations and saw that this offset their inability to move X-ray images freely. The acceptance of the PACS system was slightly different between clinical units and occupations. The clinicians in the ICU were happier with access to the PACS system than their counterparts in the ED. Nurses were happier than doctors on the relief of the burden of searching for X-ray images. However, they distanced themselves from accessing the PACS system, which they regarded as a doctors' tool.

Six months after implementation, the doctors still felt that it was difficult to remember their own user name and password. They found the function of automatic time out sometimes annoying. Forgetting to log out after finishing reviewing X-ray images on screen and sequential access on another user's log on often happened, raising issues about liability and patient confidentiality. A strategy is required to educate clinicians to log out after finishing consulting X-ray images. The period for automatic log out may need to be adjusted to suit the individual clinician's work practice.

Some of the doctors still could not access images due to lack of training. Most of the doctors tended to use the patient returning from the radiology department as the indicator that an X-ray image might be waiting to be reviewed, instead of actively searching for X-ray images.

The present study suggests that the ICU and the ED staff used PACS differently. The common theme was that given the opportunity none of the areas or clinicians surveyed would revert to the previous film system. This is strong evidence of general acceptance of the PACS system.

References

- 1 Agervold M. New technology in the office: attitudes and consequences. *Work and Stress* 1987; 1: 143-153
- 2 Crowe B, Sim L. An assessment of the effect of the introduction of a PACS and RIS on clinical decision making and patient management at Princess Alexandra Hospital Brisbane, Australia. Final Report - December 2004. *Proceedings of the 19th Congress on Computer Assisted Radiology and Surgery (CARS 2005)*. Amsterdam: International Congress Series 1281, Elsevier B.V., 2005; 964-967
- 3 Crowe B, Sim L. Assessment of the effect of the ready availability of radiology results on clinical decision making at Princess Alexandra Hospital Brisbane, Australia. *Proceedings of the 18th Congress on Computer Assisted Radiology and Surgery (CARS 2004)*. Amsterdam: International Congress Series 1268, Elsevier B.V., 2004; 254-259
- 4 Fisher W, Wesolkowski S. How to determine who is impacted by the introduction of new technology into an organization. *Wiring the world: the impact of information technology on society: ISTAS 98, proceedings of the*

1998 International Symposium on Technology and Society Indiana, June 1998; 116-122. See

<http://ieeexplore.ieee.org/iel4/5646/15128/00689165.pdf?arnumber=68916>

5. Last checked 18 July 2005

- 5 Siegel EL, Pomerantz SM, Protopapas Z, *et al.* PACS in a "Digital Hospital": Preliminary data from Phase III evaluation of the experience with filmless operation at the Baltimore VA Medical Center. *Proceedings of the Fourth International Conference on Image Management and Communication (IMAC 95): medical imaging service in a network environment, August 20-24, 1995, Oahu Island, Hawaii*. Los Alamos California: IEEE Computer Society Press, 1996; 38. See <http://doi.ieeecomputersociety.org/10.1109/IMAC.1995.532557>. Last checked 12 July 2005
- 6 Aas IH. Organizational cooperation in teleradiology. *J Telemed Telecare* 2005; **11**: 45-50
- 7 Crowe B, Hailey D. Cardiac picture archiving and communication systems and telecardiology - technologies awaiting adoption. *J Telemed Telecare* 2002; **8** (suppl 3): 3:9-11

Figure 1. Number of participants from different medical units

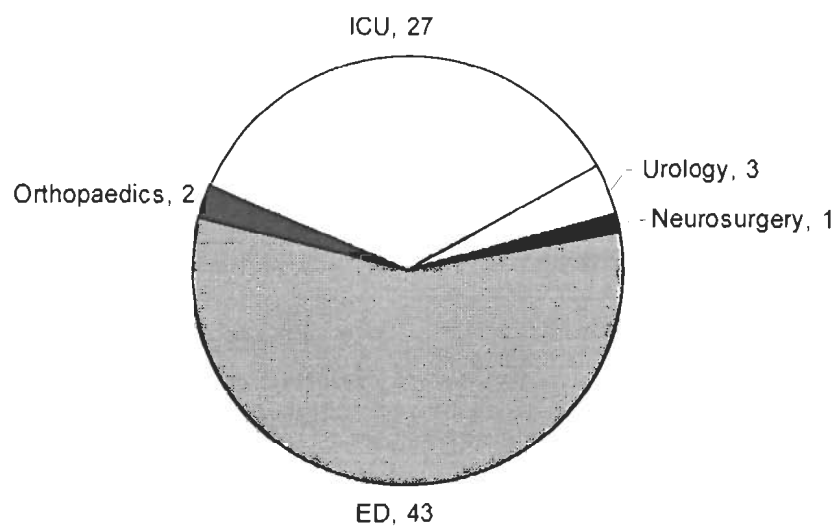
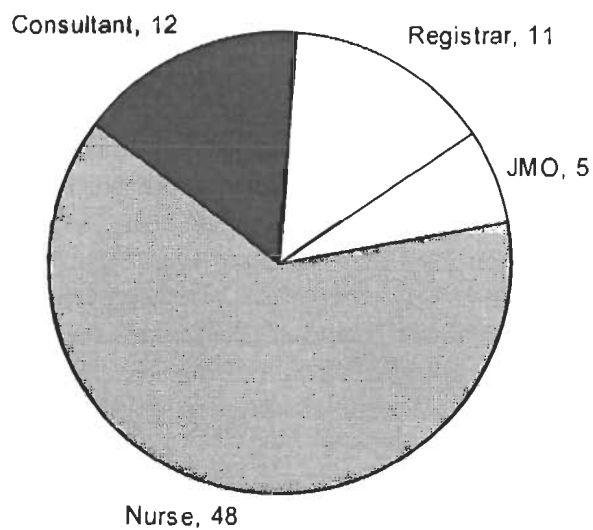


Figure 2. Occupations of the participants



POSTERS

Real-time video in the neonatal intensive care nursery

Nigel Armfield¹, Tim Donovan² and Richard Wootton¹

1 Centre for Online Health, University of Queensland, Australia

2 Division of Neonatology, Royal Brisbane and Women's Hospital, Australia

Correspondence:

Nigel Armfield
Centre for Online Health
Level 3, Foundation Building
Royal Children's Hospital
Herston 4029
AUSTRALIA
(Fax: +61 7 3346 4705; Email: N.R.Armfield@uq.edu.au)

We have developed a prototype mobile camera to investigate the feasibility of transmitting a view of an infant through the wall of an intensive care nursery incubator. The same device was also evaluated as a mechanism for transmitting neonatal X-ray images. The apparatus consists of a mobile stand carrying a pan/tilt/zoom camera (SNC-R30ZP, Sony). The camera has wired and wireless Ethernet interfaces and is remotely controllable using a standard web browser. The camera captures live video at 25 frames per second, has a 25x zoom lens and produces a 640x480 pixel colour image. Experiments were carried out in intensive care nursery conditions, with a variety of lighting levels, to view a dummy infant through the double perspex wall of an incubator and to capture an X-ray image of a neonate displayed on a light-box.

Wear and tear features evident to the naked eye on the dummy were used to test the optical zoom capabilities of the camera through the incubator wall. The apparatus successfully captured clear and stable images of the dummy infant. Key issues which affected image quality included the lighting level, positioning of the camera with regard to the incubator wall and the use of manual focus. Images of neonatal X-rays were also successfully captured and transmitted. The quality of transmission was sufficient to allow endotracheal tube position and the presence of air leaks to be assessed reliably without changing transmission parameters.

The preliminary findings suggest that diagnostic information useful in improving neonatal outcomes can be transmitted using relatively simple and unobtrusive apparatus from remote sites of neonatal care.

A global telemedicine and teaching network for children in underserved areas

Frank Brady

Medical Missions for Children, New Jersey, USA

Correspondence:

Frank Brady
Medical Missions for Children
35 Getty Avenue, Building 400
Paterson
NJ 07503
USA
(Fax: +1 610 497 7865; Email: fbrady@mmissions.org)

Medical Missions for Children (MMC) operates a global network which encompasses paediatric healthcare facilities in Latin America, Africa, India and Eastern Europe. It has improved the traditional medical mission model by employing information technology to connect a worldwide network of mentoring hospitals. Currently there are volunteers in 22 major US-based and four international medical institutions.

The organization's programmes are managed through its global telemedicine and teaching network, a satellite and Internet-based communications platform. The network supports the real-time diagnosis and treatment of remote, critically ill children. This includes real-time examination of the patient and direct access to the patient's full medical history, including echocardiograms, nuclear medicine scans, MRI scans, X-rays and any other supporting documentation. This information is normally provided prior to the live session, but may also be accessed during the examination.

MMC also broadcasts worldwide an extensive programme of continuing medical education. This includes access to a world-class digital library, including live and pre-recorded lectures, symposia, grand rounds and research seminars. Programming is available via satellite broadcast or streaming broadcast on the Internet. The broadcast programming features a wide variety of topics, such as recent lectures provided by St Joseph's Children's Hospital on the management of idiopathic adolescent scoliosis, skeletal maturation and its application in orthopaedic surgery.

MMC's activities have raised the level of medical expertise in hospitals in underserved areas through medical education for physicians, nurses and hospital administrators. The organization facilitates the treatment of about 1500 children each month. Whether it is medical, emotional, or educational, the MMC organization takes a holistic view of healing, and is dedicated to bringing the highest quality resources directly to disadvantaged children.

A Web-based system for collaborative diagnosis in pediatric oncology

Thiago Tognoli Lopes¹, André Luiz M da Rosa¹, Adilson Yuuji Hira¹, André Nebel de Mello² and Marcelo Knörich Zuffo¹

1 Laboratório de Sistemas Integráveis, Escola Politécnica da Universidade de São Paulo, São Paulo, Brazil

2 Unidade de Onco-Hematologia, Instituto da Criança HC-FMUSP, São Paulo, Brazil

Correspondence:

André Nebel de Mello
Laboratório de Sistemas Integráveis
Escola Politécnica da USP
Av. Prof. Luciano Gualberto, travessa 3, 158
Butantã
Cidade Universitária
São Paulo CEP 05508-900
BRAZIL
(Fax: +55 11 3091 5664; Email: andrenm@gmail.com)

Health services in Brazil tend to be concentrated in the larger urban centres, thus requiring patients to travel in search of specialized medical services. This also produces overcrowding of hospitals in the urban centres. We have developed Web-based diagnostic image applications for paediatric cancer patients. These visualization tools are part of a computing environment that supports collaborative work. Our goal is to offer remote assistance in diagnosis and also distance medical training in paediatric oncology in Brazil.

The electronic medical records in our work are focused on information acquisition and medical image processing. The system architecture is based on an acquisition server, storage server, information manager, Web image server and a system interface. The diagnostic interface, using geometric, image enhancement and data tools, helps the health professional to diagnose and report these images, attaching them to a patient record. The collaborative interface allows health professionals remotely located to visualize and discuss medical images interactively through the Internet. Text chat and videoconferencing are also available to the participants.

The system allows health professionals to reach a diagnosis more efficiently, share information and obtain new knowledge. It improves access to specialist care for patients in Brazil, no matter where they are located.

Assessing acquired neurogenic language disorders online: a telerehabilitation application

Anne Hill¹, Deborah Theodoros¹, Trevor Russell² and Liz Ward¹

1 Division of Speech Pathology, School of Health and Rehabilitation Sciences,
University of Queensland, Australia

2 Division of Physiotherapy, School of Health and Rehabilitation Sciences,
University of Queensland, Australia

Correspondence:

Ms Anne Hill
Division of Speech Pathology
School of Health and Rehabilitation Sciences
The University of Queensland
St. Lucia 4072
AUSTRALIA
(Fax: +61 7 3365 1877; Email: a.hill@shrs.uq.edu.au)

It is generally accepted that certain speech pathology services are well suited to the telerehabilitation service delivery model.[1,2] However, there has been little research to establish valid and reliable assessment protocols in this area. We have developed a custom-built, Internet-based telerehabilitation application, for the assessment of acquired neurological language disorders in adults. This application was developed specifically to enable a standardised language assessment tool, the Boston Diagnostic Aphasia Examination (BDAE), to be performed over the Internet in a manner as close as possible to the traditional face-to-face procedure.

The system consists of a therapist module and a participant module which provide real-time videoconferencing through a 128 kbit/s Internet link. The software makes use of a second web camera at the participant's site to collect high quality video clips, captured by the participant's computer at a resolution of 640 x 480 pixels and 25 frames per second. These clips are compressed at 235 kbit/s using a software codec (WME v9, Microsoft) and automatically forwarded to the clinician's computer simultaneously with the real-time videoconference. The software also enables the capture of high quality audio data that is compressed (70 kbit/s) and automatically forwarded to the clinician's computer. Additional tools which are incorporated into the software allow the display of printed material, images and video demonstration clips on the participant's computer screen. A touch screen is used to record the participant's responses to stimuli displayed on the screen.

The software has been designed so that participants do not require any computer skills to complete the tasks. A study is currently underway to validate this application in the assessment of acquired neurogenic language disorders in adults.

Acknowledgements

We thank Roy Anderson and Monique Waite for their help in the development and testing of this application.

References

- 1 Brennan DM, Georgeadis AC, Baron CR, Barker LM. The effect of videoconference-based telerehabilitation on story retelling performance by brain-injured subjects and its implications for remote speech-language therapy. *Telemed J E Health* 2004; **10**: 147-54
- 2 Rosen MJ. Telerehabilitation. *Telemed J E Health* 2004; **10**: 115-17

Diagnostic value of a written referral and/or images for skin lesions

Amanda M M Oakley¹, Felicity Reeves², Jane Bennett¹ and Stephen H. Holmes³

1 Department of Dermatology, Health Waikato, Hamilton, New Zealand

2 University of Nottingham, UK

3 Clinical Audit Department, Health Waikato, Hamilton, New Zealand

Correspondence:

Associate Professor Amanda Oakley

Department of Dermatology

Health Waikato

Private Bag 3200

Hamilton

NEW ZEALAND

(Fax: +64 7 838 2032; Email: oakley@wave.co.nz)

We performed a study to evaluate a telemedicine referral system for skin lesions. The aim was to see whether dermatologists could accurately diagnose benign and malignant skin lesions by telemedicine, if they were given an accurate history (i.e. text), clinical images, or both. A medical student recorded a standardised history and description of 109 skin lesions and took digital photographs of the presenting lesions immediately before a normal outpatient dermatology consultation. Fifty-two dermatologists were invited to participate in online diagnosis and 38 took part. They were provided with the text and/or the images via a secure website. When images and text were provided, 53% of teledermatology diagnoses were the same as the face-to-face diagnosis. When images alone were provided, 57% of diagnoses were the same. When text alone was provided, 41% of diagnoses were the same. The relatively low diagnostic concordance may have been due to the inexperience of many teledermatologists and poor quality image display systems. The teledermatologists were less confident in their diagnoses than face-to-face specialists, especially in the absence of images. The teledermatology management plan was more likely to include biopsy, excision or review than was the case at the face-to-face consultation. Teledermatology may result in an increase in follow-up appointments and surgical procedures.

Pilot implementation of an online disease management system for depression in Australia

Lucy Robertson , Michael Smith, Dennis Tannenbaum and Holly Exeter-Kent

Sentiens Pty Ltd, Perth, Australia

Correspondence:

Dr Lucy Robertson
Sentiens Pty Ltd,
PO Box 842
West Perth
WA 6872
AUSTRALIA
(Fax: + 61 8 9481 1952; Email: lucyr@sentiens.com)

Healthcare resources are under increasing pressure to meet the needs of consumers with chronic diseases. New healthcare solutions are required to meet demand whilst maintaining quality and containing costs. Chronic disease management systems are being widely used in the US and Europe and have been found to improve outcomes and reduce costs.[1] An online disease management system for depression, called Recovery Road, was implemented for mental healthcare in Western Australia.

The Recovery Road system was available for use by consumers and clinicians to augment usual treatment. It provided online systematic education and progress monitoring questionnaires with feedback. Other features were online evidence-based therapy, adherence reminders, an e-diary, and e-consultation and medical record systems. Clinicians reported finding Recovery Road helpful, although they tended to under-utilise the online features of the system. Consumers reported finding Recovery Road helpful. Their adherence to Recovery Road was high and appeared to be enhanced by personalised encouragement and support to use the system. Medication adherence amongst Recovery Road users was very high and clinical outcomes were positive.

The findings suggest that consumers and clinicians have a favourable view of online healthcare systems such as Recovery Road and warrant further research to determine whether such systems represent a cost-effective addition to usual treatment.

Acknowledgments

We thank the Office of Mental Health, Western Australian Department of Health and the Commonwealth Department of Health and Ageing for their financial contribution to research. The views expressed are those of the authors and do not necessarily reflect the opinions of the Office of Mental Health or the Commonwealth Department of Health and Ageing.

Reference

- 1 LeGrow G, Metzger J. (2001). *E-disease Management*. See <http://www.chcf.org/documents/ihealth/EDiseaseManagement.pdf>. Last checked 22 June 2005

Expanding the sphere of influence of e-health to determinants of health

Richard E Scott

Health Telematics Unit, University of Calgary, Canada

Correspondence:

Richard E Scott
Health Telematics Unit
University of Calgary
Health Sciences Centre G204
3330 Hospital Drive NW
Calgary
Alberta T2N 4N1
CANADA
(Fax: +1 403 270 8025; Email: rescott@ucalgary.ca)

Governments worldwide formally accept the World Health Organization's definition of health, "a state of complete physical, mental, and social well-being, and not merely the absence of disease or injury". Similarly, they acknowledge that there are many factors that affect this state – the 'determinants of health'. Despite this, traditional healthcare is reactive, responding to signs and symptoms exhibited by a patient who may in fact suffer 'ill health' long before their first signs or symptoms ever appear.

These realisations are not new, and have led to greater public or population health initiatives and recent promotion of the benefits of 'wellness'. Yet the majority of published applications of e-health (a combination of telehealth and health informatics initiatives) have been in the domain of traditional healthcare. They have focused primarily on clinical, administrative and educational support of traditional healthcare services in the treatment of disease and injury. This can be considered to represent a failure in our current thinking, and offers an opportunity for greater success in the future if the sphere of influence of e-health is enlarged to embrace more of the determinants of health.

How might e-health support the broader social, economic, environmental – even spiritual – dimensions of health? In Canada, the key determinants of health have been identified as: income and social status, social support networks, education and literacy, employment and working conditions, social environments, physical environments, personal health practices and coping skills, healthy child development, biology and genetic endowment, gender, culture and health services. Future applications and evaluations of e-health initiatives should employ a broader and more inclusive approach that addresses the key determinants of health.

Technology and innovation to support healthy ageing and aged care

J Soar and R Gururajan

Programme for Health and Aged Care Informatics, University of Southern
Queensland, Toowoomba, Australia

Correspondence:

Dr Jeffrey Soar
Information Systems
Centre for Health and Aged Care Informatics
University of Southern Queensland
Toowoomba 4350
AUSTRALIA
(Fax: +61 7 4631 5594; Email: soar@usq.edu.au)

Technology is expected to support independence in elderly people and to assist with the management of problems such as falls, incontinence, medication and cognitive decline. Technology that will assist active ageing and aged care is likely to include intelligent software in the form of a Personal Care Assistant, smart homes, smart vehicles and wearable computers. The client's PCA will be informed of their care plan, will manage their health history and will search for relevant research evidence. The PCA will have the capacity for learning about an individual's patterns of daily living, preferences and behaviours. It will adapt to loss of function and coherence, and interpret what the individual is trying to say better than any human and with greater patience.

Purpose-designed smart homes will assist in delaying or avoiding a move to residential aged care. Voice commands and facial recognition will control access, heating and cooling, lighting and window shades. Technology already used in supermarkets and industrial warehouses will be built into refrigerators and pantries to provide intelligent stock control.

A feasible view of future technology in ageing and aged care has been constructed from research into the application of technology in aerospace, transport, security, retailing and other industries.

Responses of clinicians and families to a telepaediatric diabetic retinopathy screening programme in Queensland

Jill Stillman , Glen Gole and Richard Wootton

Centre for Online Health, University of Queensland, Australia

Correspondence:

Jill Stillman
Centre for Online Health
Level 3, Foundation Building
Royal Children's Hospital
Herston 4029
AUSTRALIA
(Fax: +61 7 3346 4705; Email: jstillman@ccs.uq.edu.au)

We evaluated the satisfaction of users with a store-and forward diabetic retinopathy (DR) screening programme for children and adolescents. Two questionnaires were developed from surveys used by a telepaediatric service.[1]. User satisfaction questionnaires were mailed to all the clinicians at the completion of the feasibility phase of the programme and were mailed to families throughout the programme. The satisfaction survey contained 12 questions which covered issues related to communication, information, support, organisation, service quality and type, benefit, health promotion, access and delivery of specialist health care to rural and remote areas, and overall satisfaction. An economic survey was also mailed to families. This contained nine questions related to direct and indirect costs for families associated with attending the DR screening appointment.

A total of 10 clinicians completed and returned the satisfaction survey (91% response rate). On the whole, the responses from the clinicians to all questions were strongly supportive of the DR screening programme. A total of 62 satisfaction and economic surveys were returned by the families (37% response rate). The comments from the families were very positive. The majority of the respondents (95%) either strongly agreed or agreed that they were able to ask questions and receive answers during the DR screening appointments.

The survey showed that the majority of the respondents were confident that the paediatric ophthalmologist received sufficient information to make a diagnosis. All the respondents believed that the screening programme would benefit children and adolescents with diabetes even though 12 (19%) of the families reported that they did not save time and money. Overall the majority of families stated that they were very satisfied or satisfied with this type of eye screening service. The results of the present survey are similar to previous satisfaction surveys in adults. This encourages the further use of telepaediatrics for diabetic retinopathy screening in young people.

Reference

- 1 Smith AC, Youngberry K, Christie F, *et al*. The family costs of attending hospital outpatient appointments via videoconference and in person. *J Telemed Telecare* 2003; **9** (suppl 2): 58-61

Low-cost telemedicine in Iraq: an analysis of referrals in the first 15 months

P Swinfen¹, R Swinfen¹, K Youngberry² and R Wootton²

1 Swinfen Charitable Trust, Canterbury, UK

2 Centre for Online Health, University of Queensland, Australia

Correspondence:

Professor Richard Wootton
Centre for Online Health
Level 3, Foundation Building
Royal Children's Hospital
Herston 4029
AUSTRALIA
(Fax: +61 7 3346 4705; Email: r_wootton@pobox.com)

The Swinfen Charitable Trust (SCT) uses simple email telemedicine links to connect remote hospitals in the developing world with expert medical opinion and advice. It uses an email routing system to automate much of the message-handling.[1,2]

Some of the countries utilizing these links, such as Iraq, are passing through conflict and post-conflict situations. In March 2004, the SCT established telemedicine links in four hospitals in Iraq, located in Baghdad, Basrah, Erbil and Dohuk. Following word of mouth and a variety of conference presentations on the SCT, many more hospitals in Iraq have requested registration. There are now 25 hospitals registered in the system. During the first 15 months of operation, there were 140 telemedicine cases referred to the SCT from 20 of those hospitals. The advice requested has been in a wide variety of specialty and subspecialty areas, the most common being neurology, orthopaedics and surgery.

Due to the unreliable nature of power and telecommunications in post-conflict areas there have been problems with some of these links. Most are operating successfully on email, but two, in Baghdad, have had teething troubles mainly due to faulty telecommunications. One hospital at Al Hillah closed temporarily for repairs to its operating theatres following a car bomb. Despite the difficulties experienced by the hospitals in Iraq they have continued to send referrals through the system, with four hospitals sending 50% of the referrals.

References

- 1 Wootton R. Design and implementation of an automatic message-routing system for low-cost telemedicine. *J Telemed Telecare* 2003; **9** (suppl 1): 44-7
- 2 Swinfen P, Swinfen R, Youngberry K, Wootton R. A review of the first year's experience with an automatic message-routing system for low-cost telemedicine. *J Telemed Telecare* 2003; **9** (suppl 2): 63-5

Accuracy and utility of real-time paediatric echocardiographic transmission via telemedicine

Mark Lewin¹, Cathy Xu^{1,2}, Mary Jordan¹, Heidi Borchers¹, Catherine Henson¹, Dennis Wilbert¹ and Sanford Melzer¹

1 Children's Hospital and Regional Medical Center, Seattle, USA

2 Centre for Online Health, University of Queensland, Australia

Correspondence:

Dr Cathy Xu
Centre for Online Health
Level 3, Foundation Building
Royal Children's Hospital
Herston 4029
AUSTRALIA
(Fax: +61 7 3346 4705; Email: cxu@coh.uq.edu.au)

Echocardiography studies were transmitted by videoconference from four regional hospitals in Washington State to the Seattle Children's Hospital and Regional Medical Center (CHRM) between January 2002 and December 2004. There were 769 paediatric studies, of patients aged from Day 1 to 19 years. 766 studies (99.6%) were initially successfully transmitted; three studies were not sent due to technical difficulties but were successfully completed within 24 hours. A cardiac abnormality was detected in 336 studies (44%), of which 25 were deemed critical and prompted urgent transport. 351 studies (46%) were performed in neonatal patients younger than 6 weeks of age. 114 of the neonatal studies (15%) demonstrated normal anatomy. 217 neonatal studies (28%) detected a non-urgent congenital heart defect (CHD) and the patients were managed without transport.

70 studies were repeated in person at the CHRM. The diagnoses were: 55 non-urgent CHDs (79%), 12 critical cardiac abnormalities (17%) and 3 normal (4%). All follow-up echocardiograms except one confirmed our initial telemedicine diagnosis (99% sensitivity). Four follow-up studies suggested a slight variation in the type of ventricular septal defect detected. There was diagnostic agreement in 93% of the follow-up group.

In addition to the real-time telemedicine studies, 655 video-recorded studies were sent to the CHRM from non-telemedicine sites in Washington between February 2002 and November 2004. 32 of these studies were repeated in person. The diagnoses were: 19 non-urgent CHDs (59%), 3 critical cardiac abnormalities (9%), 9 normal (28%) and 1 acquired heart disease (3%). There were either discrepancies or lack of diagnostic clarity in 12 studies (38%) compared with on-site echocardiography. Among these, there was a change in diagnosis in 10 studies from the initial videotape diagnosis, compared with only one change in diagnosis in the telemedicine follow-up studies. This suggests that echocardiography

evaluation using video recordings may be less accurate than via real-time telemedicine.

INDEX

A

Aarnio, P.....	70
Agnew, J.....	151
Aho, J.....	117
Arild, E.....	81
Armfield, N.....	159, 213
Atlas, MD.....	49

B

Bailey, MA.....	3
Bennett, J.....	218
Best, D.....	134
Borchers, H.....	226
Bowman, A.....	100
Brady, F.....	214
Brauchli, K.....	8
Brebner, J.....	100
Brown, NA.....	16
Burkow, TM.....	23

C

Chetty, U.....	100
Clark, R.....	159
Clemensen, J.....	27
Coulthard, M.....	159
Crowe, B.....	31

D

da Rosa, ALM.....	215
Davis, D.....	197
de Deus Lopes, R.....	41, 45
deMello, AN.....	35, 41, 45, 215
Deraas, T.....	81
Dillon, E.....	197
Dixon, JM.....	100
Donovan, T.....	213

E

Eikelboom, RH.....	49
Ejlsjaer, N.....	27
Ellis, I.....	57
Exeter-Kent, H.....	219

F

Faria, RRA.....	35
Fielding, RG.....	100
Filho, VO.....	35, 41, 45
Fitzgerald, A.....	3
Foerster, V.....	65

G

Gagnon, M.....	139
Gardner, T.....	100
Goffe, R.....	159
Gole, G.....	223
Gururajan, R.....	62, 222

H

Hailey, D.....	65
Halin, N.....	70
Heinzelmann, PJ.....	75
Henrikson, E.....	81
Hensen, C.....	226
Hill, A.....	216
Hilton, P.....	205
Hira, AY.....	35, 41, 45, 215
Holmes, SH.....	218
Huston, J.....	89

I

Isles, A.....	1, 159
---------------	--------

J

Jacques, G.....	75
Johansen, M.....	81
Jordan, M.....	226
Jumila, M.....	70

K

Kahara, M.....	117
Kalliola, P.....	117
Kim, D.....	94
Kim, SH.....	94
Koivukoski, AM.....	117
Kunkler, IH.....	100
Kurunmaki, H.....	117
Kvedar, JC.....	75

L

Larsen, SB.....	27
Lee, MJ.....	100
Lee, RJ.....	100
Lewin, M.....	226
Lewis, C.....	111
Loermans, J.....	197
Lopes, TT.....	41, 45, 215
Loula, P.....	70

M

MacDermott, A.....	31
Maclean, JR.....	100
Macnab, M.....	100
Mäkelä, K.....	117
Mansfield, P.....	121
McMahon, D.....	125
Melzer, S.....	226
Moloney, C.....	62
Mottarely, I.....	159
Murtagh, JA.....	65

N

Nakagawa, B.....	65
Ndumbe, P.....	145
Ncades, G.....	100

Nilsen, L..... 23

O

Oakley, A..... 218
Oberholzer, M..... 8

P

Prescott, RJR..... 100

R

Reeves, F..... 218
Robertson, L..... 129, 219
Russell, T..... 216
Ryan, V..... 134

S

Scott, RE..... 139, 145, 221
Sinclair, S..... 151
Smith, AC..... 3, 134, 151, 159
Smith, M..... 100, 129, 219
Smitten, J..... 65
Soar, J..... 222
Stathis, S..... 134
Stavrianou, C..... 175
Steblecki, JA..... 65
Stewart, S..... 169
Stillman, J..... 223
Swann, S..... 100
Swinfen, P..... 188, 225
Swinfen, R..... 188, 225

T

Tannenbaum, D..... 129, 219
Taylor, F..... 3
Taylor, S..... 159
Theodoros, D..... 216

Tually, P..... 175

U

Uusitalo, L..... 117

V

Valli, M..... 117
Van Ast, P..... 180
Virjo, I..... 117
Vuotari, V..... 117

W

Walker, J..... 175
Walls, A..... 100
Wapshall, TM..... 65
Ward, L..... 216
Whetton, S..... 183
Wilbert, D..... 226
Williams, J..... 151
Wong, G..... 65
Wootton, R..... 134, 145, 151, 159, 169, 188, 213, 223, 225

X

Xu, C..... 197, 226

Y

Ylinen, S..... 117
Yoo, SK..... 94
Youngberry, K..... 151, 159, 188, 225
Yu, P..... 205

Z

Zuffo, MK..... 35, 41, 45, 215



Successes and Failures in Telehealth

Graphic design by Central Medical Illustration Unit, Royal Brisbane Hospital
Printed by the Print on Demand Centre, University of Queensland