

Successes and Failures in Telehealth

21-22 June, 2001



Editor: R Wootton

Centre for Online Health
University of Queensland, Australia



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Successes and Failures in Telehealth

Brisbane, Australia

Auditorium, Level 5, Woolworth's Medical Building, Royal Children's Hospital

Conference Programme - Thursday 21st June, 2001

08:00	Registrations (refreshments) SESSION 1 (chairman: Peter Yellowlees)
09:00	Welcome
09:05	Introduction 1 Telehealth - a health manager's perspective <u>Alan Isles</u>
09:10	Introduction 2 Successful telehealth - a university perspective <u>Peter Brooks</u>
09:15	What constitutes success in telehealth? <u>Richard Wootton</u> and MA Hebert
09:30	Realtime fetal ultrasound by telemedicine in Queensland. A successful venture? <u>Fung Yee Chan</u> , Barbara Soong, David Watson and John Whitehall
09:45	Telemedicine in Kansas: the successes and the challenges <u>Gary Doolittle</u>
10:00	Clinical call centres - does low-bandwidth video have a place? <u>Andrew Howard</u>
10:15	PANEL DISCUSSION
10:30	Morning Tea SESSION 2 (chairman: Richard Wootton)
11:00	Problems with paediatric A&E telemedicine in Calgary <u>Bob Johnson</u>
11:15	E-health and online teaching: a successful synergy <u>Emma Hughes</u>
11:30	Taking telehealth to the bush: lessons from North Queensland <u>Julie Watson</u> , Lee Gasser, Ilse Blignault and Robyn Collins
11:45	The experience of a rural GP using videoconferencing for telemedicine <u>Max Bowater</u>
12:00	Successes and failures with Grand Rounds at the Royal Children's Hospital in Brisbane <u>Robert McCrossin</u>
12:15	PANEL DISCUSSION
12:30	Lunch SESSION 3 (chairman: Peter Yellowlees)
13:30	An analysis of why telehealth systems in Australia have not always succeeded <u>Peter Yellowlees</u>
13:45	The experience in Victoria with telepsychiatry for the child and adolescent mental health service <u>Harry Gelber</u>
14:00	Evaluating satisfaction with a child and adolescent psychological telemedicine network <u>Heidi Kopel</u> , Kenneth Nunn and David Dossetor
14:15	The fall and rise of the South Australian telepsychiatry network <u>Steve Kavanagh</u> and Fiona Hawker
14:30	Telehospice: a tale of two states <u>Dave Cook</u>
14:45	PANEL DISCUSSION
15:00	Afternoon Tea SESSION 4 (chairman: Richard Wootton)
15:30	Telemedicine in South Africa: success or failure? <u>Sam Gulube</u> and S Wynchank
15:45	The effect of nuclear medicine teleradiology on diagnostic pathways and management in Western Australia <u>Peter Tually</u> , John Walker and Simon Cowell
16:00	Teledermatology in the Waikato region <u>Amanda Oakley</u> , Marius Rademaker and Mark Duffill
16:15	Progress in Australian teledermatology Adrian Lim, Adrian See and <u>Stephen Shumack</u>
16:30	A review of the experience with teleradiology in Australia <u>Bernie Crowe</u>
16:45	PANEL DISCUSSION
17:00	Close of day 1; followed by
19:00	Conference dinner (drinks served from 18:00) at Palma Rosa, 9 Queens Road, Hamilton, Brisbane

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Brisbane, Australia

Auditorium, Level 5, Woolworth's Medical Building, Royal Children's Hospital

Conference Programme - Friday 22nd June, 2001

08:30	Refreshments	SESSION 5 (chairman: Peter Yellowlees)
09:00	The Georgia Statewide Telemedicine Programme: some lessons learned <u>Max Stachura</u>	
09:15	Online eye care in prisons in Western Australia <u>Yogi Yogesan</u> , C Henderson, C Barry and I Constable	
09:30	Successes and failures in videoconferencing: a community health education programme <u>Kathy Faulkner</u>	
09:45	Telemedicine and clinical genetics: establishing a successful service <u>Michael Gattas</u> , J MacMillan, I Meinecke, M Loane and R Wootton	
10:00	Pathology Grand Rounds by videoconferencing <u>Joan Faoagali</u> , Wendy Coles, Lee Price and David Siebert	
10:15	PANEL DISCUSSION	
10:30	Morning Tea	SESSION 6 (chairman: Richard Wootton)
11:00	Some successes and limitations with telehealth in the Canadian health care system <u>David Hailey</u>	
11:15	The point of referral barrier - a factor in the success of telehealth <u>Anthony Smith</u>	
11:30	Online consulting. The experience of a commercial service <u>Simon Leslie</u>	
11:45	The development of a pilot telemedicine network in Scotland - lessons learned <u>John Brebner</u> , E Brebner, H Ruddick-Bracken and R Wootton	
12:00	PANEL DISCUSSION	
12:15	Prizes for best papers and poster <i>(Awarded by SMS consulting)</i>	
12:30	Lunch	
13:30	Conference closes	

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CONTENTS

01. Telehealth – a health manager’s perspective	1
02. Successful telehealth - a university perspective.....	3
03. What constitutes success in telehealth?	5
04. Realtime fetal ultrasound by telemedicine in Queensland. A successful venture?	15
05. E-health and online teaching: a successful synergy.....	23
06. Clinical call centres: does low bandwidth video have a place?	27
08. Telehospice: a tale of two states	32
09. Taking telehealth to the bush: lessons from north Queensland	33
10. The experience of a rural GP using videoconferencing for telemedicine.....	41
11. Successes and failures with Grand Rounds at the Royal Children's Hospital in Brisbane	44
12. An analysis of why telehealth systems in Australia have not always succeeded .	52
13. The experience in Victoria with telepsychiatry for the child and adolescent mental health service	57
14. Evaluating satisfaction with a child and adolescent psychological telemedicine service	63
15. The fall and rise of the South Australian telepsychiatry network.....	74
16. Telemedicine in Kansas: the successes and the challenges	79
17. Telemedicine in South Africa: success or failure?	85
18. The effect of nuclear medicine telediagnosis on diagnostic pathways and management in rural and remote regions of Western Australia	90
19. A review of the experience with teleradiology in Australia	96
20. Progress in Australian teledermatology	99
21. Teledermatology in the Waikato Region	107
22. The Georgia Statewide Telemedicine Programme: some lessons learned	112
23. Online eye care in prisons in Western Australia.....	113
24. Successes and failures in videoconferencing: a community health education programme	117
25. Telemedicine and clinical genetics: establishing a successful service	122
26. Pathology Grand Rounds by videoconferencing	127
27. Some successes and limitations with telehealth in the Canadian health care system	131
28. The point of referral barrier - a factor in the success of telehealth	136
29. Online consulting. The experience of a commercial service	142
30. The development of a pilot telemedicine network in Scotland: lessons learned	151
52. Patient satisfaction using telemedicine: a comparison study in geriatric patients	156
53. Connecting the primary and the acute health care sectors.....	160
56. Minimum acceptable standards for digital compression of a fetal ultrasound video clip.....	161
Index	167

01. Telehealth – a health manager’s perspective

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Queensland is, in many respects, an ideal place for a conference about telehealth, since the state has a large area, a widely scattered population, and there is a single organisation, Queensland Health, providing government-funded health services. We also have excellent weather. Delivery of health care across the State is a challenge because of the distances. Providing equity of access to specialist medical services and allowing patients to be treated as close to their home as possible is a government priority. As a consequence, health service providers are now looking for alternative methods of delivering specialist services to regional and remote areas to reduce patient travel. Telehealth is an attractive alternative model for service delivery. Although many hospitals in Queensland have telemedicine facilities, the early growth in telemedicine network use appears to have stopped, see Fig 1.

To date, the telemedicine network in Queensland has been used predominantly for education. Only a minority of network activity, 8%, is for clinical purposes (Fig 2).

Health service providers need to give careful consideration to identifying and removing the barriers that prevent telehealth from becoming an effective means for delivering clinical services. Research in our District is currently addressing some of these issues. If these impediments can be identified and overcome, the geography of our state is ideally suited for the delivery of health services using the telehealth network. Specialist and some sub-speciality services can be made available to remote areas. In many cases, this will prevent the need for the patient to travel to the specialist with less disruption to work and family life, as well as obvious savings in travel costs for both the patients and the health care system. One key impediment that is being slowly addressed by government is the ability of health care providers to bill for consultations delivered by telemedicine. This is an essential step if telehealth services are to be sustainable in the long term.

Continuing postgraduate education for those in rural and regional areas is an important function of the tertiary hospitals and the telemedicine network is being widely used for this purpose thus reducing the professional isolation of practitioners in rural and remote areas. This may be a potent way of improving workforce retention rates in these areas.

For telehealth to fulfill its potential, an appropriate funding model must be developed and the barriers to increasing clinical utilisation determined and overcome.

Reference

1. Hornsby D. *Videoconference Usage Report: May 2000*. Brisbane: Queensland Telemedicine Network (Queensland Health), 2000

Fig 1. Videoconferencing usage on the Queensland Telemedicine Network, November 1997-May 2000 (six-monthly audit data). [1]

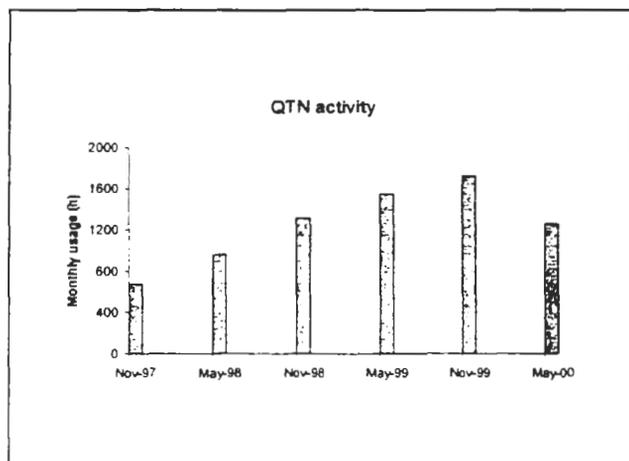
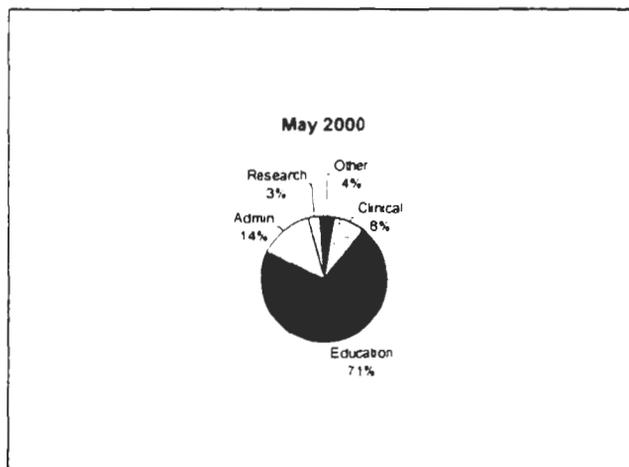


Fig 2. Principal purpose of videoconferencing as recorded in the May 2000 audit. [1]



02. Successful telehealth - a university perspective

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From an educational (university) perspective, telehealth offers the opportunity for institutions to reach out to the community around the world. The potential benefits include:

- improved access to information
- provision of care not previously available
- improved access to services
- improved professional education
- quality control
- involvement in research
- reduced healthcare costs.

As a 'medium' the new technologies provide opportunities to link as never before the three important elements of a successful healthcare system – service, education and research.[1]

From the university perspective a successful telehealth programme can enhance the educational offerings at an undergraduate and graduate level, a postgraduate level and importantly in continuing education. Another aspect of telehealth is that it allows the university to link significantly with the community, providing important health information to the population at large. Providing information to the general public may play a significant role in health promotion, improving knowledge about health and disease and the relationship between lifestyle and health outcomes. A significant challenge in this area remains the provision of this information to the disadvantaged.

Telehealth provides online access to undergraduates and graduates in university training programmes particularly when they are on clinical attachments in health care facilities distant from the central campus.

Over the next few years it is likely that all of the health professions will mandate compulsory continuing education for the maintenance of registration. Telehealth allows these education programmes to be provided for health professionals at a site and a time when they can best engage with them. The provision of the programmes in a web-based format significantly

increases the offerings that are available and allows health practitioners to engage in a much broader range of educational experiences than were previously possible.

Telehealth also allows the assessment of these programmes, the ability to establish tutorial groups through “chatrooms” and a range of other opportunities which may be particularly useful for bringing isolated health practitioners together. The Internet also provides the opportunity of significantly expanding the student base for universities and promoting the concept “global universities” and internationalisation. This being said, the challenge for universities is to compete in the new globalized education world and make sure that the web-based courses are of high standard, creative and user-friendly.

Universities also have the ability to drive research agendas across the Internet, whether by bringing research groups together, rapidly transferring research data or using the Internet for actually doing the research. Clinical trials and other patient-based research can now be carried out using web-based assessment forms and this is likely to increase significantly in the future. Research opportunities using the Internet are only just starting to be explored and will expand significantly in the years to come.

Examples of health service delivery using telehealth abound and will expand rapidly as patients and health professionals become more comfortable with the technology.[2] Teleconsultation, delivery of services to rural and remote areas, and to developing countries, will become much more common. Consultations between health professionals and transmission of images – be they radiological, pathological or clinical – will become very much a part of normal health practice.

Telehealth is the new medium but it does present universities with significant challenges in how to use these technologies and also makes the environment much more competitive than it has been before.

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1. Wootton R, Craig J (eds). *Introduction to Telemedicine*. London: Royal Society of Medicine Press Ltd, 1999
2. Yellowlees PM, Brooks PM. Health online: the future isn't what it used to be. *Medical Journal of Australia* 1999;171: 522-5

03. What constitutes success in telehealth?

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Summary

Before telehealth applications can be judged, there must be some general understanding about what constitutes success. At first sight it seems that defining success in a telehealth application should be relatively easy: a successful application is one that produces high quality care at low cost. However, the calculation of cost requires some care, since it depends on assuming a particular financial perspective (the patient's, the health care provider's, or society's) and is meaningless without a statement of the workload being handled. In addition there are a number of other factors, including the context in which the service is being delivered. Ultimately, the political imperative may override any rational judgement of success.

Introduction

A rational discussion of telemedicine, or any other medical technique, can only be conducted if there is some general understanding and agreement about how it will be judged. In other words, what constitutes success or failure in telemedicine? Everyone who has actually worked with telemedicine will have an intuitive idea about what constitutes success. Indeed, one of the characteristics of telemedicine is that almost everyone appears to have strong opinions about it, whether they have had direct experience or not.[1]

What constitutes a successful telemedicine application? Factors that are often said to be associated with success include:

- routine operation, i.e. the application has entered into the ordinary practice of medical care. There are relatively few examples of this
- successful outcomes, i.e. the application is clinically effective. That is, it produces the result intended by the clinician (and, one hopes, by the patient). Note that medicine is susceptible to fashion, so that an operation such as tonsillectomy would have been judged to be clinically effective in the 1950s, but would not be considered so in the light of later evidence-based practice.[2] Outcome may be measured quantitatively in terms of survivability or quality-adjusted life years, or it may be measured qualitatively in terms of perceived quality of care
- mainly clinical activity, i.e. the telemedicine infrastructure is not being used predominantly for administrative or educational purposes. However, there is some scope for debate in the case of education, since there are telemedicine networks whose activities are mainly educational, which are also considered to be successful. Examples include the network providing continuing professional education to rural physicians and patients in Nova Scotia[3] and the network used by the Mayo Clinic for postgraduate education[4]
- sustainable operation, i.e. the telemedicine system continues to function after any pilot funding runs out
- cost-effectiveness, i.e. the net difference in cost of telemedicine in relation to the net difference in outcome. Measurement of cost is not straightforward – health economics is not an exact science. It also begs the question "cost-effective for whom?" i.e. for society as a whole, for the individual patient, or for the organization providing health care services
- adequate financing, i.e. the telemedicine application is not treated as a special case, but is integrated into routine operations. It does not require special funding arrangements, e.g. for equipment replacement
- high activity levels
- acceptance by clinicians, i.e. is the topic taught in medical schools? Has it entered the medical textbooks? Is it underpinned by a proper scientific understanding?
- improved access to health care, particularly in rural and remote areas. Better access may mean a reduction in the time required to obtain an appointment with a specialist. There may also be a secondary effect on the recruitment and retention of staff in rural areas, as a consequence of reduced professional isolation

- avoidance of travel, either for the patient or the healthcare providers.

Equipment is an additional factor that is associated with success in telemedicine. The equipment must be suitable for the job, located in appropriate places and must be safe to use. In addition, users must be provided with the requisite technical support and training. Thus the right equipment is a necessary condition for success, but it is not a factor that indicates success in the sense of the factors identified above.

Metrics of success

Clearly then, there are many possible indicators of success, some of which are highly correlated (e.g. whether a service is sustainable and whether there is sufficient financing for it) and some of which are independent (e.g. whether a technique is clinically acceptable and whether it avoids travel). Nonetheless, the core indices are probably cost and quality of care, and these are orthogonal metrics. The factors that are said to indicate success can be classified under these headings, see Table 1.

Table 1. Factors associated with success in telemedicine

Factor	Quality metric	Cost metric
routine operation	✓	✓
successful outcomes	✓	
mainly clinical activity	✓	
sustainable operation	✓	✓
cost-effectiveness		✓
adequate financing		✓
high activity levels	✓	✓
acceptance by clinicians	✓	
improved access to health care services	✓	
avoidance of travel		✓

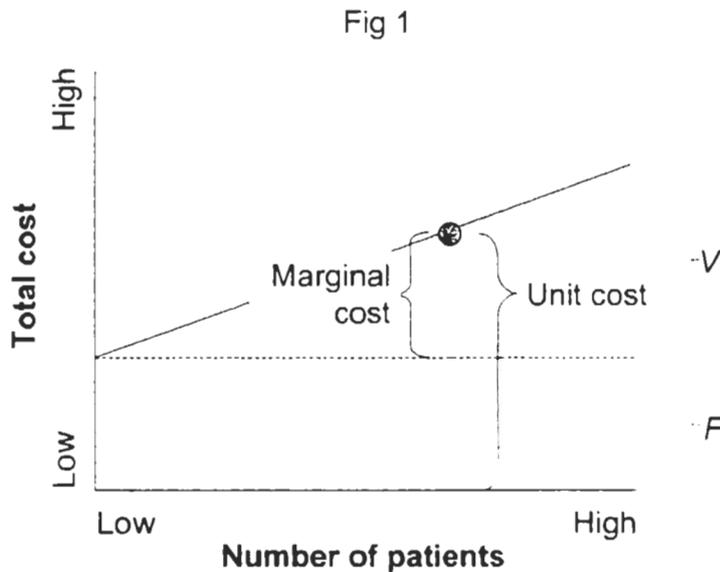
A successful technique in mainstream, public sector medicine is one which is (a) demonstrably effective clinically (i.e. more than just fashionable) and (b) cost-effective (i.e. less expensive than the alternatives).

The cost metric

Cost comparisons are complicated by the question "less expensive for whom?" In other words, does a service cost less from the perspective of the patient, the health care provider, or funders/society as a whole? Before any kind of cost analysis is conducted, an important decision is to determine whose perspective is to be used. For example, Hailey *et al* examined the cost of telepsychiatry in Alberta from different perspectives.[5] Unsurprisingly, they found that conventional psychiatry, in which the patient travelled to hospital to visit the psychiatrist, was the most expensive for the patient. From the service provider's perspective, on the other hand, telepsychiatry was much more expensive than conventional psychiatry, since telemedicine equipment had to be bought and operated. From society's perspective as a whole, telepsychiatry was more expensive, although the difference was relatively less. All these cost calculations were made at a realistic workload of 56 consultations per year. At higher workloads telepsychiatry would be less expensive for society.

From the health care provider's perspective, the cost metric is further complicated by the issue of how costs are calculated. Should the total cost be used, the unit cost, or the marginal cost, for example? The total cost of providing a service normally depends on the numbers of patients to whom it is provided. As more patients are dealt with, the total cost increases (see Fig 1). Using the total cost as the metric therefore requires an accompanying statement about what workload is being handled.

Fig 1. The total cost of providing a service (e.g. telemedicine) is proportional to the number of patients dealt with. The cost of dealing with a given number of patients comprises the fixed costs, F , which are incurred irrespective of workload, and the variable costs, V



The total cost of providing a service is generally made up of two components. There is an initial, start-up cost which is independent of workload, and there is a variable component, which depends on the number of patients. In the context of telemedicine, part of the fixed component, F , would be the cost of buying the equipment and the initial installation charge for the telecommunications lines. Part of the variable component, V , would be the call charges for the telecommunications, and costs of the physician's time, which will be proportional to the number of patients dealt with.

Thus at any particular annual workload, n , the total cost of providing the service is:

$$T = F + V$$

The unit cost of the service is simply the average cost at that workload, i.e. the unit cost is:

$$U = T / n$$

The marginal cost is the cost of providing the service to additional patients, assuming that the fixed cost has been written off. That is, the marginal cost is:

$$M = V / n$$

Bergmo examined the cost to the public health service of providing dermatology services by various means in northern Norway.[6] She calculated that the cost of the patient travelling to hospital to see a dermatologist was Nkr 4360 per patient. An alternative was teledermatology, which was associated with a fixed cost of Nkr 398,785 and a variable cost of Nkr 192 per patient. Thus at a realistic annual workload of 375 patients, teledermatology cost Nkr 470,780, while patient travel was more than three times as expensive, costing Nkr 1,635,075.

These are the total costs. At the same workload, the unit cost of teledermatology was Nkr 1255 versus Nkr 4360 for patient travel. At lower workloads, say 50 patients, the unit cost of teledermatology was much higher: Nkr 8168, i.e. nearly twice as expensive as patient travel.

Another important decision in cost calculations therefore, is whether to use total cost (at a particular workload), unit cost, or marginal cost. For simplicity, the remainder of this discussion uses the unit cost.

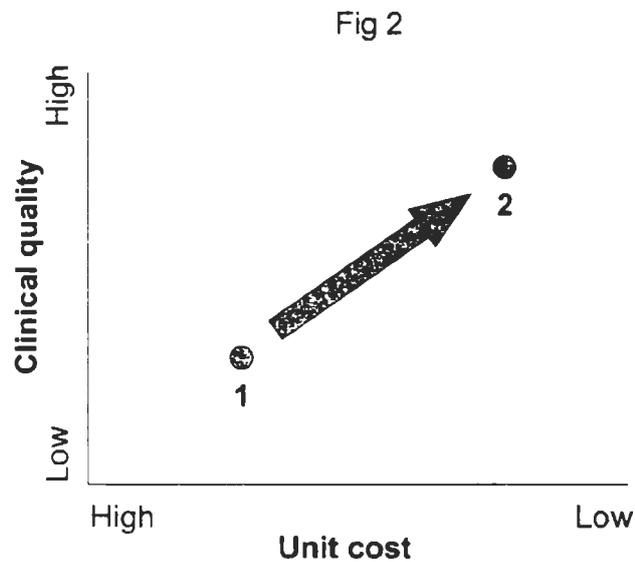
Comparison of techniques

Even if there are no alternative methods of doing a job – for example, liver transplants – a successful technique is one that is in some sense better than not doing it. If there are two methods of performing the same task – perhaps conventional radiology and teleradiology – then intuitively if the cost of one is less, and the quality of its outcome is higher, it must be judged a success. This seems unarguable.

In practice, when a new technique is first introduced it may be neither clinically effective nor cost-effective. Nonetheless, if the potential for success is evident then its use may continue. For example, heart transplants were (and are) very expensive to carry out. They were also technically unsuccessful at first.

The history of health care services has demonstrated that a successful technique is therefore one in which either or both indices increase over time (i.e. increased quality and reduced cost) such as CT scanning, vaccinations or antibiotics (Fig 2). That is, success is relative. A telemedicine application may be considered successful if it has superior performance to the conventional alternative: it may also be considered successful if it improves its performance in relation to what it did previously (say one year before).

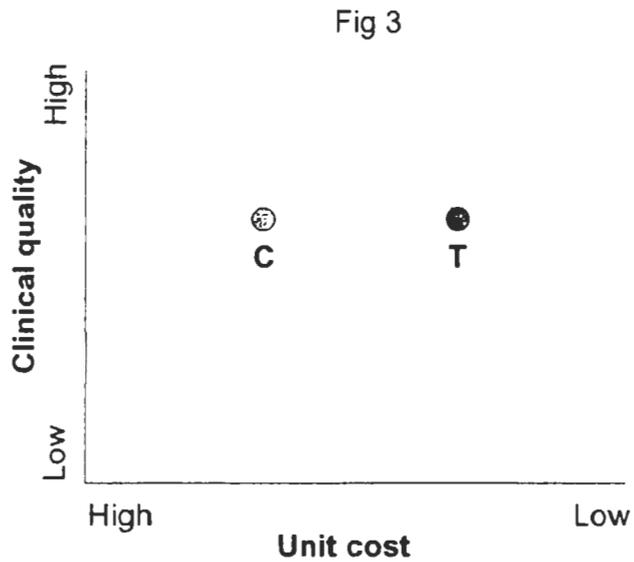
Fig 2. A successful technique improves its clinical quality from year 1 to year 2, and also reduces its cost



Thus with two metrics (cost and clinical quality), a comparison is straightforward if one of the measures stays the same while the other one changes. Many telehealth studies comparing the cost of traditional care to telehealth care focus on the cost issues and assume that the clinical quality, and therefore patient outcome, is the same. This may be a reasonable assumption in the case of radiology and teleradiology, but parity of outcome should be justified in other cases.

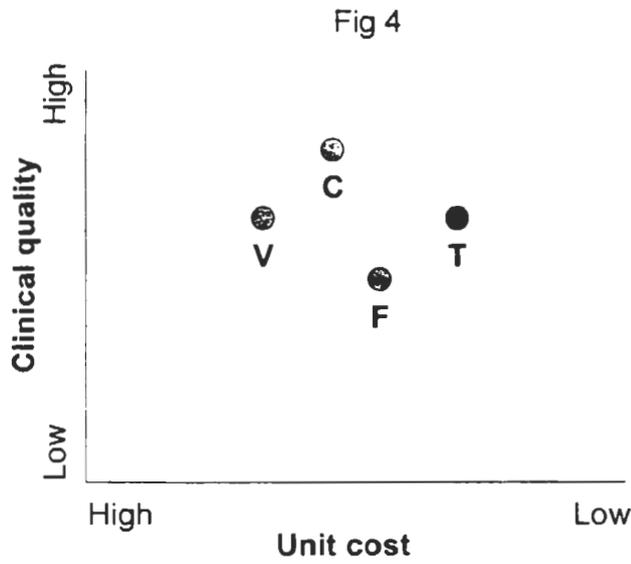
For example, telepsychiatry has been compared with conventional psychiatry. If each technique is assumed to be of the same clinical quality, then any comparisons can be made solely on the basis of cost. Thus, the technique that is least expensive can be judged to be the most successful (Fig 3). A study in Alberta found that telepsychiatry was less expensive than travelling psychiatrist consultations at workloads greater than 400 consultations per year.[7]

Fig 3. Conventional psychiatry (C) compared to telepsychiatry (T). Since the clinical quality is the same, the least expensive technique (telepsychiatry) is preferable



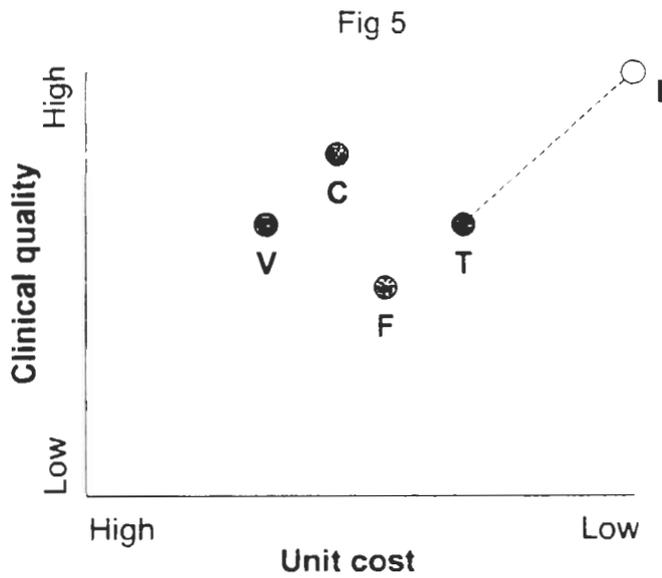
However, even this simplified representation is not without its problems – how do you compare alternative techniques if both indices alter? In other words, how do you make a comparison if there is evidence that the quality of care *and* the cost differ with different delivery mechanisms? For example, consider teleradiology in comparison with three alternatives: conventional radiology (the patient travels to the main hospital), a visiting radiologist service (the radiologist travels to the peripheral hospital on a regular basis), and a service in which the films are sent by courier to the main hospital for reporting (Fig 4).

Fig 4. Conventional radiology (C) compared with a visiting radiology service (V), with a film transport service (F) and with teleradiology (T). Which is the most successful?



If both metrics have equal weights, then presumably the most successful technique is the one nearest point I, the ideal (Fig 5).

Fig 5. If both metrics have equal weight, then the most successful technique is that nearest to the ideal, point I



The ideal technique is the one whose unit cost is lowest, and whose clinical quality is highest. However, even this may be hard to define in practice. The best possible value of unit cost is zero. But what is the maximum value for clinical quality? Infinite lifespan, perhaps?

The context of health care delivery

The context in which health care is delivered also affects the success of new services, as well as the measures of that success. It has been said that telehealth applications have "not had any significant effect on medical practice, or the structure and organization of health-care. In order to utilize the potential of telemedicine, its integration with traditional health-care is very important. There are country-specific variations in the health systems that make it difficult to generalize the results from country to another." [8] This is exemplified by the issue of patient travel. In the UK, patients generally live close to hospitals and the national health service does not usually pay their travel costs. Under these circumstances, it is less expensive for the health care provider if patients attend hospital outpatient clinics for dermatology, than if teledermatology is introduced at primary care level. [9] In New Zealand, on the other hand, much of the population lives in rural or remote areas, and travel costs are often borne by the health care system. In these circumstances, teledermatology is less expensive (for society) than conventional hospital attendance. [10]

Table 2. Three different contexts in which health care is delivered

New Zealand	Canada	UK
Long distances	Long distances	Short distances
Travel paid by the health care system	Travel paid by the patient and/or government	Travel paid by the patient

Finally, it should be recognized that all the above considerations may be overridden by political will. For example:

- in Norway, the government made a decision to provide equal access to health care for all [11]
- in Alberta, private donor and government funding has been used for telehealth initiatives to ensure equitable access to health care services for residents. [12]

Notwithstanding considerations of the cost of providing telehealth services, therefore, there may be political reasons why they must be implemented.

Discussion

The above analysis implies that success of telehealth initiatives must be considered in relative, not absolute, terms. That is, success cannot be judged in isolation – there is always a comparison, if only implicit, with other potential alternatives for care. In addition, care is provided in a context that provides boundaries for the definition of success. For example, if a radiologist is not available locally, teleradiology may be seen as a successful alternative service, even though it may be more expensive than employing a radiologist locally.

Success is relative. It is also clear there is no single criterion for success in telehealth. This is no different to judgements of success in other fields. For example, what is a successful car? Is it the fastest (Ferrari), the safest (Volvo), the most expensive (Rolls Royce) or the one

produced in largest numbers (Volkswagen)? That is, we have to define the criteria for success.

In telehealth, the judgement of success can be broadly based on indices of cost and clinical quality, but these are also subject to interpretation in various ways:

- (a) costs have to be calculated from a particular financial perspective, whether that be the perspective of the patient, the healthcare provider, or society as a whole
- (b) costs are workload-dependent. Without a statement of the workload, cost reports are meaningless
- (c) the value of a service depends on its context, such as the characteristics of the health care system in the country in which it is being provided.

Finally, all rational decision-making may be over-ridden by the political imperative, which may create other "political" markers for success.

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04. Realtime fetal ultrasound by telemedicine in Queensland. A successful venture?

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Summary

We have established a realtime fetal tele-ultrasound consultation service in Queensland, which has been integrated into our routine clinical practice. The service, which uses ISDN transmission at 384 kbit/s, allows patients in Townsville to be examined by subspecialists in Brisbane, 1500 km away. Of the 90 tele-ultrasound consultations performed for the first 71 patients, 90% have been delivered, and outcome data have been received on all the pregnancies. All significant anomalies and diagnoses have been confirmed. Of the first 71 patients seen (90 consultations), the referring clinicians would have physically referred 24 to Brisbane in the absence of telehealth. A crude cost-benefit calculation suggests that the tele-ultrasound service resulted in a net saving of A\$6340, and at the same time enabled almost four times the number of consultations to be carried out.

Introduction

Telemedicine, which involves the delivery of health care across a distance, is a branch of medicine that is heavily technology-based. It has the potential to improve access to care for rural areas or areas under-served by health care specialists; improve access to medical education; and enhance the quality of care. While telemedicine applications have flourished in the 1990s, many have not progressed beyond the pilot stage. Telemedicine is still not integrated into mainstream clinical practice in most instances. It is therefore imperative to analyse the factors leading to success and failure of such ventures, so that scarce resources can be utilised to maximum potential. We report our experience with a realtime fetal tele-ultrasound consultation service in Queensland, and examine the factors affecting the success of such a service.

Background – need of service

Obstetric ultrasound is now an indispensable tool in the assessment of fetal problems and well being. The use of routine obstetric ultrasound screening in a low risk population may have been controversial because of the variation in performance between tertiary referral centres and general units¹⁻³. On the other hand, the value of ultrasound in high-risk populations, in assessing suspected fetal problems, and monitoring the growth and wellbeing of the high-risk fetus, have been well established⁴.

When there is a suspected fetal anomaly, an accurate diagnosis is essential before management options can be discussed with the parents. The families require accurate, unequivocal information and a high standard of compassionate, professional care during these times of crisis. Referral to a tertiary referral unit is required, where a multi-disciplinary team of specialists can be provided, including maternal fetal medicine subspecialists, neonatologists, paediatric cardiologists, neonatal surgeons, geneticists and genetic counsellors. Unfortunately, the scarcity of tertiary referral centres, and the anxiety and stress created by the delay in referrals for equivocal findings, are often inhibitory factors for referral. A survey performed in Australia showed that a large proportion of litigation problems associated with antenatal ultrasound were due to the lack of appropriate referral to a tertiary referral unit after equivocal findings had been detected.⁵

Australia is a huge continent. Queensland covers an area of over 1.7 million square kilometres, and accounts for nearly 25% of the total land area of the Australian continent. By way of comparison, Queensland covers seven times the area of the United Kingdom, is more than twice the size of Texas, and five times larger than Japan. There are 50,000 births per year in Queensland and 40,000 births occur in the Central and Southern zones of the state, which are served by two major tertiary obstetric hospitals. Both of these hospitals are located in the state capital city of Brisbane. There are approximately 10,000 births in the North Queensland region each year, with the main tertiary obstetric unit being based at Kirwan Hospital for women in Townsville, 1500 km from Brisbane.

The Mater Mothers' Hospital at Brisbane is the only tertiary centre in Queensland staffed with full-time accredited maternal fetal medicine subspecialists. It has a full complement of perinatal specialists that form a multi-disciplinary team to offer advice and management to complicated perinatal problems. Traditionally, patients with problems in North Queensland are either flown personally, or their videotapes sent to Brisbane for assessment. A pregnant mother in a rural area may require a road journey of 3-4 hours to reach a provincial centre, followed by a flight to Brisbane. An overnight stay in the city is often required before the multiple consultations can be accomplished. The costs of air travel and the disruption to family dynamics pose extra problems during these times of intense emotional stress. Videotape review is also difficult, as there is no instantaneous feedback to the sonographer, and the tape may not contain all the ultrasound views necessary to make a definitive

diagnosis. There is also a delay in response to the consultation, which is often unacceptable to patients during this stressful period.

Telemedicine should be an ideal tool in Australia to help bridge the health care gap between the country and the city, as well as improve access to medical education; and enhance the quality of care. In 1997, a pilot tele-ultrasound perinatal consultation service was planned between the Kirwan Hospital for Women, the major referral centre in North Queensland, and the Mater Mothers' Hospital, Brisbane.

Personnel involved

The project was initiated by the clinicians from both centres, who had direct and extensive experience in dealing with complex perinatal consultations. Technical advice was sought from external parties such as the TARDIS team, Queensland Health staff, Telstra, technicians from various videoconferencing companies, as well as IT technologists from the two hospitals involved. Two project officers, one for each hospital, were recruited to assist in the co-ordination and smooth running of the project. At least four clinicians and two sonographers from each hospital were involved during the pilot clinical phase of the project.

Technology assessment

In view of the sensitivities in dealing with possibly anomalous fetuses, and the significance of obtaining all relevant information on a fetus during the ultrasound examination, a decision was made to use realtime transmission. During realtime transmission, the clinician can direct the sonographer at the remote site to obtain all the information required, interpret the findings, and assist in the counselling of women and families about subsequent management.

This realtime interaction was deemed to be one of the most important factors in the success of the project. It involves the simultaneous availability of both parties, is obviously harder to organise, and may be more expensive. However it improves the communication between the two sites, assists in the education and training of staff in the remote site, as well as reduces the risk of liability, which may arise in a 'store and forward' transmission, when some vital information may have been missed in the pre-recorded examination.

Equipment and bandwidth requirement

One barrier to realtime telemedicine is the running cost, especially if high bandwidths are required. The transmission of video information involves high volumes of data. Bandwidths as high as 2 Mbit/s have been used in obstetric ultrasound⁶, and near-broadcast-quality video has been transmitted at 45 Mbit/s in paediatric echocardiography⁷. However, the cost of high bandwidth transmission would inhibit the introduction of such services to the remote areas, which are in fact most in need. While there have been two reports in the literature using lower bandwidths such as 384 kbit/s in obstetric ultrasound^{8,9}, and even 128 kbit/s in paediatric echocardiography^{10,11}, no systematic evaluation of the adequacy of performance at different bandwidths has been reported.

Telemedicine is an area in which it is notoriously difficult to conduct scientific assessments¹². Tele-ultrasound is one of the most difficult amongst the range of telemedicine applications. Many variables are involved in the assessment of realtime ultrasound images transmitted from one site to another. Some of the more obvious variables include: quality of the ultrasound machine used in the initial site; skill of the sonographers in performing the study; gestational age at which the study is performed; size and habitus of the pregnant woman; complexity of the case examined; quality of the videocodec used; bandwidth used for the transmission; distance of transmission required; resolution of the monitor used at the receiving end; and experience of the specialists involved in assessing the images.

We performed a pilot study to assess the bandwidth required for accurate diagnoses in realtime fetal tele-ultrasound consultations¹³. Randomised blinded comparisons are the Gold Standard for the most vigorous scientific evaluations. We therefore used randomised and blinded assessments to evaluate the needs of the different components for the transmission. We also made use of a standard video recording with a pre-agreed scoring protocol, where the 'gold standard' for a maximum score was 'image quality as good as the original videotape'. This is important because the assessment of image quality is a subjective process. By setting a 'gold standard', and by using a total of 30 anatomical landmarks, the average scores from each clinician for each of the systems tested were found to follow a normal distribution, allowing statistical analysis with parametric methods.

The pilot study was divided into three phases¹³. In **Phase I**, three experienced clinicians evaluated the quality of ultrasound images transmitted at various bandwidths (internally looped back within Brisbane) using a standard ultrasound videorecording, with eight commercially available videocodecs at random. The two videocodecs that performed best proceeded to **Phase 2**, where a live link of up to 2 Mbit/s was set up between Brisbane and Townsville. Testing with the standard videotape was performed at seven different bandwidths played at random to four clinicians (who were blinded to the equipment and bandwidths used). The optimum bandwidths for transmission were determined, and testing was then performed using these rates for fetuses with various anomalies (**Phase 3**). The results showed significant differences of performance according to bandwidths used ($P < 0.0001$), but not according to observers ($P > 0.36$). The performances could be grouped into three levels: at level I (256 kbit/s), the performance was significantly worse than at level II (384, 512 or 768 kbit/s), which was in turn worse than at level III (1, 1.5 or 2 Mbit/s). However, within each level, the performance of one bandwidth was not significantly different from the others. The most cost-effective rates were therefore found to be 384 kbit/s and 1 Mbit/s¹³.

Clinical evaluation

To evaluate the clinical value of our realtime tertiary tele-ultrasound consultation service, patients requiring tertiary ultrasound consultations were recruited from North Queensland. Clinicians from the referral site established an initial diagnosis and management plan. The patients travelled from their primary site of referral to Kirwan Hospital at Townsville, which is equipped with modern ultrasound equipment, and staffed with qualified sonographers. Using standard ISDN lines, the realtime ultrasound images were transmitted to the maternal fetal medicine subspecialists in Brisbane. The ultrasound examination was completed under the direction of the subspecialist. The subspecialist explained the findings to the patient at the end of the session, and discussed the diagnosis and management plans with the clinicians involved. Any diagnosis and management variations were classified into minor and major upon agreement by the two teams of clinicians involved. The clinicians and patients in Townsville rated the value of the consultation, and the subspecialists rated the confidence of their diagnoses on a five-point scale. Pregnancy outcomes were obtained and the data analysed.

We have already reported the results of our first 24 clinical consultations over a three-month period¹⁴. Results from our subsequent 90 consultations are similar, and will be reported separately. The major indications for referral were: complex fetal problems such as twin complications or multiple fetal anomalies (43%); detailed assessment for high risk patients (19%); isolated fetal anomalies (17%); evaluation of markers for anomalies (13%); and assessment of growth restriction/fetal well-being in the third trimester (8%).

Effect of consultation on diagnosis and management

The clinicians from both teams reviewed the cases at six-month intervals and rated the impact of tele-consultation on clinical diagnosis and management. The variations were classified into minor or major, depending on the effect on the case. The classification was agreed by both teams of clinicians involved.

Overall, the consultations resulted in some modifications to the clinical diagnosis in 41% of the cases, and modifications to the management plan in 40% of the cases, about half of which were minor variations. It is important to point out that most of the variations were from the initial diagnosis at referral from the primary obstetric site, and do not necessarily reflect the performance of the team at Kirwan Hospital. In fact, most of the 'major' variations in management was in prevention of physical transfer of the patients to Brisbane, and the 'minor' variations related to reduced frequency of subsequent monitoring.

Accuracy of diagnosis

Of the 90 tele-ultrasound consultations performed for the first 71 patients, 90% have been delivered, and outcome data have been received on all the pregnancies. All significant anomalies and diagnoses have been confirmed.

Evaluation by clinicians¹⁴

The referring clinicians at Kirwan Hospital rated the usefulness of the tele-consultations on a five-point scale. Overall, the scores were 4 in 25% of cases, and 5 in 75% of the cases (mean score 4.7, SD 0.4). The mean score when there were diagnostic or management variations, either alone or in combination, was 4.8 (SD 0.3), while the mean score when there were no variations was 4.7 (SD 0.5).

The maternal fetal medicine subspecialists in Brisbane rated their confidence in making diagnoses using telemedicine on a five-point scale¹⁴. The scores were 4 in 54%, and 5 in 47% of the instances, indicating that they were confident/very confident (mean score 4.2, SD 0.4).

Evaluation by patients¹⁴

Of the 24 clinical consultations performed during the course of the pilot project, a total of 20 feedback forms were sent back from the patients in the mail. The results from these feedback forms showed that 75% of the women had not used videoconferencing before. Two women participated in the study on two occasions. One woman had used videoconferencing before in the course of her work. 95% of the women felt satisfied that they had the videoconferencing process clearly explained to them. Before the consultation, 80% felt very positive or positive about seeing a medical specialist in Brisbane, whereas 20% indicated they felt neutral. During the videoconference, 100% strongly agreed or agreed that they felt comfortable with the specialist in Brisbane. 95% of the women strongly agreed or agreed when asked if their privacy and confidentiality were maintained during the videoconference, and 95% indicated that they would recommend videoconferencing to others.

Cost evaluation

A crude estimate of the cost-benefit of realtime tele-ultrasound consultation is to balance the telecommunications cost for the consultations versus the cost of transfer should the tele-consultation not be available. During the project, the referring clinicians were asked to indicate what method of consultation they would have resorted to if the telemedicine link had not been not available. Of the first 71 patients seen (90 consultations), the referring clinicians would have physically referred 24 to Brisbane. For the other patients, they would have either

sent their videotapes for review, or telephoned for opinions. After the tele-ultrasound consultations, seven patients still had to be transferred to Brisbane for intervention.

Assuming that all patients travel alone to Brisbane (in fact most of them travel with their partners), the cost of airfare saved for the 17 patients amounted to A\$13,000. The average duration of each tele-ultrasound consultation for these patients was 37 min. 384 kbit/s was used as the transmission bandwidth in 95% of the consultations. The average cost per tele-consultation was calculated to be A\$74. The total line cost for consultation for the 71 patients (seen 90 times) therefore amounted to A\$6660. The tele-ultrasound service therefore resulted in a net saving of A\$6340, and at the same time enabled almost four times the number of consultations than if the service had not been available.

These are only crude estimates. The initial set up and equipment costs have not been included, and the costs for the clinicians have not been included. While the average duration of each consultation was 37 min, the time required to generate a report, and to enter all the data into a database was another 30 mins. These costs were not included in the calculations. On the other hand, the benefits in terms of reduced anxiety and social costs to the families involved were not measured either. The value of support and education to remote clinicians is similarly hard to quantify.

Limitations and barriers

The project showed that tertiary realtime fetal ultrasound consultation by telemedicine is not only technically feasible, it is welcomed by the clinicians and patients involved. It also contributes to diagnostic and management differences, and appears to be a cost-effective strategy for bridging the health care gap between country and city. However, there are still limitations for its widespread application:

1. the need for a minimum of 384 kb/s connection currently precludes many regional centres from access
2. the skill of obstetric ultrasound is highly operator dependent. Intensive training and education may be required for many regional centres
3. with improvement in access, the number of consultations is likely to escalate. Resource and support need to match the demand in service
4. realtime consultations are very time-consuming. Strategies may need to be developed so that some consultations can be performed in store-and-forward mode, such as the use of compressed videoclips^{15,16}
5. the perceived threat to local services needs to be addressed. It must be stressed that telemedicine cannot replace local services. It can only provide support and education. Full collaboration between the parties is an absolute necessity before the venture can be successful
6. the possible medico-legal implications and confidentiality issues need to be considered as this type of service becomes more wide spread.

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05. E-health and online teaching: a successful synergy

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Summary

Knowledge of the successes and failures of a variety of e-health applications has contributed to the teaching *process* as well as the *content* of an online e-health course. Examining the synergy between e-health and online teaching as forms of technologically-mediated communication is useful in developing knowledge about both. Two conclusions may be drawn. The first is that success rests on the ability to make sense of the information that is communicated. The second is that success depends on building social networks. We have developed an online course in e-health in which participants develop an understanding of the domain both through sharing their own experience of online delivery, as well as through course content that illustrates the successes and failures of others.

Introduction

In this paper I draw on experience of teaching an online subject, Contemporary Health Delivery Infrastructure.[1] My knowledge of e-health comes from experience of the teaching process as well as the course material itself, and in particular from a variety of case studies. This subject was taught for the first time in 2001 by La Trobe University, Melbourne to students in metropolitan and rural Victoria and New South Wales. It is part of a postgraduate e-health qualification offered in collaboration with the Universities of Queensland and Southern Queensland.

E-health and online teaching are different, but synergistic, forms of technologically-mediated communication. This means that each can learn from the other. There are two key elements in the factors contributing to the success or failure of technologically-mediated communication. The first concerns the extent to which technology-as-mediator allows the people using it to communicate meaningful information, that is information that can be used as the basis of decision-making. The second is the nurturing of social networks, and more specifically the relationships between people, that make technologically-mediated communication successful.

Communicating meaningful information

It is not enough to be able to communicate via technology, we must also be able to communicate meaningful information. The technologies associated with e-health and online teaching/learning can seem like a profound change, yet in context, they are simply the next step in a continuum. The desire to record and communicate information is uniquely human. We have developed systems and tools to do this, beginning with language and alphabets. The following statement about the alphabet is equally applicable to the technologies of e-health:

"The central role of the alphabet in the storage and communication of information cannot be overstated... It minimises the obstacles to understanding, is easy to learn, easy to use and readily adaptable, it is not however perfect... Both knowledge and ability limit our capacity" [2]

Technologies from the alphabet, book and printing devices onwards have simply made the communication of information faster and more efficient, thus widening the scope of what can be communicated.

The key point is that knowledge and ability limit our capacity to communicate meaningfully – be it via alphabet, computer or videoconference. To continue the alphabet analogy, there are several steps necessary for the communication of meaningful information. First we need to understand the language, be able to access the words (e.g. have the book), and have skill in reading. Understanding comes when we can make meaning out of the words. To do this we have to be able to put the words into a context that is based on our understandings developed from previous experiences. Take the example of an ostensibly factual piece of information such as "x% of Australians die of a heart attack every year". Imagine how you might change your acceptance of that information if I was to tell you that the statement was from (a) a comic; (b) a peer-reviewed academic article; (c) a student essay; or (d) a newspaper. Finally, beyond understanding is another step – knowledge. This requires interacting with the communicated information by processes such as using it to make informed decisions (healthcare) or sharing it with others (education).

Context

The technologies involved in e-health and online teaching pose two particular challenges to successfully communicating meaningful information, both related to context. The first

challenge is that information is decontextualised by technologies that have made it increasingly possible to transmit small bits of data rapidly and cheaply. [3] This is particularly true of information delivered via the Internet. However, as in our alphabet analogy, if information is to be meaningful we need to be able to relate the context in which the information is communicated to our particular context and experiences.

The second challenge is that the technology itself is often the context for the communicated information. The effect of this is that the information delivered by technology often carries with it the appearance of authority. The technologies of e-health and online learning need to be seen in the context of developments such as broadcasting, which has made it possible to transmit information and opinions directly to people's homes. Television in particular is an almost universal, potentially instantaneous and powerful means of communication. This is demonstrated by the extent to which commercial interests exploit this form of communication, e.g. for advertising. The use of technology to deliver information can often make it seem that there is only one right choice, only one normal or correct way to do something. In this context it is difficult to use information to make meaningful decisions – that is decisions based on real choices.

There are two solutions to these contextual challenges. The first is to exercise critical appraisal skills. Just as the success of evidence-based medicine depends on the development of practitioners' critical appraisal skills so we have tried to encourage course participants to think critically about information. This is made easier by using course material with a social science approach and we often pose questions to which there is no single correct answer. We do not present the course information as resting on an unquestionable authority.

Second, context is to be found in relating the information to experience. This is the subject of the final part of this paper – how social interactions contribute to understanding context and therefore making meaningful use of information.

Social networks, human relationships

Online teaching can appear static and at its worst it is seen as electronically-delivered pages of information that simply transfer the costs of postage and printing to the student. Feedback from other online courses indicated that students often found it hard to engage with this kind of static course material. The way that we counteracted this clearly demonstrates the synergy between e-health and online teaching/learning. First we tried to make the information in the course more meaningful through the use of case studies. As we wrote these one of the lessons that came through strongly was the importance of social networks for the success in communicating via technology. This in turn influenced our decisions about how to deliver the course.

To begin with, I will describe the lessons learnt from three of the case studies that influenced our decisions about course delivery. The first case study involved a private practitioner and an occupational therapist setting up videoconsultations as an adjunct to their conventional practice. This demonstrated the importance of the personal networking skills that the occupational therapist had developed in both setting up and maintaining a telehealth practice. The occupational therapist had also reinforced the social networks that she had created through the use of email lists.

Similar points were illustrated in a case study involving the Mental Health Review Board of Victoria. Videoconferencing was embraced out of necessity through a combination of internal and external pressures. Because the financial gains in not having to fly psychiatrists and other practitioners to rural locations were substantial, the Review Board saw little need to look further for the factors for success. However, it is clear that the new system has benefited from having an administrative team throughout the state that was strongly connected before

the introduction of the technology. Indeed, its members had consciously maintained this human network, by telephone and email contact.

Finally, the possibility that decontextualisation can improve interpersonal relationships was illustrated in a case study involving the mentoring of overseas-trained psychiatrists in rural Victoria. Previously the power differential between these psychiatrists and their mentors meant the process was of little value. The introduction of a completely different process via videoconferencing, that involved the psychiatric team as a whole being able to discuss cases with the remote mentors, effectively flattened the power differences, and was far more effective in improving psychiatric services.

Consequently, our approach to online delivery is based on trying to develop a learning community or social network. This not only makes good pedagogical sense, it also models the social networks that course participants will have to develop for successful e-health practice. So, even though online delivery appears to offer course participants the flexibility to complete the course at their own pace, we have encouraged them to work together as a group. This means that participants access course material week by week, and reflecting on this in bulletin board, chatroom, telephone and videoconferenced encounters.

Context and meaning is developed in this 'learning community' in several ways. Course participants use the e-health experiences described in the case studies to develop their own understanding of context. In addition, course participants are offered a variety of ways to interact with the course material, and it is in this interaction that course information is given meaning. This is an important part of the learning process, where writing or talking is an essential part of organising and clarifying thinking. This is why we tried to create opportunities for collaboration, both within the group and with the variety of chatroom and teleconferenced guests. An online debate was particularly effective in drawing the students together as a group.

Conclusion

It is no longer enough to provide the infrastructure and skills that enable access to information; people need to the ability to make sense of information, and make use of it in a meaningful way. This ability comes from critical appraisal skills, knowledge of context and social networks. In our online course on contemporary health delivery infrastructure the synergy between e-health and online education allowed course participants to develop an understanding of e-health both through their experience of online delivery, as well as course content. It also means that existing e-health practitioners can learn from both the content and process of the course.

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06. Clinical call centres: does low bandwidth video have a place?

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Summary

Low bandwidth video has a place in health service delivery. Videoconferencing systems commonly used in telehealth have a high capital cost, take days or weeks to install at specific locations, and have high communications charges. A range of circumstances can be envisaged where video may be of benefit but would not justify the cost of large systems. There are projects in community nursing, home dialysis, post acute respiratory care where various low bandwidth video technologies have been added as a supplement to the humble telephone call. It can be expected that at least some of these projects will be able to demonstrate tangible improvements in health outcomes such as decreased readmission rates, reduced acute episodes of a chronic illness and improved health status from the additional social support.

Introduction

Low bandwidth is defined as being in the range that can be transmitted by ordinary telephone lines; that is 9.6-56 kbit/s. The telephone is a ubiquitous and essential tool in effective health care systems. Patients and their carers have, since its advent, been phoning health care professionals to obtain advice and receive support. Hospitals, medical practitioners, community health organisations, home carer/nursing services all conduct telephone interactions daily; sometimes this service is formalised into a call centre.

A range of decisions is made via telephone advice, including the timing of seeing the next professional (from an immediate ambulance to next available outpatients) and mechanisms for self-treatment. My own experience involves taking calls from parents in a paediatric emergency department to assist in the decision of whether or not to bring in a child with a temperature into hospital at 02:00 in the morning and distress calls from the carers of palliative care patients. In the long-established practice of taking a history, then doing an examination it is logical that a valuable step is to facilitate the patient or carer and professional to be able to see each other.

The value of video in health services

Australia has already invested substantial capital in sophisticated videoconferencing systems for the delivery of health care with thousands of hours of clinical service provided every month. This equipment is too expensive (over \$10,000 in capital and \$10-100/h transmission costs) to use in every circumstance where video is conceivably useful. I believe there is a role for equipment costing about \$2000 per unit and where the transmission cost is that of a standard telephone call.

Benefits

What tangible benefits are expected from the video interaction? There are two main potential benefits of the addition of video to a telephone call (1) a contribution to clinical assessment and (2) improved social interaction.

Clinical assessment

Any contribution to clinical assessment, in the case of lower frame rate/resolution video is clearly different from the more expensive in systems in use. An exercise in which I have experience both as a student and teacher was to ask medical students to examine a patient from the end of the bed and pass an opinion as to the likely severity of illness. After the examination the student were asked questions such as "Did the patient look distressed or otherwise uncomfortable?"; even a basic visual observation such as this has long been considered valuable information in clinical assessment and can be provided with low cost video systems.

In a community patient nursing project described below, a 95 year old patient with low grade dementia made a comment that it was nice to see [nurse's name] in green today; a comment that seemed to assist in mental state assessment at the time.

Social interaction

It is well established that social support has a positive effect on the health status of older people and the chronically ill. Carers and nurses in Community Health Care organisations state that a large part of the value of their work is social support and interaction. Sometimes, however, that value is lost once the wound is healed or the diabetes stabilised and the home care service ceases. Video interaction does not substitute for live social interaction. The

anecdotal feedback from users, however, is that nearly any level of video provides greater value than no video at all. We like to watch people laugh and smile, even if they go a bit blurry when doing so.

Closing the service gaps

As the Australian health system has evolved the people delivering care have sought to close gaps in delivery models. This has seen the advent of home nursing, hospital in the home, step-down facilities in hospitals and a range of non-acute residential care. In essence, the benefit we seek from adding a video facility to the humble telephone call is to close another of these gaps.

About the technologies

There are two technical considerations, the nature of the connection and the user device. The core issues for the services under discussion are the (1) ease of deployment, (2) the simplicity of the user interface, (3) the stability of the connection, particularly in relation to voice, and (4) the cost effectiveness of both the initial outlay and any transmission costs. The benchmark for all these issues is the humble telephone.

Modes of transmission

There is a belief that future improvements in bandwidth will make redundant the use of low bandwidth devices. The most basic ISDN link still costs about \$120/month and takes two weeks to install. Even at sites with pre-existing services the immediate availability is restricted to certain outlets. These characteristics are not ideal where users may be in their home and there is a need for rapid service deployment. I do not believe that future predictions of connection availability justify delaying activity in the field.

There are many projects which employ standard telephone connections, without Internet access. Where Internet subscription does suit an application the quality of the video can of course be improved, at a cost, via the use of higher speed connections such as cable modem.

The devices

A range of inexpensive, low bandwidth, video options is available including: the use of cameras on PCs with videoconferencing software such as Microsoft Netmeeting, CUSEE ME or Proshare; videophones or equivalent devices. In my experience it is technically easier to use computer-based systems via an Internet Service Provider. However computers can be set-up to provide point-to-point connections via a standard telephone call.

Recently a videophone was approved for use in Australia over the ordinary telephone network (Fig 1). This device is being used for a number of health service projects. The feedback from users is the main advantage is the ease of use for the client

I am aware that devices have gone into commercial production with electronic vital sign measurement. These are often marketed as home telemedicine devices. It is my opinion that a client's blood glucose for diabetes, peak flow rate for chronic lung conditions, or weight for congestive cardiac failure all represent important information during a telehealth interaction. The additional benefit of electronic transmission (compared with relaying the information verbally) of these data is a separate discussion from the value of video.

Case studies

I have direct experience with the first case study only.

Case study 1: Community nursing

An important issue in relation to care for the older person or physically impaired is the usability of the computer and the quality of voice transmission. In a project with community nurses a range of technology was tested. Two issues arose, the stability of inexpensive videoconferencing software for computers, and the user interface. We developed a system where software and cameras were installed on a PC and were able to communicate over an ordinary telephone line without arranging for an Internet connection. The platform however was unstable and required computer expertise for installation and maintenance.

A standard telephone videophone received approval for use in Australia during the project. Its advantages were: usability, voice quality, no Internet or ISDN connection required (no connection costs beyond normal telephone call charges); the device will make use of available bandwidth installation is similar to that of a powered phone, and no action is required from the patient to start the video.

The device has been used to provide additional interaction with clients who were being telephoned on a regular basis for other reasons. Staff and clients report the interaction to be useful.

Case study 2: Post discharge respiratory care

A tertiary hospital has conducted a trial adding video to the usual phone call support for a patient with chronic obstructive pulmonary disease. One of the outcomes being measured is re-admission rate.

Case study 3: Support for interventional home care

An Australian paediatric renal unit has just commenced an investigation of the value of low bandwidth video for home peritoneal dialysis.

Case study 4: Social support for paediatric patients

A recent television report described an Australian paediatric oncology unit making use of low bandwidth video for social support of rural inpatients in their home towns.

Conclusion

Where to from here? The technology is immediately available for low cost, user friendly, video interaction between any two sites with ordinary telephone lines. Research is now required to study where such interaction provides a beneficial health outcome.

Fig 1. Commercial videophone



08. Telehospice: a tale of two states

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Two large hospice organizations in Kansas and Michigan have begun a bi-state telehospice project with the goal of improving care at the end of life using telemedicine. Hospice nurses provide services using video directly to the homes of hospice patients. The telemedicine equipment is connected by ordinary telephone lines. Nursing services include symptom assessment and psychospiritual evaluations. Clients reside in both urban and rural settings. Studies have been designed to evaluate utilization patterns, access to care, patient/ carer acceptance, medical outcomes and cost. During the first year of the project, telehospice care was initiated at five rural (two MI, three KS) and three urban (two MI, one KS) sites. There was greater telehospice activity in MI compared to KS, with 118 and 44 patients served respectively. Further, the urban site in Kansas withdrew from the study after participating for only nine months. In an effort to understand the difference in utilization patterns and reasons for withdrawing from the project, in depth interviews of key study participants including hospice administrators, nurses, and research personnel were conducted. Human factors appear to be important in the adoption of novel telemedicine applications.

09. Taking telehealth to the bush: lessons from north Queensland

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Summary

Networking North Queensland (NNQ) was a two-year project to improve access to health care services in rural and remote communities. The project involved email and Internet access in 61 communities, in a region almost three times the size of the UK. Videoconferencing equipment was also installed at 21 sites and a total of 197 h of videoconferencing was recorded at ten of the sites during a 12-month period. As a result of the project, health consumers enjoyed improved access to medical, specialist, allied health and primary health care services. In addition, health service providers had better access to reliable, up-to-date health care information via intranet and Internet services. Consideration of local issues – local needs and existing resources – was vital to the achievements of the project. Community involvement and community access were also important factors in its success.

Introduction

Australia is a vast country with a very small population. Apart from regional centres, the north is relatively sparsely populated and underdeveloped. The lack of telecommunications infrastructure has been a major impediment to the extension of telehealth in north Queensland, particularly in the Gulf and Cape York. In 1998 staff of the Queensland Telemedicine Network consulted community groups, non-government organisations and government departments regarding the need for improved telecommunications in North Queensland and how this could be addressed through funding via Networking the Nation (NTN), an initiative of the Commonwealth government. As a result of these consultations, Networking North Queensland (NNQ) was developed as a collaborative project involving a number of health service providers including the Queensland Ambulance Service, the Blue Care nursing organization, the Divisions of General Practice and the Queensland Health department.

Networking North Queensland was a project to improve the health outcomes of people living in rural and remote North Queensland, by increasing their access to telecommunications.

Methods

Videoconferencing

The primary objective of this component of the project was to provide basic, reliable videoconferencing services to facilitate delivery of health and other services, distance education, family support and business. Videoconferencing facilities were installed in 21 communities in North Queensland (see Fig 1), the majority being rural or remote communities. Ten remote sites located at least two hours from an urban centre were chosen for analysis of videoconferencing usage and community access (see Table 1).

Table 1. Remote communities that received videoconferencing

Community	Facility and staffing*		Population**	Travel time to nearest urban centre (h)
Burketown	Clinic	1 RN	220	5
Camooweal	Clinic	1.5 RNs	258	2
Chillagoe	Hospital	1 RN	150	3
Cow Bay (Daintree)	School	4 teachers	500	2.5
Croydon	Hospital	1RN	223	8
Dajarra	Clinic	1 RN	203	2
Doomadgee	Hospital	6 RNs, 2 GPs	754	5
Georgetown	Hospital	1RN	298	6
Karumba	Clinic	2 RNs, 0.5 GP	1043	6
Normanton	Hospital	6 RNs, 2 GPs	1328	6

*RN Registered Nurse, GP General Practitioner

** 1996 Census, ABS Website¹

Key components of the model used in this project were gleaned from similar Networking the Nation projects and previous telehealth infrastructure installed in rural and remote communities. These included:

- *user-friendly technology* – the purchase of user-friendly equipment suitable for all aspects of community and clinical requirements.
- *portability* - functional, sturdy trolleys designed for portability
- *accessibility* – equipment located to maximise ease of community access
- *room-set up* – provision of accessories including furniture and curtains to ensure best visual presentation for videoconferencing
- *privacy and confidentiality* – a critical consideration in both accessibility and room-set up issues
- *timely support* - technical and administrative support during installation was made readily available, including follow-up and advocacy by project staff on behalf of sites experiencing difficulties
- *resources* – video tapes, manuals, posters, on-line resources all made available at the time of installation and in conjunction with the training
- *awareness* – community forums and demonstrations in each local community, along with advertising at the local level (newsletters, media, brochure distribution) and at a regional level (i.e. urban centres – Mt Isa forum, Cairns and Townsville media releases)
- *collaboration*– consultation and collaboration with local government and non government agencies to ensure sustainability and long-term success of the initiative
- *local "champion"/driver* – identifying, training and supporting key people in each community was primary focus of the project team.

Email and the Internet

Upgraded data lines (up to 128 kbit/s) were installed in 61 communities, along with PCs and modems to connect over 300 users to the Internet. This component of the project focussed on the whole region, including regional, rural and remote areas across all of the participating organisations. The project provided computers to connect participating agencies to intranet and Internet services, offering health service providers and support staff email facilities and access to online medical, specialist, allied health and primary health care information.

Baseline data on participants' abilities with email and the Internet was collected early in the project. An appropriately customized 'Health on the Internet' training programme and support model was then developed to facilitate the acceptance and uptake of these new technologies. Some unique aspects included:

- training delivered in regional workshops and onsite in remote sites to ensure that everyone had the opportunity to receive training
- a health-focussed Internet reference manual and step-by-step email reference sheets
- an Internet training programme designed specifically with an emphasis on finding and evaluating quality health information (see Table 2)
- a mailing list with links to reviewed health sites on the Web to support participants in accessing quality health information
- individual support from the project team throughout the project.

Table 2. Outline of the Health on the Internet training programme

Introduction to the Internet	What is the Internet What is on the Internet Connecting to the Internet
Surfing the WWW	Browser basics Using Favorites/Bookmarks Privacy and security on the Internet Printing and saving information
Searching the WWW	Using search engines Search strategies
Health information on the WWW	Advanced searching on search engines Medical search engines Online medical databases Evaluating web pages

Results

Videoconferencing

Videoconferencing data were analysed for a 12 month period at each of the remote sites. The total number of hours of videoconferencing usage at each facility is shown in Fig 2. As expected, the highest usage stemmed, in the main, from communities with the largest population bases and highest levels of staffing. The results also demonstrate higher usage in communities most distant from urban centres. Interviews with key contact people at each site indicate that any variance was due to a number of local factors. For example, higher usage occurred where:

- staff turnover was lower and there were permanent nursing staff
- regular periodic education programmes were accessed
- there was a local community "driver" based at the facility
- there were fewer occurrences of technical difficulties.

Telehealth usage varied from community to community. However education, both professional development and community health education, represented the highest proportion of the usage in the ten remote communities. Educational activity was predominantly accessed in a multipoint environment with more than 60 hours of delivery on primary health care topics. Clinical activity accounted for an estimated 10 % of usage over the 12 month period, with the majority of clinical consultations reported in the three communities where GPs were located. This clinical activity included sessions where patients were present, and also sessions where isolated health professionals discussed specific patient assessment and treatment options with larger centres. The principal specialty areas to record the most videoconferencing activity were paediatrics, mental health, surgical and general medicine. Family contact supported by local clinicians between facilities was highest in remote indigenous communities.

While levels of community access for non-health related reasons such as job interviews, school interactions, meetings and legal issues were relatively low, a number of innovative community uses emerged. Organisations such as the Alzheimer's Association, Home and Community Care, Queensland Council of Carers, Aged Care Assessment Team, and the Mobile Independent Living Centre used the new infrastructure for training of volunteers, support workers and/or carers in remote communities. The project team supported several links with parents in remote communities to their children (or children's teachers/carers) at boarding schools. Indigenous communities in the Gulf region held meetings to discuss issues

of concern with family members great distances away. One community used the facilities to help save their local ambulance service that was under threat of being removed from the area.

Email and the Internet

A total of 330 new email accounts were created as a result of the project. Intranet and Internet facilities were also made available to a large number of additional users. Training was delivered via workshops in regional areas (133 participants in 11 workshops) and onsite to remote communities (174 participants in 33 communities). Evaluations from both types of delivery were extremely favourable. Searching on the Web was the area found to be most useful. Participants rated the resources developed very highly.

Quantitative data on the use of email was not available from participating organisations. However, email has been adopted across all organisations, staff being requested to use email in preference to fax where possible. Staff comments reflected an outcome of improved communication generally, with additional benefits including access to pathology results, online medical databases and reference manuals.

Feedback from the Health on the Internet mailing list recipients, which has 350 subscribers, indicates that sites were easy to access. The respondents found the Internet was a useful resource to improve patient care, formulate changes in work practices and for study purposes. Sites from the list were indexed by recipients and saved for future use and/or forwarded to others.

Discussion

Videoconferencing

As has been well documented^{2,3}, there are numerous factors that affect telehealth usage in urban settings, e.g. time taken to organise personnel and equipment for sessions, physical proximity of the equipment, technical competence and confidence of users, reliability of the infrastructure, availability of technical assistance and the support of management. There appears to be less documented research that identifies factors specifically affecting the uptake of videoconferencing for telehealth in remote communities. Even fewer have explored issues affecting community access and community participation in utilising telehealth resources now available in many remote communities.

As the results of the videoconferencing component of this project indicate, there are a number of variables in remote communities that affect the level of usage, both by clinicians and the general public. One of those, the importance of the local 'drivers' or champion/s, is not a new concept in telehealth. As argued by Yellowlees, it is crucial to identify the clinician drivers carefully, as well as other key users, and to support and nurture them². The remote communities that had permanent staff, particularly directors of nursing or medical superintendents who were local drivers, were clearly higher users of the facilities.

While this proved to be a useful strategy in a number of communities with beneficial affects on usage, overall community usage remained relatively low. A number of commentators outside the telehealth area have looked at this issue. Rogers³ argued that getting a new idea adopted is difficult even when it has obvious advantages and many "innovations require a lengthy period, often of many years, from the time they become available to the time they are widely adopted". Similarly, as Day and Harris⁵ pointed out, initiatives which have the aim of enhancing inclusion may be initiated by community groups, local authorities or other organisations, but to be successful they must have credibility in the local community. Projects need to develop community ownership and responsibility, and this takes time. This is undeniably the case in relation to the NNQ project, as is the following observation:

“community IT initiatives do not necessarily depend on finding a single local ‘champion’ – it is the combined skills of a group of communicative workers and amateurs that counts”⁶.

Email and the Internet

There are many references to the current and potential use of email and the Internet in the delivery of health-care^{6,7,8}, but the degree to which it is accepted and used will depend on how much it costs to access and how well people are trained in its use⁹. Feedback from participants was significant in highlighting this latter point – training is critical.

Rural and remote health service providers and support staff across North Queensland have now been provided with the tools, knowledge and initial support to incorporate the use of email and the Internet as part of their daily communication and information sharing. They now have the same access to information as their city counterparts. It can never be said often enough however, that training and support needs to be continuous, particularly in remote communities to allow for the constant movement of staff.

Conclusion

As a result of the project, clients of health services involved in the NNQ project have increased access to medical, specialist, allied health and primary health care services in rural and remote communities. Access to reliable, up-to-date health care information via intranet and Internet services has been made available to health service providers and has clearly demonstrated benefits for rural and remote clients and patients. The videoconferencing and Internet projects demonstrated a range of new and innovative ways to both use and share technologies across the health care continuum. Training, integral to the project at each step was shown to be essential, while the resources developed and fed back into the system will remain as an ongoing support for years to come. Indeed, the project demonstrated what a small team working together across a vast region can achieve in supporting organisations in rural and remote areas that had 1960s technology.

Acknowledgements

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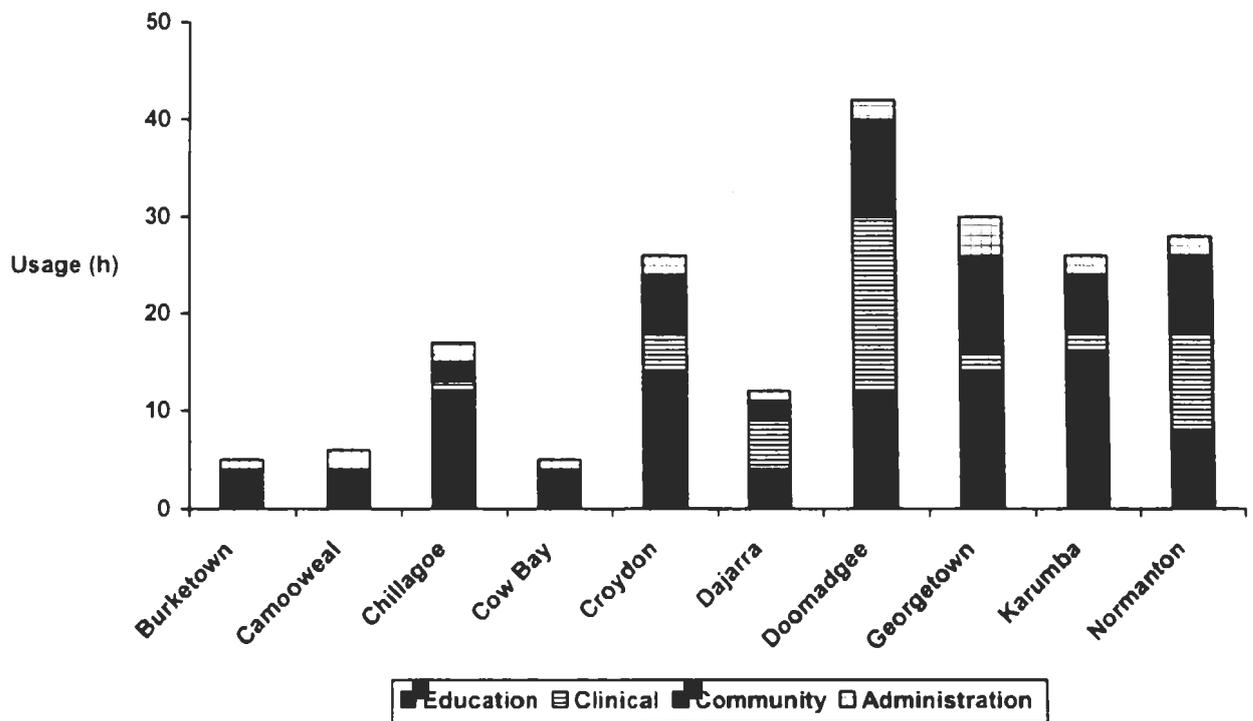
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Fig 1. North Queensland, Australia



Fig 2. Videoconferencing usage at ten of the 21 sites during a 12 month period



10. The experience of a rural GP using videoconferencing for telemedicine

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Summary

A telemedicine link was installed between a mining town in Western Australia and clinical specialists in Perth, about 1800 km away. Standard commercial videoconferencing units connected by ISDN at 128 kbit/s were used. During a two-year period, a total of 90 teleconsultations were carried out. About one-third of the injuries to mining construction workers were eye problems. In more than 75% of teleconsultations a patient transfer to Perth was avoided.

Introduction

Between 1995 and 1998 the BHP company constructed a \$2.5 billion Hot Bricket Iron plant at Port Hedland, Northwest Western Australia. Three major construction contractors were used and at its peak, some 3000 construction workers were employed. All of the contractors approached me to undertake the pre employment medicals for the staff that were hired locally and to undertake the injury management for the project. Over the 3-year period we managed 600 injuries and on some occasions there was uncertainty as to whether the injury would best be managed at the local Regional Hospital or by specialists in Perth (approximately 1800 km away).

Methods

To assist in decision-making I established a real-time video link to specialist offices in Perth. One orthopaedic group and one ophthalmologist participated in regular link ups for specialist advice regarding cases that presented to the surgery. We used standard commercial videoconferencing units (see Table 1) connected by ISDN lines at 128 kbit/s. The use of sequential high-resolution capture shots was the secret to being able to use a system with such a low bandwidth. This was one of my original research criteria and Sony were the only manufacturers who were able to deliver this with an off the shelf item that was plug and play.

Table 1. Equipment used at the GP's site (Port Hedland)

Videoconferencing unit	Sony 1500 Contact
Display monitor	Sony Medical monitor (36 cm)
Slit lamp	Topcon SL4FT with Sony camera
Retinal camera	Topcon with polaroid attachment
Theatre light camera	Sony
Portable video camera	Handicam Sony with memory stick
Video capture device	Sony Mavicap
Cardiac monitor	Cardiocap II
Ultrasound	Aloca
Viewing stand	Xray viewer

At the specialists' site in Perth, a videoconferencing unit (Sony 1500) and display monitor (36 cm) were used.

Results

As well as the injuries arising during the construction project, we were able to conduct many consultations for our regular patients and for the detainees of the Port Hedland Detention Centre for illegal immigrants. This latter group of people often presented with third world medical problems including a lot of eye disease and it was very helpful to have a direct link to an ophthalmologist. For dermatology problems we found that the captured video pictures were best sent as attachments to email messages as we were not able to find a dermatologist who was interested in the immediacy of videoconferencing. We also used a scanner to digitize X-rays and sent the resulting image files as attachments to email messages.

A retrospective analysis of the injury profile of the construction workers revealed that 32% of the injuries were eye problems, such as foreign bodies or other complications. On one occasion I used a tele-ophthalmology link to sort out any eye problems that may have occurred to four workers who had been involved in a blast accident. On this occasion we were able to determine that three of the workers were safe to stay in town for treatment and

follow up, and that one required transfer to a Perth Hospital for the treatment of a torn retina. Examples of the pathology observed included:

- corneal lesions
- lens lesions
- retinal lesions
- skin lesions
- cardiac problems
- chest lesions
- bone lesions.

Discussion

In summary, the experience of using a videoconferencing unit for telemedicine over a two-year period helped my professional skill level tremendously. For example, each time that we linked to the ophthalmologist or the orthopaedic surgeons I learned from observing how they would conduct a consultation with the problem at hand. I was often asked to act as their hands and eyes, and after a while I became familiar enough with the more common difficult pathologies to be able to deal with them myself. Thus telemedicine not only links your patients to distant specialists it is also a most valuable educational tool.

Is it affordable? In more than 75% of the consultations I was able to prevent the transfer of the patients to Perth and thus save the public and Worker's Compensation system large amounts of money. Unfortunately the equipment is expensive and I did not come close to covering the costs of purchase in the two-year period. Nonetheless, I would definitely recommend larger organizations such as state health organizations, mining communities and insurance companies use videoconferencing to link distant sites to regional and central specialists. As others have also observed, it takes enthusiastic parties at both ends to make the process work.

11. Successes and failures with Grand Rounds at the Royal Children's Hospital in Brisbane

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Summary

Grand Rounds at the Royal Children's Hospital in Brisbane began to be conducted by videoconference in 1997. They are held each week starting at 07:45. A total of 44 multisite videoconferences were held in the year 2000, to an average of 10 sites in Queensland. The remote audience is steady at about 60 people. The local audience at the Royal Children's Hospital is 20-40 people. Many other centres have also made requests to join the Grand Rounds, but expansion is not possible because of technical limitations. The lessons learned during four years of close partnership with provincial centres mirror Hippocrates: "*The need is great, the scope wide, Growth inexorable and timing difficult.*" Everyone basically wants to do a good job, and most errors can be overcome by good design and dedicated technical support.

Introduction

A teaching hospital should be a source of specialised knowledge which permits the shared care of patients throughout its region of responsibility. Clinical care should be a mixture of direct delivery by the primary carers and tertiary consultants, and of virtual consultation by the same groups. This approach betrays two biases: to multidisciplinary medicine, as opposed to solo medical consultation, and to education as a key part of clinical care delivery. This is the way of the future; surgery should also be decentralised if a critical patient mass can be assembled in the provinces. One-way education is no more appropriate than one-way consultation. With this in mind, the Grand Rounds at the Royal Children's Hospital (RCH) in Brisbane began to be videoconferenced in 1997.

Timing of the Round

For a long time the Round, which lasts for an hour or so, has begun at 07:45 hours on Wednesday. The starting time was presumably chosen so that Visiting Medical Officers (VMOs) and visitors from nearby hospitals could attend and still reach their hospitals, clinics and consulting rooms at a reasonable hour. Attendance by full-time staff and junior staff from the RCH is variable. There has been an occasional flurry of guilt or concern about local attendance, and various other possible times, generally lunchtimes, have been proposed as more convenient. I have been resistant to such suggestions, for several reasons.

Attendees at regular meetings have to get the event imprinted into their unconscious, so that they naturally go there as part of their normal activity. Thus changing a time is fraught with danger, as you will lose regular attendees and may not necessarily pick up new ones. This is why, for example, "regular" meetings at greater than weekly intervals frequently do not work. The imprint appears to fade exponentially after one week. In the late 1990s there was an undercurrent of opinion that the needs of VMOs were of little consequence. However, the RCH will rely on VMOs for the foreseeable future, and their availability is necessarily constrained by having to earn an honest living in the real world.

Now that there are 12 provincial sites participating in Grand Rounds, a change is too terrible to contemplate. My reluctance has been reinforced by recent spot checks on the size of the remote audience. This is steady at about 60 people. Country people cannot afford to waste teaching opportunities. The local audience at the RCH is 20-40 people. The provinces thus have the majority. The total audience of up to 100 people is very pleasing, if a little daunting. This is a large conference to be convening each week. Failure would now be expensive, but conversely the size is a clear indication of success.

For a variety of reasons the RCH has in the last few years developed a more vigorous academic culture, and lunchtimes are now used for research meetings, journal clubs, audit and clinical standards meetings, and these times are no longer available. Thus the early morning timing has been a success in the context of subsequent hospital intellectual development.

Growth of the network

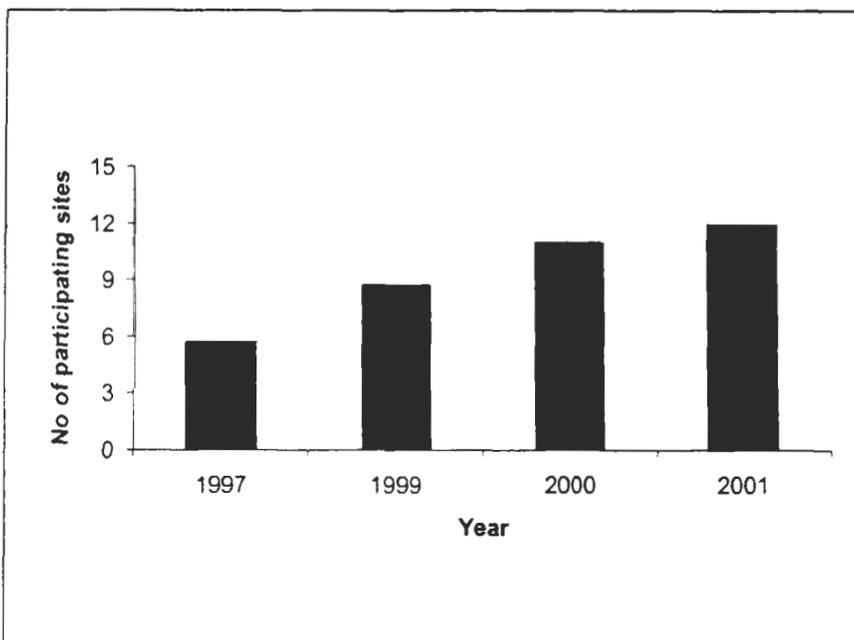
The Grand Rounds are conducted by multisite videoconference using a single ISDN line at 128 kbit/s. We currently use two multipoint bridges, which allow a total of 14 sites to be connected. These are presently allocated to:

- Gold Coast
- Toowoomba
- Logan
- Ipswich

- Caboolture
- Nambour
- Hervey Bay
- Bundaberg
- Rockhampton
- Mackay
- Townsville
- Cairns
- Royal Children's Hospital
- quality control in the Centre for Online Health (COH)/emergency allocation

This is manifestly inadequate. The average number of sites participating has now grown to saturation point (Fig 1).

Fig 1. Number of participating sites, excluding the RCH



Hospitals which form pairs with some of the participating hospitals have been excluded. These include:

- Redcliffe
- Maryborough
- Kirwan

This forces travel and cooperation between these neighbouring hospitals, which no doubt delights the strategic planners. These same planners do not understand that while the dislike of strangers is weak and abstract (*xenos* in Greek means both stranger and guest), the hatred of neighbours is visceral and immediate. Whether, in forcing collaboration, the bridge limit should be viewed as failure or success is a matter of opinion.

There remains only one set of neighbours where collaboration on the Grand Round is non-existent:

- Royal Children's Hospital

- Mater Children's Hospital

(The Mater Children's Hospital is the other specialist children's hospital in Queensland, also located in Brisbane). This must certainly count as a failure. It should be said though, that we do collaborate on the Registrar FRACP lectures. In passing these are as well attended by provincial sites as the Grand Round, and form a very important element in the continuing education of provincial paediatricians. By comparison, no consultants attend the FRACP lectures at the RCH. Presumably this reflects the ease of knowledge networking at a teaching hospital, but it also emphasises the difficulties of being a provincial specialist. I find their thirst for knowledge humbling, and it reinforces the necessity for us to make distance education excellent if possible.

Other centres have also made requests to join the Grand Rounds, such as Rural Training at Atherton and even Woden Valley Hospital in Canberra. It is worth noting that if you add up these others, at least three bridges would be required. This represents a chicken-and-egg problem. We do not have the funds to invest in an extra bridge, and until we do, we will not know if an expanded Grand Round would be successful – which would therefore justify the cost of an extra bridge. The next tier of hospitals who might be interested, such as Gladstone, Emerald, Roma, Charleville and the like, have not even been approached. With our current technical expertise, and now considerable experience in running large meetings, I do not believe that the number of sites is a problem. Our stalled expansion is definitely a failure.

Designing the programme

The Grand Rounds programme must accommodate a variety of sessions. These include specialties at the teaching hospital, our associated district services and city hospitals, and the provincial centres, and also includes the telecast of some regular special events. The list of participants includes:

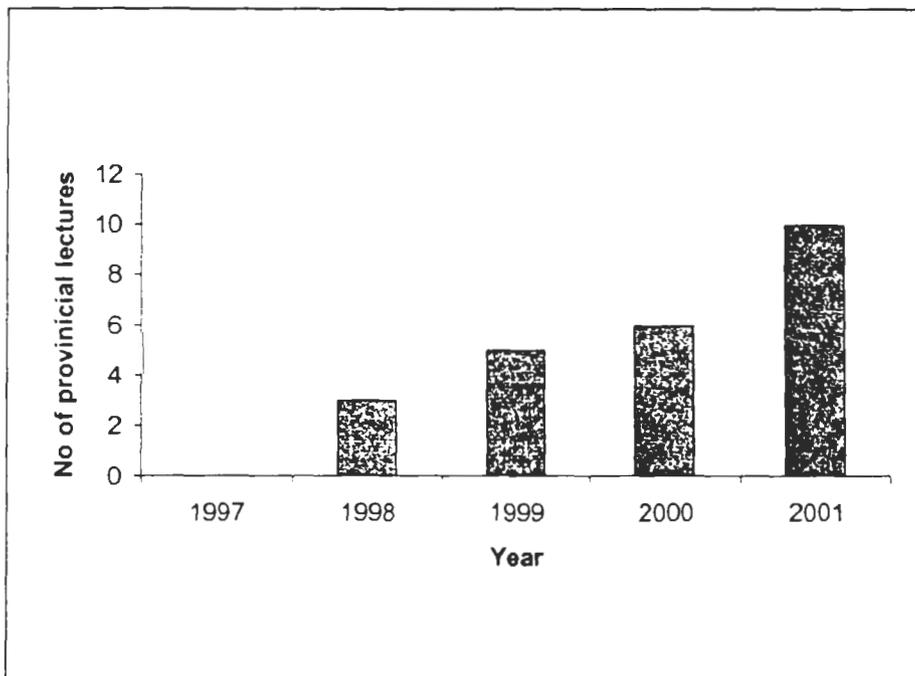
the twelve provincial centres
 Royal Women's Hospital Neonatal unit
 Queensland genetics service
 Sir Albert Saksewski Virus Research Centre
 Prince Charles cardiology
 community child health
 child advocacy
 child development
 mental health
 dentistry
 radiology
 nuclear medicine
 emergency medicine
 intensive care
 rehabilitation
 clinical epidemiology
 clinical pharmacology
 toxicology and envenomation
 allied health topics
 medical ethics
 medical subspecialties: endocrinology/diabetes, metabolic medicine, respiratory, haematology/oncology, gastroenterology/hepatology, general paediatric medicine, neurology, nephrology, immunology, infectious disease, dermatology
 surgical subspecialties: paediatric surgery, ophthalmology, ENT, neurosurgery, orthopaedics, burns, plastics, transplantation, maxillofacial
 Events:

RCHF visiting professor 2 weeks
Fellow research presentations 2 weeks
Quiz

This adds up to a total of 56 topics. In a typical year there are 44 Wednesdays available. Furthermore, it is obvious that some of these areas need more than one slot per year, such as radiology, general paediatrics and neonatology for example. It is also inevitable that a teaching hospital will attract some 3-5 "visiting firemen" per year, who will also need a slot. In addition, we are attracting an increasing number of visiting fellows on sabbatical (and here the COH has recently been generating business and taking up my scarce slots). While the teeming programme must obviously be counted a success, it requires judicious juggling.

A particularly pleasing feature has been the readiness of the provincial centres to do their share. The nature of these sessions has changed with our increasing familiarity with the technology. Initially the sessions tended to cover issues such as acute resuscitation, transport to major centres and such like. Now the sessions are often interactive, with a local case and expert comment from the city subspecialist. We are getting quite adventurous. One successful session was chaired from the Gold Coast, with a visiting fireman lecturing in Brisbane, and discussion from everywhere. After initial zero input in 1997, there were three in 1998, five in 1999, six in 2000, and 10 are scheduled for this year (Fig 2). This is unqualified success.

Fig 2. Growth in talks from provincial centres



I plan to extend this principle, with participation from outside agencies. For example, a meeting is planned on the deleterious effects of ultraviolet radiation with the physics department of the University of Southern Queensland, in an interdisciplinary session run from the RCH.

In this vein I will mention the Quiz. As a pre-Christmas bit of fun I have run a trivial pursuit session with provincial centres joining up to form teams. Each has to interact within a strict time limit before giving the answer to Brisbane, where there are further teams in the auditorium. This has again been useful to test the technology and protocols to the limit. The

idea must count as a success because when I cancelled the last one to accommodate a visiting lecturer, general displeasure was expressed by the provinces.

Registrar participation

One area which has been squeezed because of the lack of programme slots is general paediatrics at the RCH. This has led to reduced registrar participation, both in presenting cases and in presenting researched (and hopefully even research) information. While this is still common from the provincial sites, the more precious time devoted to subspecialties at the RCH has led to subspecialists hogging the time, probably with the subliminal and inadvertent agenda of imparting the precious pearls of wisdom with maximum efficiency. This must count as a systemic failure and we will try to redress the balance in future.

Complaints

Generally the shortcomings of any session are painfully apparent to the local audience. There have been recurring themes over the years, which form the bulk of the consumer feedback complaints. These involve the platform, the content and the delivery.

Content:

- microscopic text
- poor colour contrast
- slides too busy
- graphs and diagrams too busy

Platform:

- poor sound
- poor lighting
- poor staging, so that the presenter cannot face the distant audience, the local audience and the screen simultaneously

Delivery:

- every known technical glitch (and some previously unknown)

All these problems can be solved by good design. The solution is to have full-time technical support and backup.

Education of presenters

There were some initial concerns that doctors would not take kindly to having to conform to rules to minimise the presentation problems. This is nonsense. No-one wants to do a bad job, and once technical support for presenters was available at the RCH it was heavily utilised. It is partly a matter of peer pressure. Once a high standard has been reached, no-one wants to be upstaged. There has been, however, a well-founded scepticism, and some fear, of the technology. It is not fair to expect the occasional lecturer to operate the technology unaided, and I think that early efforts to try and force senior people to do so without much help were misguided. This just produces stubborn and uncooperative behaviour and represented an early failure. The uptake of technical help, once it was available, and the subsequent good performance by senior staff has been a gratifying success.

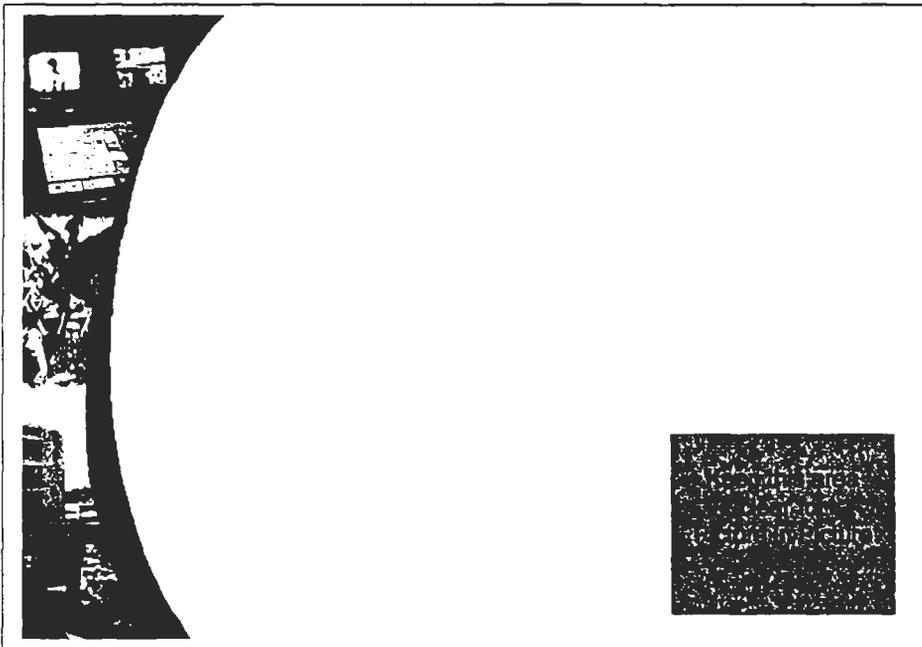
Presenters are encouraged to produce the basic text and diagrams for their lectures as PowerPoint files and the technical staff then format them prior to the talk. This has proved highly successful. In principle more formatting might be done by presenters, but if our own technical staff, then it is easier to maintain a consistent quality. Technical staff run sessions

for potential presenters on PowerPoint skills and these are well attended. Presenting skills are taught as part of this exercise, and there have been other such programmes from time to time. This is a bit ad hoc, and while not being a clear failure, falls into the category of activities which could be done better.

Design

An RCH slide template has evolved which has a number of subtle features (Fig 3). The colour scheme is simple and functional. Dark text on an off-white background is the clearest combination possible. The margin has a picture of the hospital which is constant. The other two pictures are themed to the talk. The bottom right hand corner is kept free for a live picture-in-picture of the presenter. The title is used for the district logo. This is the place where the eye comes to rest after scanning the slide. The amount of room left when the normal font size is used is small, which prevents over-busy slides. There is now widespread acceptance of this corporate format, giving a consistent standard.

Fig 3. The RCH slide template



Presentation has been helped greatly by the auditorium design. The monitor placement, which allows the presenter to face both studio and remote audiences, and the slides, at the same time, has been a huge success (Fig 4). A lot of planning went into the sound system. Questioners in the audience freeze when asked to follow simple protocols, and roving microphones are an unqualified disaster in practice. The ceiling microphones and audience camera have been very successful, as long as the floor manager and technician work as a team. It produces excellent three way interaction between both audiences and the speaker. I believe that no auditorium should be designed without these features.

Fig 4. The auditorium, showing the monitors from the presenter's viewpoint. The monitors are mounted in the ceiling over the heads of the local audience



Break a leg!

The actual presentation is show business. After all, there are enough boring lectures in the world without us adding to them. You need the technician and floor manager to run the show properly. We are training people to do these jobs, but we are thinly spread. Considering that we are putting out a conference for an audience of 100 over the area of Western Europe every week it would be nice to have more reserves. The line between success and failure can be very fine indeed.

Conclusion

Overall the Rounds are a success. Education in the health system is one of those sacred cows which everyone says is essential, but which tends to be shipped to the abattoir when the inevitable annual funding crisis supervenes. We have been fortunate that equity funding by the RCH Foundation has allowed us to do the job properly. Our experience shows that this requires considerable human and material resources, and a lot of iterative development to reach a satisfactory standard. The outreach programme is a beneficial confluence of interests. We coordinate an exciting program of mutual education, and the entirety of paediatrics in Queensland benefits.

Acknowledgements

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12. An analysis of why telehealth systems in Australia have not always succeeded

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Summary

Telehealth programmes are rather similar to humans in the way that they are planned, developed, grow and ultimately die or disappear. To achieve good life expectancy for a telehealth programme there appear to be three major needs: (1) *Nurturing*, which includes the provision of money, ideas, education, training and innovation; (2) *Experience*, which involves an integrated management process, the achievement of long and wide patterns of usage, the development of updated policies and procedures and the involvement of multiple disciplines; (3) *Success*, which involves evidence of outcomes, evaluation and research, and most important, the sharing of information through scientific and popular press publications, and conferences and collaborations with internal and external groups. The future of telehealth in Australia is at a watershed. There are now a substantial number of programmes, and there has been a large amount of financial and human investment in telehealth around the nation. There is however no forum for national leadership, no national association and little support at Federal Government level.

Introduction

Australia has a reputation for providing good quality telehealth programmes^{1,2,3,4,5}, but there have also been a substantial number of telehealth services that have either failed, or have not succeeded to the extent that was originally envisaged. How does one evaluate whether a telehealth programme has been successful?⁶ Telehealth programmes are evaluated for many reasons. It may be to provide scientific proof of effectiveness, for curiosity, to lead to re-funding of programmes or in support of the creation of an evidence base for telehealth. Other evaluations are carried out for more political purposes, or as part of a continuous quality improvement process. Some evaluations occur for no obvious reason, and possibly because the programme managers believe it is a generally good thing to do. The major reason for evaluating a telehealth programme however, should be to obtain evidence of success of the programme on a variety of scales, including clinical, technological, consumer and provider acceptance. The ultimate proof of effectiveness of any telehealth programme is that it becomes a mainstream activity of the normal process of healthcare, and therefore effectively disappears as a "special" programme. This mainstreaming may not occur in a way that was perhaps originally envisaged, or may not occur at all, or may occur despite poor evaluation results.

Traditional evaluations

Australian telehealth programmes have been subjected to a wide range of evaluations^{7,8}. The typical evaluation questions used in most programmes are fairly narrow or reductionist. Research workers usually start with an outcome, and then frame a question which is both measurable and reasonable. Typical evaluation outcomes in the field of diabetic e-health might include the following:

- current diabetic population size
- projected client health outcomes
- decreased HBA_{1c}
- improved retinal screening rates
- service utilization – pre and post
- consumer surveys
- patient, caregiver and provider satisfaction.

What most of these evaluations do not do, however, is take the broad approach to attempt to answer the "mainstreaming question" which says "Is this telehealth model, tool or process worthwhile in a way that makes us wish to support it in some way over a significant period of time?" In essence we should be asking whether the telehealth programme should become part of the routine healthcare delivery service. Moving back to the e-health diabetic programme the overarching question for that programme might well be "Is this tool, process or programme so useful to the management of some aspect of diabetes that it is worth implementing in routine practice"?

The conduct of a typical evaluation

Most evaluations consist of three main steps. First information is collected, second it is analysed, and third the information is used. We think about information in a number of different ways, however. It is possible to take either a narrow or a broad perspective to this information, and to look at either individual outcomes or systemic or group outcomes. To take the broad mainstream perspective it is sensible to start with the principles for the development of telemedicine programmes, and see if these are supported⁹. This means that any telehealth programme has to be examined from a variety of perspectives to show whether

it is effectively mainstreamed into the normal process of healthcare. There are nine indicators of relevance:

1. is there a long-term funding model?
2. is there a formalised management and clinical leadership process?
3. is there buy-in at senior level with telehealth being part of the strategic direction of the healthcare organisation?
4. are clinical telehealth outcomes part of the routine continuous quality improvement process?
5. does a telehealth programme have a wide range of user-driven applications?
6. is there regular research and learning occurring through the telehealth programme?
7. is there a routine and continuously updated telehealth education programme for users?
8. are there routine evaluations on usage and acceptance, and are users supported by regularly updated protocols and guidelines?
9. is the telehealth process multidisciplinary, and is the system open to external users?

These questions are all fairly straightforward, and all telehealth programmes can be judged against them to achieve some broad assessment as to the level of mainstreaming.

Are Australian telehealth programmes being mainstreamed?

Telehealth programmes are rather similar to humans in the way that they are planned, developed, grow and ultimately die or disappear. There appear to be five main categories of mainstreaming outcome, using this human developmental model. The various State and Federal programmes in Australia can be approximately placed in these five categories, as judged against the questions above.

1. *Early abortion at the planning stage, or the need for in-vitro fertilisation?*
This applies to Western Australia which has had a large number of rather grandiose telehealth programmes over many years, but which finally from about 1999 onwards gave up these visionary perspectives, and decided to make modest starts to their telehealth programmes.
2. *Infertility, with programmes adopted from elsewhere*
The Australian Capital Territory, as a very small region, has tended to import its programmes from elsewhere.
3. *Death or severe starvation in adolescence or adulthood*
New South Wales is the best example here. Over a number of years large amounts of money have been spent on telehealth in New South Wales, with relatively little clinician buy-in or acceptance, no published research or outcome studies to my knowledge, and a general lack of training and support programmes.
4. *Failure to thrive with long-term under-nutrition*
Here Victoria, the Northern Territory and Tasmania all appear to be represented with all States having spent a considerable money on telehealth programmes, shown a great deal of interest and initiative, but relative lack of success in achieving good levels of clinical or educational usage.
5. *Reasonably successful growth and development*
Queensland and South Australia are States that can be seen to have generally achieved reasonable success with programmes that have now existed for more than five years and which are fulfilling for most of the mainstreaming parameters discussed above.

To continue the metaphor of human development it is interesting to look at the perspective of the Federal Government in the telehealth arena. On whole the Federal Government does not provide direct services in health, but it does provide much of the drive for the States to organise these services, from policy and funding viewpoints. In Australia the Federal Government has taken a remarkable back seat in the telehealth process, and is perhaps best described as a rather cold distant parent that is uninterested in its telehealth baby. As such the Federal Government has not adequately resourced the National Telehealth Committee, has not provided any support – despite requests – for the development of professional national bodies in telehealth, has not made any attempts to integrate the various State programmes, and has pursued a deliberately slow policy on the creation of Medicare Benefit Schedule item numbers for reimbursement for telehealth. So whilst the rhetoric of politicians has generally been that telehealth is a “good thing”, especially in terms of providing services to rural Australia, the actions of the Federal Government have been the opposite, and there has been no effective central leadership in this area.

How do we achieve good life expectancy for a telehealth programme?

Continuing the human development metaphor there appear to be three major needs.

1. *Nurturing*
This includes the provision of money, ideas, education, training and innovation
2. *Experience*
This involves an integrated management process, the achievement of long and wide patterns of usage, the development of updated policies and procedures and the involvement of multiple disciplines
3. *Success*
This involves evidence of outcomes, evaluation and research, and most important, the sharing of information through scientific and popular press publications, and conferences and collaborations with internal and external groups.

The future

The future of telehealth in Australia is at a watershed. There are now a substantial number of programmes, and there has been a large amount of financial and human investment in telehealth around the nation. There is however no forum for national leadership, no national association, and little support at Federal Government level, where the National Telehealth Committee is still starved of resources and MBS item numbers have once again missed the budget round in May 2001. The technical issue of bandwidth in Australia remains a major problem with the national carrier, Telstra, still attempting to sell ISDN rather than moving towards broadband alternatives (e.g. xDSL). In the area of health informatics the very successful General Practice Computing Group has just had its funding withdrawn by the Federal Government, leaving general practice computing in a very difficult position, and the National Electronic Health Records Taskforce¹⁰ which recommended expenditure of \$500 million on a national health information system over ten years from 2001 received a budget response of only \$18 million for the first two years of this cycle¹¹.

In spite all of this, the voice of consumers have become increasingly powerful, and evidence of the effectiveness of telehealth is gradually accumulating. Some programmes have now entered the mainstream and providers retain great interest in telehealth, especially in niche areas such as radiology and mental health. Perhaps more important, both basic and applied research into telehealth continues^{12,13}. Despite everything, Australia remains a world leader in this area.

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13. The experience in Victoria with telepsychiatry for the child and adolescent mental health service

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Summary

In 1995, the Royal Children's Hospital Mental Health Service in Melbourne developed the first telepsychiatry programme in Child and Adolescent Mental Health Services (CAMHS) in Australia. A survey of 25 CAMHS clinicians in five rural regions who had used videoconferencing showed that 64% had used the technology for more than 18 months, and 20% had used it for 7-12 months. Also, 60% had used the technology on over 30 occasions, and 24% had used it on 20-29 occasions. Respondents clearly recognised its benefits in terms of their increased knowledge and skills (96%), strengthening of relationships with colleagues (92%) and decreased sense of isolation (92%). To build on the success of telepsychiatry there are a number of challenges that health service managers will need to address. Telepsychiatry works most effectively as a tool to complement face-to-face contact. It cannot be promoted as the total solution to the issue of isolation from mainstream services.

Introduction

In 1995, the Royal Children's Hospital Mental Health Service in Melbourne, in partnership with a number of rural child and adolescent mental health services (CAMHS), piloted the first application of telepsychiatry in Australia. (For simplicity, where reference is made to 'telepsychiatry' in this paper, it refers to the use of videoconferencing). Since the initial pilot, videoconferencing has been integrated into the service delivery model of the Royal Children's Hospital Mental Health Service. A key feature of the project is the commitment to ongoing evaluation. Two previous evaluations by Blaskett¹, and by Alexander and Gelber², have identified the value of telepsychiatry in the delivery of mental health services to children and adolescents.

In 1996 the Victorian Telepsychiatry Programme was established by the Department of Human Services to improve access by rural communities in Victoria to all mental health services, i.e. elderly, adult, and child and adolescent services. Its aim was to link rural and remote sites via videoconferencing to the major providers of specialist mental health services. The programme funded the establishment of 27 telepsychiatry facilities located at various sites across regional Victoria, as well as facilities at six specialist locations.

In 1998, the Department of Human Services funded an independent evaluation of the telepsychiatry network. The programme was found to have improved access to mental health services by rural communities³. In order to inform the future development of telepsychiatry in the Royal Children's Hospital Mental Health Service, a user survey was conducted in early 2001.

Methods

A telephone survey was conducted in April and May 2001. The questionnaire was tested with a small group of rural CAMHS clinicians to ensure that the questions identified relevant issues. Respondents could offer verbal comments in relation to some of the issues. The survey involved interviews with 25 rural CAMHS clinicians in five of the eight rural CAMHS regions in Victoria.

The clinicians who participated in the study were recommended as users of videoconferencing. They were therefore able to provide an informed opinion about it. The survey was intended to discover their key experiences – both positive and negative – that had shaped the implementation of telepsychiatry in these services.

Results

The questionnaire focused on six key areas. The responses are summarised in Table 1. The first area concerned usage. Sixty-four percent had used the technology for more than 18 months, and 20% had used it for between 7-12 months. Also, 60% had used the technology on over 30 occasions, and 24% had used it on 20-29 occasions.

The second area was whether the level of comfort with the technology improved with its continued use. Ninety-six percent of respondents reported an increased level of comfort over time. Comments in relation to this question included "... it has now become second nature", "... it is part of everyday life" and "... I am learning to make allowances for not being in the same room."

The third area was the purpose of use and whether the respondents had tried telepsychiatry for creative applications. Ninety-two percent of respondents reported that they had used the technology for clinical/consultation applications and supervision, while 36% had used it for teaching. Given the paucity of specialist CAMHS in rural Victoria this indicates that

CAMHS clinicians continue to utilise the technology to improve their clinical work. It was interesting that there had been little use of the technology for creative purposes.

The fourth area was the effect on professional practice and clients, through using the technology. Respondents clearly recognised its benefits in terms of their increased knowledge and skills (96%), strengthening of relationships with colleagues (92%) and decreased sense of isolation (92%) that the use of the technology has facilitated. Only 60% chose to comment on the effect on clients. An important theme among these respondents was that the subsequent gains in their own clinical practice would inevitably benefit their clients.

The fifth area covered the advantages and disadvantages of telepsychiatry. The advantages in terms of savings in time and costs (76%) were consistent with the rationale for implementing telepsychiatry in the first place. In terms of disadvantages, an important comment in relation to distance was that when rural clinicians travelled or were away from their region, there was often nobody to assume their workload, and consequently the service to the rural community was significantly affected. In addition, technical difficulties with the technology accounted for the vast majority of concerns (76%). In particular, concerns were expressed in relation to time delay and picture quality.

The loss of emotional cues when using the technology was also a significant concern in the sense that the interactions between staff at rural and metropolitan sites was seen as impersonal. Notwithstanding the above, 50% of respondents valued the use of telepsychiatry as a tool in the delivery of CAMHS, and a further 45% highly valued it.

The final area invited suggestions for improvements. The respondents suggested improved technology and better IT support. Better on site access to equipment was seen as important as often CAMHS did not have the equipment on site. More comprehensive training of CAMHS clinicians in the use of the technology was also recommended. This is understandable given that they do not receive any formal training in telepsychiatry as part of their orientation to working in the mental health system.

Discussion

It is clear from the survey that CAMHS clinicians have embraced the use of telepsychiatry in their work, especially in relation to clinical applications, supervision and teaching. This is consistent with the findings of overseas studies. For example, "... the literature supports the use of telepsychiatry for continuing medical education and remote medical supervision".⁴

There are currently more opportunities for rural CAMHS clinicians in Victoria to access specialist mental health training opportunities via telepsychiatry. The Development Psychiatry Course for CAMHS clinicians is now available via telepsychiatry, as are regular forums for professional development.

As technology becomes more accepted as a tool for presenting education and training, it is anticipated that its utilisation will increase. This process may be assisted following the recent Commonwealth-funded tele-education project.⁵ The recommendations of this project and the model developed from it, can act as a resource for services wishing to use the technology for tele-education in Australia.

It seems that use of the technology directly with CAMHS clients may still be in its formative stage and not as well developed as other telemedicine applications. While some respondents commented on the client experience, it is clear that the low frequency of telepsychiatry use reported by respondents, does not allow one to draw strong conclusions. A future study could explore the barriers that may exist in relation to client use. Given that various different client groups may experience the technology differently, it may be important to clarify the

definition of 'client' as CAMHS clinicians work with children, adolescents and parents or carers.

Comments from other overseas projects suggests that children and families are generally comfortable with videoconferencing technology. Children and families adjust quickly to new technology and become relaxed and comfortable with this method of providing service.⁶ Blackman has argued that children may find it easier to be open with a consultant who they are not meeting in person.⁷

In terms of the effect on professional practice, the present study found that telepsychiatry facilitated relationships with mental health clinicians. This is something that Rothchild has referred to "... that for information alone we can get by with audio visual devices, but that the visual component increases interactions by enhancing the sense of contact and relatedness".⁸

Concerns by users about the complexity of using the technology remain a problem. Notwithstanding the technological advances in recent years, and the benefits that respondents identified, it is clear that the full benefit of telepsychiatry will only be realised when the equipment is seen as user-friendly. This could be greatly facilitated by staff training during the orientation of new clinicians, rather than the ad hoc approach to training that currently exists.

Success in telepsychiatry beyond 2001

To build on the success of telepsychiatry there are a number of challenges that health service managers will need to address. First, the health environment continues to be in a state of flux. One manifestation of this is the increasing focus on the rights of clients in the development, planning and implementation of health care systems. If telepsychiatry is going to develop successfully in the future it will need to embrace the consumer as a partner, more than has been the case in the past.

A second challenge relates to the integration of the wide variety of telepsychiatry tools. As the technical options in telepsychiatry broaden it will be important to integrate them as part of the clinical culture in the same way that videoconferencing has been integrated.

A third challenge is that health service providers need to continue to monitor the effect of technology on consumers, clinicians and the community at large. This is important because given the rapid growth in the IT industry, health managers may be forced to devote significant resources to keep pace with technology and as a result, lose sight of the health outcomes.

The final challenge is to remember that telepsychiatry works most effectively as a tool to complement face-to-face contact. Rural Australians have the same entitlement to face-to-face specialist mental health contact as consumers in urban areas. Furthermore, pressure must be maintained for equity in the distribution of health resources in rural areas that are significantly more disadvantaged than urban areas. Telepsychiatry cannot be promoted as the total solution to the issue of isolation from mainstream services.

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Table 1. Summary of the questionnaire responses

Question	Response rate (n=25)	Proportion of responses (%)	If a YES/NO response was invited, the following numbers were 'Yes' Responses	If a YES/NO response was invited, the following percentages were 'Yes' Responses
-	Number of years in mental health	24	96	
1	Over what period of time have you utilised videoconferencing equipment?	25	100	
2	How many times you have used videoconferencing equipment?	25	100	
3	Over time has the level of comfort improved with the use of the equipment?	23	92	22/23 96
4A	What was the purpose of videoconferencing?			
	(a) administration	25	100	6 24
	(b) supervision	25	100	23 92
	(c) teaching	25	100	9 36
	(d) consultation/clinical	25	100	23 92
4B	Have you used videoconferencing for creative or more unusual applications?	25	100	1 4
5	What has the effect on your professional practice been?			
	(a) increased knowledge and skills	25	100	24 96
	(b) strengthened relationships with colleagues	25	100	23 92
	(c) decreased sense of isolation	25	100	23 92
	(d) opportunity for other specialist input	25	100	13 52
	(e) opportunity for networking	25	100	1 4
	(f) other	25	100	Nil
6	What is the effect of using technology on clients?	15	60	
7A	What are the advantages not previously covered?	25	100	
7B	What are the disadvantages not previously covered?	21	84	
8	How highly do you value use of this equipment in your work?	25	100	
9	How could videoconferencing services be improved to make it more successful as a tool in the delivery of CAMS services?	24	96	

14. Evaluating satisfaction with a child and adolescent psychological telemedicine service

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Summary

A child and adolescent telepsychiatry service in rural New South Wales was evaluated. Part of the evaluation was to assess whether rural mental health workers and patients were satisfied with the videoconferencing services provided by child psychiatrists from the Children's Hospital at Westmead. During a twelve-month study, information was collected using questionnaires on a total of 136 new patients who had been interviewed via videoconferencing. Satisfaction questionnaires were completed by 100 rural mental health workers, and 82 patients and their families/carers. Questionnaires about satisfaction with the technology were completed by 136 child psychiatrists, 101 rural mental health workers and 79 patients. Patients and their families/carers, as well as rural clinicians, expressed high overall satisfaction with the telepsychiatry service. The evaluation suggest that the use of videoconferencing for child and adolescent psychiatry consultations is a good method of providing services to remote and rural communities.

Introduction

For many years, quality assurance activities have been well established in medical and health related professions. Improvements in standards of care and service delivery have ensued. With the advent of videoconferencing, telepsychiatry care and service delivery should also be subject to quality assurance monitoring as with other forms of medical care. Despite the development of indicators in psychiatry, such procedures are only now being developed to systematically monitor and evaluate this form of care. The department of psychological medicine at the Children's Hospital at Westmead (CHW) has a strong record in the audit of outpatient cases as well as the measurement of outcomes of these cases. Thus, an evaluation program was specifically developed for the Child and Adolescent Psychological Telemedicine Outreach Service (CAPTOS). One of the primary objectives of the evaluation was to measure satisfaction with the service and in so doing demonstrate the successes and failures of telepsychiatry services for rural NSW.

Methods

The evaluation period spanned twelve months from October 1999. The evaluation focused on data from initial consultations of young people and their families, who received psychological and psychiatric assessment and consultation services via videoconferencing. Three separate evaluation packages were designed for CHW clinicians, rural clinicians, and young people and their families or carers. The objectives were to evaluate satisfaction with the telepsychiatry service and to evaluate the effect of the technology on consultations and service provision. The project evaluator was responsible for the distribution and collection of packages to each rural area. If evaluations were not received within a month of the videoconference session, then a follow-up request was made to all clinicians to return their completed evaluation packages.

Participants

The study population comprised 136 outpatients living in rural New South Wales and 20 rural clinicians and eight child psychiatrists from CHW. All parents/carers gave written informed consent prior to the teleconferences session.

Procedure

Users were asked to evaluate the service following every initial consultation involving a young person being assessed and interviewed via videoconferencing. Packages were provided for clinicians in both locations, i.e. the CHW and the rural sites, as well as for the young person and their parent or carer. Young people and their families were not excluded from access to telepsychiatry services if they did not complete the evaluation packages.

Evaluation packages

Copies of the evaluation packages are available from the authors.

(1) the *Service Satisfaction Questionnaire* (SSQ) was adapted from the Patient Satisfaction Questionnaire (PSQ) which incorporates an eight item; four point rating scale of patient satisfaction¹. The SSQ was developed as a measure of the young person and parent/carer and rural clinicians' satisfaction with the telepsychiatry service. The questionnaire had 12 items that are rated on a four-point scale from very dissatisfied to very satisfied. In addition, the young person and parent/carers and rural clinicians were invited to make comments, suggestions and criticisms to improve service provision.

In a telemedicine pilot study² the return rate of questionnaires was poor, although the young person and parent/carer families were not forewarned that this information would be required

of them. Scores were compared with a sample of routine outpatients seen in the department of psychological medicine. No significant differences in the scores with the comparison groups were found and if anything the scores were greater than that previously reported in the literature¹. The young people and parents/carers generally expressed satisfaction about the telemedicine service provided. They found the videoconferencing contact easy and sensitive interviewing was possible. The young people and parents/carers indicated that they were satisfied with the access to expertise without the cost and inconvenience of travel.

(2) *Technology Evaluation Questionnaire*. An eight-item Likert-scale was devised to measure participants' experiences with the telepsychiatry technology and equipment. The questionnaire was adapted following a review of similar questionnaires used to evaluate telemedicine services^{3,4,5,6} which highlight the importance of including questionnaires that evaluate participants' experiences of the technology. The questionnaire included items assessing participants' ease of using the equipment, feelings of anxiety or embarrassment about the equipment, ability to see and hear well during the consultation, overall quality of the telelink and opinion about how the telepsychiatry consultation compared with a face-to-face consultation. There was also one open-ended question, which allowed participants to provide written feedback about any operational difficulties and what action was taken to rectify them.

Results

Satisfaction

Young people and their family/carers responses Sixty percent of the prospective young person and their family/carer group completed their questionnaire on satisfaction. Table 1 summarises their satisfaction ratings. Ninety five percent rated the quality of the service as excellent or good. Ninety seven percent reported that they had received the kind of service that they wanted and would recommend the service to someone else who was in need of similar help. Ninety seven percent were mostly satisfied or very satisfied with the amount of help they had received as well as being overall mostly satisfied or very satisfied with the service provided. Eighty percent reported that it would be somewhat inconvenient or very inconvenient to attend a face-to-face consultation in Sydney. Eighty nine percent were mostly comfortable or very comfortable with the telemedicine service. Ninety percent reported that yes definitely or yes generally the care they received from the service was a good as a regular in person visit.

Rural clinician's responses Approximately seventy-four percent of the rural clinicians responded. Table 2 summarises their satisfaction ratings. Ninety nine percent rated the quality of the service as excellent or good as well as being mostly satisfied or very satisfied with the amount of help they had received. All of them reported that they had received the kind of service that they wanted and would recommend the service to someone else who was in need of similar help. Seventy nine percent were very satisfied with the service provided while twenty percent were indifferent or mildly dissatisfied. Eighty nine percent reported that it would be somewhat inconvenient or very inconvenient to attend a face-to-face consultation in Sydney. Ninety eight percent were mostly comfortable or very comfortable with the telemedicine service. Ninety seven percent reported that yes definitely or yes generally the care they received from the service was a good as a regular in person visit.

Technological evaluation

Responses to the technology evaluation questionnaires completed by the CHW clinician, rural clinician and young person and their family/carer indicated that overall picture and audio quality was fair to good and did not interfere with the interaction of their consultations. All consultations were conducted at 384 kbit/s. Equipment failure sometimes occurred but was

viewed more as an annoyance than as a problem, as most difficulties were resolved quickly. During consultations it became apparent that the details of the technology were of secondary importance to the quality of the interaction with the child psychiatrist in overall ratings of satisfaction.

CHW clinicians' responses All CHW clinicians completed the Technological Evaluation Questionnaire. Table 3 summarises their technology ratings. Forty seven percent rated their ease of using the equipment as fair while forty nine percent rated it as good or excellent. Ninety nine percent stated that they felt not at all anxious or slightly anxious because of the equipment as well as feeling self-conscious or embarrassed. Eighty seven percent felt that the equipment interfered with the consultation not at all or slightly. Seventy four percent rated the sound quality as poor or fair. Eight six percent rated the visual quality as poor or fair. Eighty two percent rated the overall quality of the telemedicine link as poor or fair. Ninety four percent rated their satisfaction with this new style of consultation compared to a face-to-face consultation as adequate or almost as good.

Young person and parent/carer responses Approximately fifty eight percent of the young people and their families/carers responded. Table 4 summarises their technology ratings. Ninety seven percent stated that they felt not at all anxious or slightly anxious because of the equipment as well as feeling not at all or slightly self-conscious or embarrassed. Ninety seven percent felt that the equipment interfered with the consultation not at all or slightly. Ninety one percent rated the sound quality as good or excellent. Ninety five percent rated the visual quality as good or excellent. Ninety six percent rated the overall quality of the telemedicine link as good or excellent. Ninety one percent rated their satisfaction with this new style of consultation compared to a face-to-face consultation as adequate or almost as good.

Rural clinicians' responses Approximately seventy-four percent of the rural clinicians responded. Table 5 summarises their technology ratings. Eight six percent rated their ease of using the equipment as good or excellent. Ninety three percent stated that they felt not at all anxious or slightly anxious because of the equipment while ninety eight percent reported feeling not at all or slightly self-conscious or embarrassed. Ninety five percent felt that the equipment interfered with the consultation not at all or slightly. Eighty six percent rated the sound quality as good or excellent. Seventy nine percent rated the visual quality as good or excellent while eighteen percent rated it as poor. Eighty seven percent rated the overall quality of the telemedicine link as good or excellent. Ninety one percent rated their satisfaction with this new style of consultation compared to a face-to-face consultation as adequate or almost as good.

Discussion

Patient satisfaction is the most studied outcome for traditional, face-face consultations⁷. To date there have been relatively few studies that have focused specifically on patient and rural health workers satisfaction with child telepsychiatry services. The results of the present evaluation study show high satisfaction ratings by both rural health workers, young people and their families/carers of the telepsychiatry service provided by child psychiatrists from CHW. This undoubtedly was the overwhelming and surprising success of the CAPTOS service. CHW clinicians were astonished that rural families responded so positively to being provided with a child psychiatry consultation via teleconferencing. In addition, rural clinicians evidently experienced the videoconferencing service as helpful and supportive. The evaluation of the technology was rated marginally lower by CHW clinicians than rural clinicians. This may largely be reflective of the fact that CHW clinicians require that the

technology does not obstruct the ability to conduct an effective psychiatric assessment and interview. Problems with the technology, such as poor sound or visual quality would operate as extraneous variables in service provision. Thus, technological problems impinge on videoconferencing and in some instances may be regarded as a setback in the delivery of services.

A further difficulty that was revealed during the evaluation period involved the inherent complexity of collecting evaluation data. Collecting evaluation data from rural clinicians and young people and their families presented with numerous challenges, largely due to rural clinicians being overburdened with additional paper work and a lack of infrastructure or co-ordination at the rural area level. Some rural clinicians found it increasingly difficult to complete evaluation packages. Reasons that were offered by rural clinicians who failed to complete packages included feeling pressurised as a result of the additional paperwork that added to their overall workload, lack of motivation and interest, as well as failure to recognise the importance of the collection of outcome measures and satisfaction information. Despite these difficulties, the evaluation proceeded and adequate data to reflect satisfaction with the services provided by CAPTOS was collected. Overall the data provide support for the favourability and acceptability of CAPTOS and has highlighted that telepsychiatry is viewed as an acceptable and beneficial means of delivering child and adolescent psychiatry services to rural and remote communities in NSW.

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Table 1. Young person/family/carer service satisfaction questionnaire

Questions	1	2	3	4
How would you rate the quality of the service you received? (n = 82)	[Poor] 0	[Fair] 3	[Good] 29	[Excellent] 49
Did you receive the kind of service you wanted? (n = 83)	[No definitely not] 0	[No, not really] 3	[Yes, generally] 38	[Yes, definitely] 42
To what extent has our service met your needs? (n = 82)	[None of our needs have been met] 3	[Only a few have been met] 8	[Most of our needs have been met] 37	[Almost all our needs have been met] 34
If you knew of someone else who was in need of similar help, would you recommend our service to them? (n = 83)	No definitely not 0	[No, not really] 3	[Yes, generally] 20	Yes, definitely 60
How satisfied were you with the amount of help you received? (n = 83)	[Quite dissatisfied] 1	[Mildly dissatisfied] 2	[Mostly satisfied] 29	[Very satisfied] 51
Has the service you received helped you to deal more effectively with your problems? (n = 81)	[No, it made things worse] 1	[No, it really did not help] 8	[Yes, it helped somewhat] 30	[Yes, it helped a great deal] 42
If you were to seek assistance again, would you return to our service? (n = 84)	[No definitely not] 1	[No, I don't think so] 2	[Yes, I think so] 28	[Yes, definitely] 53
How convenient is the location of the health Center for you? (n = 84)	[Very inconvenient] 4	[Somewhat inconvenient] 7	[Mostly convenient] 29	[Very convenient] 44
How convenient would it be for you to attend a face-to-face consultation in Sydney? (n = 82)	[Very inconvenient] 56	[Somewhat inconvenient] 10	[Mostly convenient] 10	[Very convenient] 6
In general how comfortable were you with the Telemedicine Service? (n = 82)	[Very uncomfortable] 3	Somewhat uncomfortable 6	[Mostly comfortable] 37	[Very comfortable] 36
Was the care you received from this service as good as a	[No definitely not] 1	[No, not really] 7	[Yes, generally] 35	[Yes, definitely] 39

regular in-person visit? (n = 82)				
In an overall, general sense, how satisfied have you been with the service provide today? (n = 81)	[Quite dissatisfied] 2	[Indifferent or mildly dissatisfied] 1	[Mostly satisfied] 31	[Very satisfied] 47

Table 2. Rural clinicians service satisfaction questionnaire

Questions	1	2	3	4
How would you rate the quality of the service you received? (n = 103)	[Poor] 0	[Fair] 1	[Good] 33	[Excellent] 69
Did you receive the kind of service you wanted? (n = 103)	[No definitely not] 0	[No, not really] 0	[Yes, generally] 37	[Yes, definitely] 66
To what extent has our service met your needs? (n = 102)	[None of our needs have been met] 0	[Only a few have been met] 0	[Most of our needs have been met] 43	[Almost all our needs have been met] 59
If you knew of someone else who was in need of similar help, would you recommend our service to them? (n = 103)	[No definitely not] 0	[No, not really] 0	[Yes, generally] 23	[Yes, definitely] 78
How satisfied were you with the amount of help you received? (n = 104)	[Quite dissatisfied] 0	[Mildly dissatisfied] 1	[Mostly satisfied] 23	[Very satisfied] 0
Has the service you received helped you to deal more effectively with your problems? (n = 100)	[No, it made things worse] 1	[No, it really did not help] 0	[Yes, it helped somewhat] 25	[Yes, it helped a great deal] 74
If you were to seek assistance again, would you return to our service? (n = 102)	[No definitely not] 0	[No, I don't think so] 0	[Yes, I think so] 7	[Yes, definitely] 95
How convenient is the location of the health Center for you? (n = 101)	[Very inconvenient] 7	[Somewhat inconvenient] 5	[Mostly convenient] 6	[Very convenient] 83
How convenient would it be for you to attend a face-to-face consultation in Sydney? (n = 96)	[Very inconvenient] 77	[Somewhat inconvenient] 8	[Mostly convenient] 11	[Very convenient] 0
In general how comfortable were you with the Telemedicine Service? (n = 98)	[Very uncomfortable] 0	Somewhat uncomfortable] 1	[Mostly comfortable] 25	[Very comfortable] 72
Was the care you received from this service as good as a regular in-person	[No definitely not] 1	[No, not really] 2	[Yes, generally] 55	[Yes, definitely] 38

visit? (n = 96)				
In an overall, general sense, how satisfied have you been with the service provide today? (n = 99)	[Quite dissatisfied] 1	[Indifferent or mildly dissatisfied] 20	[Mostly satisfied] 0	[Very satisfied] 78

Table 3. CHW clinicians technology evaluation questionnaire

Questions	1	2	3	4
How did you rate your ease of using the equipment? (n =136)	[Poor] 6	[Fair] 64	[Good] 45	[Excellent] 21
During the consultation, how anxious did you feel because of equipment? (n =136)	[Not at all anxious] 112	[Slightly anxious] 23	[Mostly anxious] 0	[Very anxious] 1
During the consultation how self conscious or embarrassed did you feel because of the equipment? (n =136)	[Not at all] 105	[Slightly] 30	[Mostly] 1	[Very self conscious] 0
How much did the equipment interfere with your consultation? (n =136)	[Not at all] 49	[Slightly] 69	[Mostly] 12	[Very much so] 6
How did you rate the sound quality? (n =136)	[Poor] 10	[Fair] 90	[Good] 34	[Excellent] 2
How would you rate the visual quality? (n =136)	[Poor] 16	[Fair] 101	[Good] 18	[Excellent] 1
How would you rate the overall of the telelink? (n =136)	[Poor] 17	[Fair] 94	[Good] 24	[Excellent] 1
Overall how would you rate your satisfaction with this new style compared to face-to-face consultation? (n =136)	[Poor] 6	[Adequate] 108	[Almost as good] 20	[As good] 2

Table 4. Young person/family technology evaluation questionnaire

Questions	1	2	3	4
During the consultation, how anxious did you feel because of equipment? (n=79)	[Not at all anxious] 40	[Slightly anxious] 37	[Mostly anxious] 1	[Very anxious] 1
During the consultation how self conscious or embarrassed did you feel because of the equipment? (n=79)	[Not at all] 52	[Slightly] 25	[Mostly] 2	[Very self conscious] 0
How much did the equipment interfere with your consultation? (n=79)	[Not at all] 54	[Slightly] 23	[Mostly] 2	[Very much so] 0
How did you rate the sound quality?	[Poor] 1	[Fair] 6	[Good] 47	[Excellent] 25
How would you rate the visual quality? (n=79)	[Poor] 1	[Fair] 3	[Good] 46	[Excellent] 29
How would you rate the overall of the telelink? (n=79)	[Poor] 2	[Fair] 1	[Good] 45	[Excellent] 31
Overall how would you rate your satisfaction with this new style compared to face-to-face consultation? (n=79)	[Poor] 0	[Adequate] 7	[Almost as good] 34	[As good] 38

Table 5. Rural clinicians technology evaluation questionnaire

Questions	1	2	3	4
How did you rate your ease of using the equipment? (n = 101)	[Poor] 4	[Fair] 9	[Good] 37	[Excellent] 50
During the consultation, how anxious did you feel because of equipment? (n = 101)	[Not at all anxious] 70	[Slightly anxious] 24	[Mostly anxious] 2	[Very anxious] 5
During the consultation how self conscious or embarrassed did you feel because of the equipment? (n = 101)	[Not at all] 85	[Slightly] 14	[Mostly] 2	[Very self conscious] 0
How much did the equipment interfere with your consultation? (n = 101)	[Not at all] 62	[Slightly] 33	[Mostly] 5	[Very much so] 1
How did you rate the sound quality? (n = 101)	[Poor] 2	[Fair] 12	[Good] 59	[Excellent] 28
How would you rate the visual quality? (n = 101)	[Poor] 3	[Fair] 18	[Good] 52	[Excellent] 28
How would you rate the overall of the telelink? (n = 101)	[Poor] 3	[Fair] 10	[Good] 43	[Excellent] 45
Overall how would you rate your satisfaction with this new style compared to face-to-face consultation? (n = 101)	[Poor] 2	[Adequate] 7	[Almost as good] 66	[As good] 26

15. The fall and rise of the South Australian telepsychiatry network

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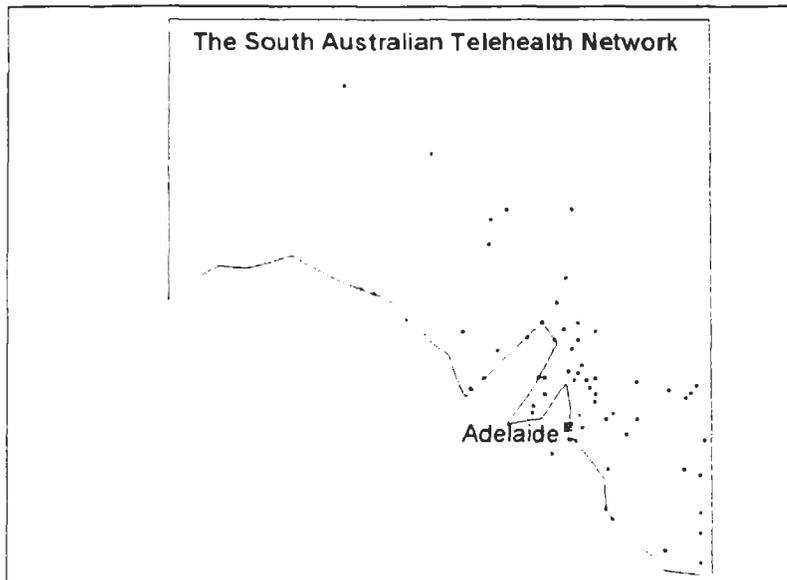
Summary

The Rural and Remote Mental Health Service (RRMHS) has delivered telepsychiatry services through the use of video conferencing to South Australian communities since May 1994. The survivability of the service results from a combination of factors that have seen the RRMHS expand to 48 centres and deliver an average of 100 clinical sessions a month. The key factors responsible for the success of the service lie in the model of service delivery, management support, and the implementation of a system for the scheduling and reporting of videoconference activity. The current model of service delivery has evolved over the past seven years and is fundamentally different to the infrastructure established at the implementation stage of the project. A retrospective analysis looks at the shift in service delivery models necessary for the sustainability of telepsychiatry services in South Australia.

Introduction

The use of videoconferencing for the delivery of mental health services has proved to be an effective and reliable means of delivering psychiatric care to patients in distant locations^{1,3}. The Rural and Remote Mental Health Service of South Australia (RRMHS) has been providing such services for over seven years and the service base has expanded from three sites in May 1994 to 48 in May 2001. In addition, expansion programmes are in place that will see the RRMHS service 61 remote locations by Jan 2002 (Fig 1). All psychiatric consultations are done at 128 kbit/s, which has proved to be reliable for primary diagnosis⁴.

Fig 1. The South Australian Telehealth Network. A total of 61 country centres throughout South Australia receive telepsychiatry services from the RRMHS. The capital, Adelaide is the centre from which most telepsychiatry services are delivered.



It still remains the case today that embedding telepsychiatry into standard operational procedures is difficult for many organisations. While others have discussed contributing factors for the successful delivery of clinical services via videoconferencing^{5,6}, this paper briefly discusses three key factors of the RRMHS that not only allow for its survival, but also sees the continued expansion of a service important to mental health care in remote regions of South Australia. The three factors are:

- a shift to a working model of telepsychiatry service delivery
- implementation of a scheduling and reporting system
- management support.

Development of a telepsychiatry model

In 1994, the telepsychiatry service was established with a mission to improve the delivery of mental health services to rural South Australia. Three videoconferencing units were installed in the country centres of Mt Gambier, Berrri and Whyalla, with an additional unit placed at Glenside Hospital, a metropolitan based mental health hospital in Adelaide. The equipment was planned for use by psychiatrists who travelled to these country centres on a regular basis and were most familiar with the patients and local health care staff. Videoconferencing units were made available to the consultants who were salaried staff of the hospital. Under this model, all clinical activity was initiated and driven by the consultant.

It became apparent that for many reasons, this model was not viable. The reasons given are as valid today as they were then:

- psychiatrists didn't have enough time
- psychiatrists were reluctant to use the equipment
- psychiatrists preferred to see patients privately
- there was difficulty in coordinating patients and equipment scheduling
- the equipment was not convenient to use for all psychiatrists.

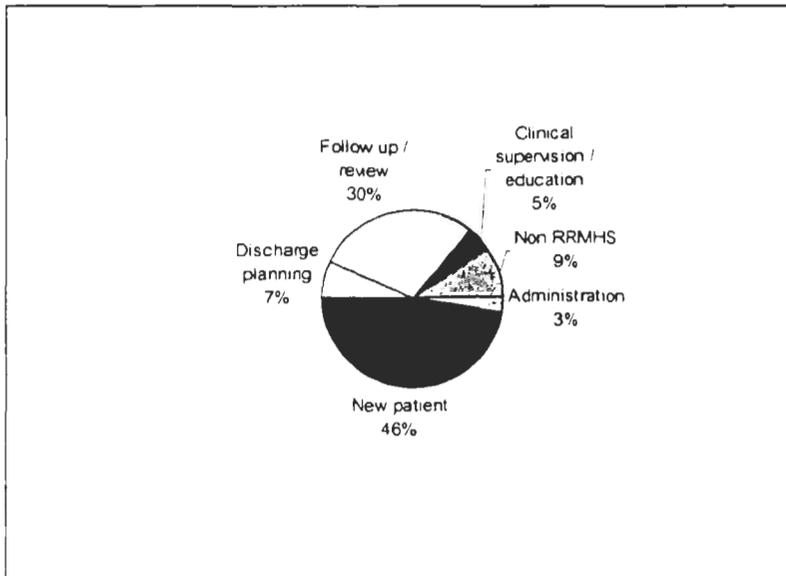
In effect, the benefits perceived by the psychiatrists did not warrant the use of the equipment.

In the first six months of the service, there were a total of 18 clinical sessions, the majority of which were by one psychiatrist. While the focus could have shifted to education or administration, clinical applications clearly did not have a future without significant change.

To rescue the clinical activity a fundamental shift was required, to a system that was responsive to country health professionals, including emergency clinical assessments, rather than a service that was initiated from the city. Practitioners or mental health workers could then request a psychiatric evaluation and psychiatrists in Adelaide would respond to country demand for mental health support. A telemedicine unit was then established, which is now a part of the Rural and Remote Mental Health Service of South Australia, and employs sessional, salaried psychiatrists. Some of these consultants work primarily providing telephone and videoconferencing support to rural based healthcare providers in their care of patients, while others have duties primarily elsewhere.

While the RRMHS provides psychiatric services to the country, it does not perform a primary care function. In every case, referrals are required from the patient's local healthcare provider who then receives faxed notification of session outcomes including treatment recommendations. Details of service delivery model of the RRMHS telepsychiatry service have previously been reviewed^{7,8}. At present over 80% of all telepsychiatry sessions are clinical, involving patients for assessments or reviews (Fig 2). The education of local health professionals is an important strategy in the continued and improved management of country patients. This is achieved in part by a requirement for all sessions to be attended by a health professional who accompanies the patient.

Fig 2. RRMHS videoconference applications. The core activity of the RRMHS is clinical work. 84% of all RRMHS videoconference sessions have the patient present throughout the conference. Non RRMHS activity refers to third party organisations who hire the equipment for health or non-health related activities. (Figures derived from Attend[®] conference software.)



Conference scheduling and reporting

After an exhaustive search, the RRMHS installed a commercial videoconference scheduling and reporting system called Attend[®]. Performance indicators for the videoconference units include utilisation by site, fault tracking, applications, cancellations, utilisation by organisation, billed revenue and other criteria. Collation of these statistics on a regular or ad hoc basis was labour intensive and error prone, however, as problematic as this was, the most critical aspect of network management was the day to day efficiencies of participant notification, room bookings, room availability and fault management. These operational issues are paramount as telepsychiatry is demand-driven by practitioners and country health workers who have no affiliation with the RRMHS and as such use telepsychiatry as their service of choice. In this respect, a telepsychiatry service not dissimilar to any other marketable product, in that if it provides no value, then it has no future. This commercial scheduling software has ensured that all aspects of conference scheduling and reporting are now streamlined, activity can be posted on the web and the day to day management of bookings is relatively transparent to the users.

Management support

As a health service, telepsychiatry requires the support and vision of senior management to survive. The existing model of service delivery requires an infrastructure and ongoing expenses that are met from state government funding. The telepsychiatry service itself is clinically driven, being led by a senior consultant who regularly performs psychiatric assessments and maintains a close association with practitioners and health workers. This "hands on" management approach is necessary to maintain a level of service and process that is valued by the country users.

Conclusions

The comments made in this review reflect seven years of experience in delivering mental health services via videoconferencing to South Australian country communities. While it is accepted that there are many factors that contribute to a sustainable service, the points made within this discussion are those that are the most critical to the RRMHS. It is also acknowledged that there are differences in service models and charters for individual telepsychiatry services. Thus, these comments may not be appropriate in other settings. In particular, the model of service delivery may not be as critical where all conference activity is "in house", in which case telepsychiatry can be employed as an organisational policy, rather than a service option. Noticeably absent from this discussion has been reference to equipment reliability and specifications. The RRMHS has found that features of equipment contribute little to an effective telepsychiatry session where it is only required to facilitate face to face discussions between psychiatrist, patient and carer.

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16. Telemedicine in Kansas: the successes and the challenges

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Summary

Based on our experience of telemedicine in Kansas, we have identified several key factors in the success of a telemedicine practice. Very early in any project, it is important to bring together all participants (especially the physicians who are expected to refer patients) to define the need, outline specific goals, analyze and test the technology and develop a plan for the implementation. As with traditional health care, many partners must come together, including primary care practitioners willing to shoulder day-to-day responsibility for management of complex patients, nurses with special expertise, and consultants willing to work with a remote team using telemedicine. These individuals must accept the challenges and appreciate the rewards of working in a different practice model, in which communication and interdependence is critical for success. The telemedicine consultant is only as good as the local health care team. The technology itself is only a small part of the equation.

Introduction

Staff at the Kansas University Medical Center (KUMC) launched a telemedicine programme to provide video links between rural communities and urban consultant specialists in 1991 [1]. The first link was established between the KUMC and the Kansas University Area Health Education Center (located 485 km to the west of Kansas city). Since that time, over 40 telemedicine sites have been established [2]. Initially the system was used primarily for education, but in 1993 clinical consultations were added to provide medical specialty care and consultation for rural Kansas physicians and patients. It was intended both to reduce the need for patients to travel long distances and to provide quicker responses to urgent cases. In addition, the service had the potential to support rural primary care providers by encouraging multiple professional links, thus reducing their isolation. Ultimately, this was expected to aid recruitment and retention of rural primary care practitioners.

Ten years later our experience has been one of remarkable successes as well as our fair share of unmet potential and missed opportunities.

Tele-oncology

Six years ago a tele-oncology practice was launched to provide care for rural Kansans as a collaborative effort between the KUMC and the Hays Medical Center [3]. To provide state-of-the-art cancer care for rural Kansans we combined our previously established outreach clinic with telemedicine as an adjunct service. Subsequently, a similar practice was established in Horton, again a combination of outreach (i.e. in person) clinics and telemedicine. In addition, cancer patients from four other Kansas communities have received care (both evaluation and management) via telemedicine exclusively.

To date, over 670 consultations (serving over 170 patients) have taken place, concerning a variety of haematological and oncological disorders [4]. New patient evaluations, second opinion consultations and follow-up visits have been conducted by telemedicine. Other services for supportive care of rural cancer patients have been developed from the tele-oncology practice, including pain management clinics, tele-hospice home-based care, interactive video support groups, and an educational series designed for patients, nurses and caregivers [3,5,6,7].

Several key elements have combined to make the tele-oncology practice successful. From the beginning we had excellent support from the university and from the physicians and other healthcare providers in the Hays community. Everybody wished to reduce the burden of travel for cancer patients, who often suffer severely as a result of their disease and treatment. From the beginning, rural members of the telemedicine team were active in developing the goals and methods of the practice. They quickly became proponents of telemedicine and did not hesitate to refer patients. Part of the university mission is to serve the healthcare needs of all Kansas citizens and telemedicine showed great promise in fulfilling that goal and building the goodwill necessary for financial support.

Once the concept had been developed, we were able to assemble an excellent team to implement the plan. Our team included a referring physician, oncology nurse specialist, and technician on the rural side, and a medical consultant, technician and project coordinator at the university. A large part of the success must be attributed to the competence and commitment of the rural health care delivery team. All nurses are chemotherapy certified, and have completed additional training in the care of cancer patients. Not only do the primary care practitioners coordinate the initial diagnostic work up, they are responsible for the day-to-day management of cancer patients, including any complications of chemotherapy treatments. For its part, the university had a sincere commitment to making the practice work and encouraged the team members to maintain a high level of responsiveness.

Financial support is a pivotal issue for any healthcare programme. The Hays Medical Center was willing to finance the practice itself with the expectation that local revenues generated from diagnostic work ups and in-patient admissions would offset the cost of tele-oncology [8]. This willingness to take a financial risk in uncharted territory like tele-oncology is unusual. The KUMC supported the programme by continuing to provide an oncologist to fly out each month for the outreach clinics, allowing a valuable transition from the traditional face-to-face care to telemedicine for physicians and patients alike. Also, important support personnel for the practice on the medical center campus are financed through the university.

Telehospice

The use of telemedicine to provide end-of-life care, known as telehospice, is another successful KUMC project [9]. It was launched in 1997 in conjunction with an urban hospice (Kendallwood) serving rural clients, often so far away that regular service visits were time consuming and expensive [10]. Telemedicine units connected by ordinary telephone lines were used in the home for nursing evaluations, psycho-spiritual care and social worker

services. After an initial feasibility study, telehospice units were offered to all patients at the start of hospice care. Largely due to the success of this first programme, a larger project in Kansas and Michigan has been launched to investigate issues of acceptance, efficacy and cost.

Once again, the shared understanding of focused goals, developed in collaboration with key partners, was critical to the success of the project. The small size of the hospice made good communication easy and efficient, and positive working relationships were quickly established [6]. Equally important, the nurses of this hospice had a particularly positive attitude towards using the new technology to render care. The project therefore worked well in extending care to the target population. Early on, the nurses also noted a significant benefit in managing call responsibilities, especially in determining when on-site visits were necessary. Using the home units, the hospice delivered more visits by video, at lower cost than sending a nurse in person [11]. This happened at the same time that the US Medicare reimbursement for hospice patients in the rural sector decreased [12]. As a result, the financial benefit we had anticipated became even more important.

School-based paediatrics

In February of 1998, the KUMC began to deliver ambulatory paediatric services to children in an urban school who were without care, primarily because of difficulties with access [13]. The partners in the TeleKidcare project include the Kansas City Unified School District 500, the KUMC departments of paediatrics and child psychiatry, and the KUMC Center for Telemedicine and Telehealth. Using desktop telemedicine units operating at 128 kbit/s, physicians from the university were connected with nurses from the Kansas City school district. Originally, four schools were involved, although the project has since expanded to eight grade schools, three middle schools and one high school. A wide range of ambulatory diagnoses including ENT problems, dermatological disorders and behavioural health issues have been managed via telemedicine [13]. Initial funding for the telemedicine units came from the Kansas city school system and the Kansas University departments of psychiatry and paediatrics. Subsequently, grants from the Department of Commerce Technologies Opportunities Programme, Wyandotte Health Foundation and the Kauffman Foundation have enabled an expansion.

The Telekidcare project has been successful in serving children with acute ambulatory problems such as otitis media and rashes. Often the family was unable to afford suitable care outside school hours and children would simply do without until the problem resolved on its own or an emergency room visit was necessary. To make the telemedicine project a success, the school nurses had to practise beyond their traditional role of triage and basic care. They received training in the technology of the units and in physical assessment. In the Telekidcare model, the nurses provide evaluation and management under the direction of a paediatrician, effectively transforming the nurse's office into a site of care. The project would have faltered if the paediatricians were unwilling to accept a practice model in which the nurse often takes the lead. Almost 1000 consultations have now been conducted and parental satisfaction has been over 90%. Evaluations of the experience by both nurses and physicians have been very positive.

In addition to these successes, like most telemedicine programmes, we have had projects that turned out poorly. Much can be learned from analyzing the reasons for failure.

Telecardiology

As a result of a request from the hospital administrator of a primary care facility in the northeastern part of Kansas, we set up a telecardiology service. Room-based videoconferencing units operating at 384 kbit/s were used to link a staff cardiologist from the KUMC with a primary care internist and nurse practitioners from the rural facility. The

practice was to be a mixture of weekly telemedicine clinics with monthly outreach clinics. The goal, as in Hays, was to reduce the burden of travel for the patients. Echocardiograms were to be sent to the KUMC by overnight courier or reported over the telemedicine system, depending on the urgency as determined by the referring clinician. Should a patient need cardiac catheterization, and the case was not urgent, a visit would be arranged to KUMC. Urgent care beyond the capabilities of local providers would result in immediate transfer, as before.

This practice failed. In fact, it was never even fully launched for reasons which were obvious, in retrospect. Early on it became apparent there was a strained working relationship between the cardiologist and the on-site presenting nurse. Further, the cardiologist was critical of the echocardiograms that were obtained locally, stating that the quality was substandard and that reading them was far more labour-intensive than would have been the case with better studies. More important, we learned that another cardiologist had been attending a clinic at the same hospital *for several years*. There was no true need for the service as perceived by the local primary care practitioners, who were satisfied with the services of the established cardiologist. (This other cardiologist was sending patients to another institution for echocardiograms.)

In summary, in order for a telemedicine service to be successful, there must be a genuine need perceived by those expected to use the service (as opposed to an administrator hoping to capture revenues lost to another institution). These physicians should be involved early on in the development of the practice. Also, the telemedicine team members are interdependent and must have rapport and mutual confidence in each other's clinical skills in order to work together effectively. Finally, the consultant must be satisfied with the quality of local support services or a suitable alternative will need to be negotiated.

Telehomecare for cystic fibrosis patients

The telehomecare project was started to monitor patients with cystic fibrosis in an attempt to improve their quality of life (and reduce costs) by avoiding emergency room visits and hospitalizations. Low-cost telemedicine units, operating over the ordinary telephone network, were installed in the homes of patients with cystic fibrosis. These allowed telenursing visits by a nurse with expertise in the care of cystic fibrosis patients [14]. Other members of the practice team included a respiratory physician and home health nurses. Telenursing visits were planned at least twice weekly, to evaluate respiratory status. Working together with a home health agency, intensive management was planned, including respiratory treatments and intravenous antibiotics when required. We hoped to prolong the period of home management, avoid emergency room visits and reduce hospital admissions. Reimbursement for home visits by nurses came from traditional sources (i.e. third party insurance, Medicaid). There was no reimbursement for the nurse conducting telenursing visits. Funding for the pilot project came from the KUMC Hospital.

This project also failed. First, we experienced difficulties with the equipment. Most problems with a telemedicine practice have concerned project personnel or the practice team – normally equipment problems are easily rectified. In this situation, the videophone worked well, but the analogue electronic stethoscope never did so. Despite multiple telephone calls and repeated visits from the equipment supplier, we were unable to make it work properly. Obviously, this was not acceptable to the cystic fibrosis practice team. Eventually the nurse specialist working on the project lost interest and left, followed closely by the respiratory physician. It takes a lot of effort to recruit good quality team members and most such people have more than enough demands on their time. Once recruited, the practice team should take part in choosing the technology they will be using. Furthermore, equipment should be tested thoroughly before the service begins.

Telepsychiatry

We were consulted by an organization of community mental health centers to help develop a plan for a statewide telepsychiatry system. The organization hoped to facilitate access to care for rural psychiatric clients by using telemedicine to share clinical staff (i.e. for special expertise or cross coverage) between mental health facilities. The telemedicine service was to include new patient evaluations, post-hospitalization follow-up and coordination of treatment and second opinions. Funding for the project came from state sources totaling over \$500,000.

At present the majority of the units are idle and have never been used [2]. The loose organization of the community mental health centers was not adequate to coordinate and implement the service, and our offers of managing the project were refused. A degree of competition exists between the community mental health centers, so issues of sharing resources and cross coverage were difficult at best. Unfortunately, a funding source had been identified and equipment purchased before these issues were resolved. This represents a 'build it and they will come' approach that time and again has been shown to fail in the world of telemedicine. Involving clinicians in the planning process at the beginning would have ensured a more realistic plan and prevented wasted resources.

Conclusion

Our experience of telemedicine in Kansas shows that there are several important factors in the success of any telemedicine practice. It is important to bring together all participants to define the need, outline specific goals, analyze and test the technology and develop a plan for the implementation. In order for a telemedicine service to be successful, there must be a genuine need perceived by those expected to use the service. Many partners must come together, including primary care practitioners, nurses with special expertise and consultants willing to work with a remote team using telemedicine. These individuals must be prepared to work in a different practice model, in which communication and interdependence is critical for success. A telemedicine consultant is only as good as the local health care team. The technology itself, while certainly important, is only a small part of the equation.

Acknowledgements

TeleKidCare is a registered trademark. Telehospice is a registered trademark.

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17. Telemedicine in South Africa: success or failure?

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Summary

A national telemedicine system for South Africa was planned in 1998. In the first phase, starting in 1999, 28 pilot sites were established in six provinces. The initial applications were teleradiology, tele-ultrasound for antenatal services, telepathology and tele-ophthalmology. Telemedicine equipment was connected by ISDN at 256 kbit/s. From January to September 2000 a total of 2663 radiographic studies was performed at the three Northwest Province teleradiology transmission sites, of which 264 studies (10%) were selected for specialist radiologist reporting by teleradiology. From June to August 2000 nine antenatal care tele-ultrasound consultations were performed in the Northern Cape Province and four transfers were avoided due to telemedicine. One area of concern is the relatively low utilisation of the telemedicine system, which raises questions about its cost-effectiveness. The experience of telemedicine in South Africa confirmed, as others have found, that common problems relate to the technical and organizational challenges of introducing telemedicine.

Introduction

Healthcare in South Africa is delivered from a range of facilities, from highly specialised urban academic centres in large metropolitan areas, to small rural clinics throughout the country. The legacy of the immediate past is an unacceptable concentration and inappropriate distribution of health practitioners and expertise that are concentrated in the major urban centres, while people living in rural areas have limited access to basic healthcare because of geographical isolation and poor public transport.[1] The South African government has identified telemedicine as a strategic tool to improve the delivery of equitable healthcare and training services in the country, particularly in the rural areas.

Telemedicine is the use of telecommunications technology to provide medical information and services.[2] Telehealth is sometimes thought to be a broader term, because it involves all aspects of health service, including health promotion, prevention, education, research, population data collection and health management.

Project design and implementation

The National Telemedicine System, one of the first of its kind in a developing country, was established to use telemedicine to improve primary care services and health education in the rural areas of South Africa.

Design

In July 1998 the Department of Health convened a National Telemedicine Task Team to design and co-ordinate the introduction of telemedicine into the delivery of health services in South Africa. The Task Team was composed of representatives from the Department of Health, the Medical Research Council, the Department of Communications and the telecommunications company, Telkom SA.

The first task of the Task Team was to develop a national telemedicine strategy.[3] This was adopted by the national minister and provincial heads of health in Pretoria in August 1998. The Task Team then developed an implementation programme. The activities of the Task Team are carried out under the auspices of the National Health Information System Committee of the Department of Health.

Technical Working Groups then developed guidelines for the implementation of the telemedicine. The guidelines were reviewed by the National Telemedicine Conference before submission to the Department of Health for adoption. The following documents were drafted:

- telemedicine clinical protocols
- telemedicine policy guidelines on data ownership and security
- telemedicine code of ethics and professional conduct
- proposal for a national medical education network
- guidelines for the development of telemedicine network.

Implementation

The national telemedicine project is being implemented in three phases over a period of five years.

- phase 1: April 1999-March 2001. A total of 28 pilot telemedicine sites in six provinces was established. The initial applications were teleradiology, tele-

- ultrasound for antenatal services, telepathology and tele-ophthalmology. A national Telemedicine Research Centre was also established
- phase 2: April 2001-March 2002. This phase will involve an expansion to 75 telemedicine sites, sub-divided into provincial networks for management purposes
- phase 3: April 2002-2004. Additional telemedicine sites will be established as required (and as affordable) to meet rural healthcare needs. There will be a transformation from the pilot stage to routine clinical operation.

In April 1999 the Lebone Consortium in partnership with Siemens was selected by the Department of Health as the successful bidder to provide telemedicine equipment for the 28 sites of the first phase. Telkom SA was responsible for the installation of the ISDN connections, two Basic Rate lines (256 kbit/s) to each of the 28 pilot sites.

Evaluation of the project

Evaluation tools were developed to assess the contribution of telemedicine to rural health care delivery. The process included the development and testing of data collection instruments to be used during the whole implementation of the national telemedicine system.[4] The clinical protocols for each of the four telemedicine applications which were implemented during the first phase, were developed by the Telemedicine Working Group.

The Telemedicine Research Centre developed the evaluation methodology to evaluate the effect of the telemedicine clinical protocols. A Telemedicine Interaction Form was used to collect data each month on the volume and nature of telemedicine encounters nationally.

The results of the first phase were reviewed at a National Telemedicine Conference organised by the Department of Health in Johannesburg from 22-24 November 2000.

Results

The teleradiology system was established to provide specialist reporting in the rural areas of Free State, North-West and Mpumalanga provinces, where such services did not exist before. The system provides first and second opinion as well as a review of clinical cases for medical management. It provides specialist support to primary care doctors, especially the community doctors practising in the rural and remote areas of South Africa.

Each province has a tertiary centre with a specialist radiologist. This acts as a receiving centre for teleradiology images. Each province has three rural district hospitals which act as teleradiology transmitting sites. The average distance between the transmitting and receiving sites is 200 km and the average population is 3-4 million per province.

From January to September 2000 the Northwest Province teleradiology transmission sites performed a total of 2663 radiographic studies. 264 studies were selected for specialist radiologist reporting by teleradiology. Therefore 10% of X-rays had specialist reporting and the other 90% of X-rays were simply interpreted by general practitioners. The availability of radiologists limited the number of possible teleconsultations.

The cases that were sent for teleconsultation comprised:

- 32 % spine trauma
- 28 % chest diseases
- 15% chest trauma
- 13 % extremity trauma
- 10 % head trauma.

The Northern Cape tele-ultrasound system started operating in June 2000. From June to August nine antenatal care tele-ultrasound consultations were performed between Kuruman and Kimberly and four transfers were avoided due to telemedicine. There was no clinical activity in September because of rotation of community service doctors. In addition to the telemedicine system, the province operated a flying doctors programme where once a month, specialists from Kimberly fly to Kuruman for clinical consultations. The clinicians were of the opinion that the telemedicine system had the potential to save costs in the flying doctors programme.

Discussion

The telemedicine system of South Africa has only been operating for one year and it might, therefore, be too early to make judgements about its success or failure. The evaluation report of the first phase suggested certain strengths and some weaknesses in the system.[4] The main success was the ability to improve access to radiology specialist reporting in ten remote sites situated in three provinces. There is only one radiologist in each of the public health services of Northwest and Mpumalanga provinces for a population of about 3 million people per province. Through telemedicine, the primary care providers were able to access specialist radiologist reporting within an hour, compared to 5-7 days delay when X-rays are transported by road.

The doctors doing their community service in the remote health facilities of Free State reported that the telemedicine system improved their ability to diagnose and manage various medical conditions, particularly those related to trauma and chest diseases. In the North West Province the community service doctors noted that telemedicine enabled them to differentiate between chronic TB lesions and occupational lung diseases, such as asbestosis and lung cancer.

The tele-ultrasound application was designed to move the ante-natal ultrasound services from the provincial referral centre to the remote and rural community health centres. In KwaZulu-Natal and Northern Cape where tele-ultrasound antenatal services were implemented, clinicians noted success of the system in two areas. First, in training health care providers in the use of an ultrasound service for pre-natal care. Second, in providing diagnostic and management services for complicated pregnancies.

The reason for selecting cases for teleconsultation was mostly for the purposes of antenatal ultrasound training of the primary care providers, although some consultations were carried out on complicated pregnancies. One of the successes of the system was that it reduced the professional isolation usually felt by junior doctors performing community services in rural health facilities.

The failures of telemedicine in South Africa include the technical problems experienced during the first year of operation and the human organisational issues. Due to persistent floods, Telkom SA had difficulties with the ISDN network in the Mpumalanga Province. This problem has gradually been resolved. The users of the teleradiology system were not satisfied with the reporting component of the software. Radiology specialist reports were sent back to the transmitting sites by either fax or email.

One area of concern is the relatively low utilisation of the telemedicine system, which raises questions about its cost-effectiveness. The clinicians felt that more telemedicine training is required to make the system more efficient. The limited period of operation may partly explain the relatively low utilization.

Conclusion

The experience of telemedicine in South Africa confirmed many issues previously identified by telemedicine pilot studies conducted in other countries. Common problems relate to the technical and organizational challenges of introducing telemedicine.[5] It is important to understand that telemedicine is not a substitute for face-to-face medical practice, but rather it is a tool to compliment current health care delivery.

The deployment of equipment to the 28 sites of the first phase took longer than expected and a number of the sites were still experiencing technical difficulties a year after installation of the system. The Department of Health Telemedicine Conference recommended that the second phase of the national telemedicine system be implemented, province by province, starting with those that demonstrated efficient operation in phase 1.

The appropriate use of telemedicine equipment and procedures such as protocols and guidelines is essential for the system to have any effect on healthcare delivery. If protocols are not implemented then the system will have no effect.

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18. The effect of nuclear medicine teleradiology on diagnostic pathways and management in rural and remote regions of Western Australia

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Summary

Limited accessibility to certain medical imaging services in regional and rural centres has led to the use of alternate modalities, which may not be best practice or required patients to travel considerable distance for diagnosis. Data collected over a three-year period were examined to determine the clinical effect of nuclear medicine teleradiology (NMT) and its effect on diagnostic patterns for the investigation of cardiovascular disease, radio-occult musculoskeletal injury and oncology. In comparison with two other rural, non-NMT areas of similar demographics, there was a significant shift in the delivery of care in terms of diagnostic work-up. The most valuable contribution resulting from NMT input was the detection of disease in which therapeutic management was changed for 122 cases and in eliminating the need to transfer patients to another facility for unnecessary and expensive examinations (38 cases). Whilst NMT is more costly than conventional nuclear medicine services it permits faster access to specialist consultation, providing for better management and is likely to reduce overall health costs by reducing the volume of inappropriate tests and treatment practice.

Introduction

It is generally acknowledged that there is a maldistribution of medical services throughout Australia with patients in rural and remote areas receiving less access to Medicare-funded services. In 1998, there was an average allocation of \$147 per person for the metropolitan population as against \$58 rurally for non-specialist services¹. In a population distribution of 100,000 people there are approximately 10.7 internal specialists in small rural centres and 29.6 for their city counterparts^{2,3}. The south-west, eastern goldfields and mid-west regions of Western Australia combined, occupy in excess of 1.2 million km² with an approximate population of 228,000⁴. In most cases, secondary and tertiary specialist consultations are available via fortnightly or monthly visits and appointment waiting times can be lengthy. In February 1997, two separate non-conventional nuclear medicine services became available to the south-west regions and a department in the eastern district was established in February 1998. The centres are interfaced to a proprietary telemedicine system connected via ISDN store and forward technology and the studies are reported by an offsite nuclear medicine physician.

Various authors have commented that an influential method of determining the value of telehealth is to investigate any clinical effects with reference to evidenced based medical outcomes, as this may be more rigorous in revealing benefits^{5,6,7}. There are concerns regarding the capacity of individuals to obtain a similar quality of service as each other and this prompted our evaluation research, which examines clinical practice guidelines, in an attempt to determine whether the use of nuclear telediagnosis offers rural and regional patients a standard of care that is equal to their metropolitan counterparts in the management of certain musculo-skeletal, oncological and cardiac applications.

There is some debate regarding the unjustifiable variations in clinical practice for the same condition and with greater interest in evidenced-based medicine, clinical practice guidelines (CPG) are becoming one of the critical links between the best available evidence and good clinical practice⁸. Recent research shows that the guidelines can be effective in bringing about change and are designed to reduce the use of unnecessary, ineffective and invasive intervention by facilitating the treatment of patients with maximum chance of success^{9,10}. In terms of medical imaging, strategies exist to inform practitioners about the best approach to achieve a diagnosis. Benefits from the use of integrated pathways have been shown to include a decrease in hospital admission periods, streamlined decision-making processes, improved clinical outcomes and reduced in overall health costs^{11,12,13}.

Nuclear medicine has an established role in the accepted clinical algorithms for the diagnosis and assessment of suspected appendicular stress fractures, coronary atherosclerotic disease and osseous metastases for breast and prostate carcinoma as outlined by the Royal Australian and New Zealand College of Radiologists and the National Health and Medical Research Council of Australia^{14,15,16}. Our two departments, in the south-west, are each operated by an accredited nuclear medicine technologist on a full time basis, whilst the Kalgoorlie centre relies on a weekly fly-in, fly-out service. Secure and efficient lines of communication are established between the practice and the nuclear physician or specialist in order to monitor and influence the conduct and outcome of the procedure.

The selection of the type of diagnostic imaging modality in regional and rural sectors has been governed by limited availability to specialist services. This has often led to alternative tests being employed which are not considered to be best practice. Our initial observations of musculo-skeletal injuries of the ankle joint revealed many cases of radio-occult pathology which included 10 radio-occult talar dome fractures which had not been identified up to six months after the onset of symptoms¹⁷. This suggested an inequality of care as compared to metropolitan standards and we were encouraged to investigate other musculo-skeletal cases and additional data on cardiopulmonary and oncology pathologies. The main focus of the

present paper is to report on the effect that nuclear medicine telediagnosis (NMT) has had on referral patterns and to assess whether a significant shift has occurred in the delivery of care for patients. Whilst individual cases will inherently differ, generally, is it assumed that a shift in referral patterns which align against best clinical practice standards should result in better outcome. We aim to understand whether patient diagnostic workup may have varied compared with another setting and whether NMT has eliminated the need to unnecessarily transfer the patient to other facilities.

Methods

The design adopted both a qualitative and quantitative approach based on case study analysis, Medicare billing data and questionnaires. The nature of the NMT service precluded the use of strict statistical sampling methods or a randomised controlled trial. The data source encompassed the entire primary care referral base and relevant specialists. The evaluation was based on a quasi-experimental design and compared equivalent groups with access to the service against a similar demographic community without access. Medical practitioners from pre-NMT and non-NMT regions were surveyed in order to identify which diagnostic and management paradigms they nominated for specific clinical scenarios. Three years after the NMT services commenced the surveys were repeated.

In an attempt to illustrate change the performance indicator was considered to be a shift in referral trends, which nominated the best clinical practice guideline. The intervening variables incorporated a range of the alternate imaging modalities available. The specific clinical indications were:

- trauma: suspicion of fracture (stress/avulsion) in acute and chronic appendicular pain where initial X-ray was normal
- oncology: need for exclusion of osseous metastases for prostate and breast cancer
- cardiology: diagnosis of significant ischaemic heart disease requiring intervention or to risk stratify.

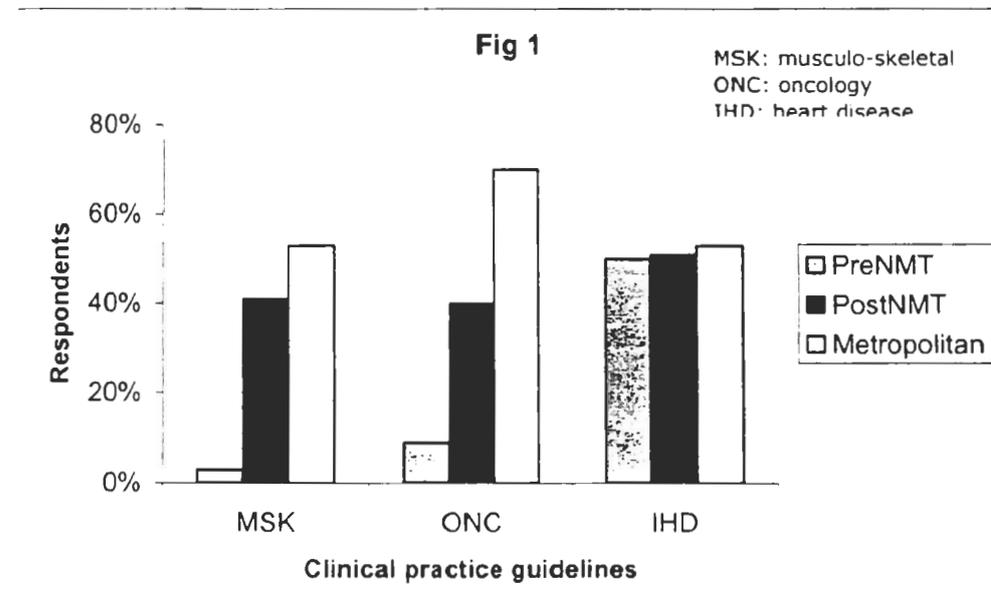
Respondents were presented with seven different paradigms for trauma and five pathways for the cardiology and oncology scenarios. The accepted best practice guideline was not highlighted in the questionnaire. Referral strategies were reconciled against Medicare statistics (health insurance commission data) and a case study record collection was included. For clinically urgent cases where immediate results were required medical officers were asked whether a patient transfer, either via Royal Flying Doctor Service or by road ambulance, would have been ordered if the nuclear medicine service had not been available. Pre-NMT and post-NMT regions encompassed the two south-west centres (Mandurah and Bunbury) and the Kalgoorlie centre in the east before and after the establishment of NMT procedures. The non-NMT or control centre was Geraldton and metropolitan practitioners with existing nuclear medicine services were also included.

Results

A total of 209 practitioners were surveyed. There were 133 pre-NMT and post-NMT respondents, a response rate of 77% and 82% respectively and 50 metropolitan and 26 non-NMT practitioners were also compared with a response rate of 77% and 82%. Fig 1 presents the comparisons for the indications before and after NMT became available. For stress fracture, the accepted CPG recommends that an initial plain radiograph be obtained, and that if negative, conservative treatment should be considered. If symptoms persist and the differential diagnosis includes stress fracture then a radionuclide bone scan is the imaging modality of choice. It is well documented that repeated radiographs rarely provide further

information^{18,19}. Of the seven strategies presented, the pre-NMT survey included 33 (40%) respondents indicating the use of a sub-optimum approach, 22 (26%) for a less favoured pathway and 15 (18%) choose to refer their patient to specialist consultation. The post-NMT survey demonstrated a change with 29 (32%) utilising the accepted best CPG, 25 (27%) for the next best strategy and a decrease in the number of respondents referring to a specialist prematurely. HIC data confirmed a decrease in repetitive serial X-ray examinations for the same condition.

Fig 1. Clinical referral patterns



In the investigation of osseous metastases, according to the pre-NMT survey, the majority of primary care practitioners referred to specialists either immediately, 27 (32%), or after initial radiographic collection in instances of intermediate or high clinical suspicion 17 (20%). Of these cases, a radionuclide whole body bone scan was considered the next imaging modality of choice and patients were then directed to a metropolitan department. The most important finding from the post-NMT survey was the increase in primary care practitioners who first acquired the bone scan prior to forwarding to specialist intervention. However, in each category the appropriate CPG was chosen, timeliness of access was the main factor to be considered.

The cardiology strategies were classified as low, intermediate or high risk for the presence of coronary artery disease and pathways were based on the NHMRC guidelines^{14,16}. In all cases, a specialist physician or formal cardiology review conducted workup for diagnosis and stratification after primary care referral. Results demonstrated a greater reliance on nuclear myocardial perfusion imaging (MPI) on the post-NMT survey in cases where equivocation for the need to request coronary angiography (CA) existed. The rate of false positive cases where CA was deemed to be unnecessary is yet to be investigated however it is worthwhile to note that 12 subjects who had a pre-NMT classification for direct CA referral subsequently had normal MPI scans and thus avoided the examination.

There were 38 studies that were given a high pre-test likelihood for transfer to metropolitan hospital if a local nuclear medicine service was unavailable. These were clinically urgent examinations, which included investigations for acute pulmonary embolus, osteomyelitis and

gastro-intestinal haemorrhage. The majority of these (22) presented with associated complications and the exclusion or positive identification of specific pathology was considered mandatory.

Discussion

Regardless of whether the nuclear medicine service is provided via conventional or electronic means, a change in certain diagnostic referral patterns is likely to occur. However, due to limited numbers of nuclear medicine specialists, this service is only feasible via telemedicine. Whilst it can be argued that the electronic transmission of radiology images does not necessarily result in different health outcomes than would a traditional method of hardcopy reporting delivered by a regular courier service, most diagnostic nuclear medicine procedures cannot be properly offered unless a multidisciplinary team is available for immediate consultation²⁰. Whilst our endpoint is accessibility to best clinical guidelines, the effect on the overall medical outcome needs to be assessed for regional and provincial patients to fully realise the disparity. We are addressing the issue of diagnosis as the paramount goal of this evaluation and how it can be achieved faster but this does not necessarily result in a direct benefit for the patient as the services required to correct or treat the disease may not be available locally and travel to metropolitan areas could still be required.

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19. A review of the experience with teleradiology in Australia

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Summary

Due to the geographical dispersion of the Australian population, where some 25-30% of the total population of 20 million live outside metropolitan areas, there has been considerable interest in the use of teleradiology. In general, the provision of teleradiology by private radiology practices has been successful. However, as regards the provision of publicly funded state-wide teleradiology services, progress has been slower than expected, following enthusiastic support for the technology in the early 1990s. While there have been some notable successes in the implementation of publicly funded teleradiology services, given the delays that have been experienced in Australia, there is a case for a closer connection between the conduct of teleradiology evaluation studies and the incorporation of the results into health policy. This link would ensure that the benefits of technology are made available to the public in as short a time frame as possible.

Introduction

Due to the geographical dispersion of the Australian population, where some 25-30% of the total population of 20 million live outside metropolitan areas, there has been considerable interest in the use of teleradiology (the transmission of medical images over communication links). The principal objective of teleconsultation using radiology images is to provide rural and remote hospitals and medical practitioners with immediate access to tertiary specialist services in major public teaching hospitals so as to avoid the unnecessary transport of patients between country and city. A related benefit of teleradiology consultations is the mentoring relationship which results between city based specialists and their rural colleagues, leading to an effective continuing medical education program in such areas as management of neurosurgical patients, fetal medicine services and emergency medicine [1].

Australian experience

In the late 1980s Australia participated in the development of teleradiology services, where radiology images were transmitted from peripheral sites to a central location for subsequent reporting by radiologists [2]. Other applications ranged from the provision of an on-call radiology reporting service by metropolitan hospitals to the provision of a routine radiology reporting service to rural and remote areas that effectively replaced existing postal and courier services [3].

It is generally agreed that teleradiology applications, involving the introduction of on-call teleradiology services and the remote reporting of radiology images by private radiology groups, have been successful. Examples include practices such as Jones and Partners in Adelaide, South Australia, which provides services from the Mt Gambier on the Victorian border to Darwin in the Northern Territory. This teleradiology system covers one of the largest geographical areas in the world. The Pittwater Group provides a teleradiology reporting service from Sydney to the North coast of New South Wales. The Southern X-ray Group have a busy X-ray reporting service for remote general practitioners in Queensland. The Epworth Private Hospital in Melbourne manages an effective on-call teleradiology service [4]. The Victorian Imaging Group at Box Hill Hospital, Melbourne, can routinely transmit CT or MRI images to radiologists at a number of metropolitan locations for reporting.

In private radiology practice, accounting for some 80% of radiology services in Australia, teleradiology technology has been successfully implemented where there has been a sound business case and where it has been seen as necessary to provide a competitive service to maintain referral networks with general practitioners. While there has been an apparent conflict over recent years between the Federal Government's desire to contain the growth of radiological services funded through Medicare and the potential of teleradiology services to increase the efficiency of the radiologist workforce and therefore the number of services provided, it is likely that the continuing consolidation of radiology practices into larger units will lead to an increasing use of teleradiology in the longer term.

As regards the provision of publicly funded state-wide teleradiology services, progress has been slower than had been initially anticipated, following enthusiastic support for the technology in the early 1990s [5]. While there have been some notable successes in the provision of publicly funded teleradiology services, such as the paediatric radiology network in Victoria and the Fetal Medicine service in Queensland, when viewed objectively progress has been relatively slow. Obviously, where there has been a significant need and an enthusiastic champion, systems have been implemented such as paediatric teleradiology links between the Prince of Wales Hospital in Sydney and country areas. Another example is the work of Dr Tina Hayward and colleagues at the Women and Children's Hospital in Adelaide, South Australia, providing second opinions on paediatric and obstetric procedures [6]. There

have also been some excellent pilot projects such as the TARDIS project in Queensland using teleradiology to support the provision of emergency services [7]. Researchers at the CSIRO have developed a prototype tele-ultrasound system using realistic frame rates which has the potential to provide cost-effective services to rural areas [8].

Other demonstrated successes include initiatives such as the Telehealth Tasmania Network, partly funded through the Federal Government programme Networking the Nation, that provides a network of health area services, including teleradiology, throughout the State [9]. The Western Australian Telehealth Project, covering a distance of some 2400 km, became operational in February 2001 with a teleradiology service to 14 remote locations [10].

Discussion

Private radiology practices have taken the lead in the provision of teleradiology services, supported by the Royal Australian and New Zealand College of Radiology [11]. Given the delays in implementing publicly funded teleradiology services in Australia, there is a case for a closer connection between the conduct of teleradiology evaluation studies and the incorporation of the results into health policy to ensure that the benefits of technology are made available to the public as quickly as possible. It is recognised that a time lag of ten years should not necessarily be viewed as a "failure". There are factors to be overcome such as modification of overseas equipment and software, national health policies involving state and federal responsibilities, the need to obtain support and co-operation from clinicians and hospital administrators, relative funding priorities and government policies. Nevertheless a shorter time delay between availability of a technology and its widespread implementation appears to be desirable in the interest of improved patient management and outcome.

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20. Progress in Australian teledermatology

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Summary

Because of their remoteness, the majority of rural towns in Australia are disadvantaged in terms of access to dermatological services. Telemedicine offers one solution. Since the mid-1990s, Australian dermatologists have experimented with telemedicine as an adjunct to clinical practice. The technical viability of teledermatology was first demonstrated in 1997. In 1999, the accuracy and reliability of teledermatology was favorably demonstrated in a real-life urban setting. In 2001, Broken Hill (western New South Wales), a dermatology-remote location, served as a trial-site for the institution of teledermatology as the primary method of access to dermatologists. This rural-based study, while demonstrating high patient and general practitioner acceptability and positive medical outcomes, nevertheless, also revealed unexpected barriers and pitfalls in the effective operation of rural teledermatology.

Introduction

Australia is a vast continent with significant numbers of widely scattered rural communities.¹ The inequitable distribution of doctors within Australia is a well-recognised problem.² In the earlier part of the twentieth century, Australians benefited from the successful application of telemedicine principles in delivering medical support to remote inland Australia (Royal Flying Doctors Service) and the Antarctic (Sir Douglas Mawson's polar expeditions).³ Today, telemedicine has the potential to bridge the geographical divide between rural communities and urban specialist services.

Demographics

90% of the Australian population is contained in the most densely settled 2.6% of the continent, with 84% of the population inhabiting the most densely populated 1% of the continent.¹ The Accessibility/Remoteness Index of Australia (ARIA) is a method of representing Australian population groups in terms of proximity to service centres⁴, thus providing an indication of the number and distribution of rural and remote communities within Australia.

This index reveals 11,338 populated localities across Australia (Fig 1). Of these localities, only 201 can be classified as service centres with a population of 5000 or more, that are able to provide and sustain adequate health and education services.⁴ A significant number of communities across the Australian continent fall into the category of 'locationally disadvantaged' – with very little accessibility to goods and services and opportunities for social interaction. Clearly, these communities are geographically disadvantaged in their access to essential services such as commerce and health care relative to their urban counterparts. It is a challenge to overcome the great distances separating urban and rural/remote communities, as well as between individual remote communities.

Specialist service distribution

The distribution of Australian dermatologists mirrors the imperfect specialist coverage across Australia. The Australasian College of Dermatologists has approximately 270 practising members in Australia with a predominance of practice locations in urban areas. By contrast, the rural and remote communities are widely scattered across the continent. At present, rural and remote health care remains suboptimum, with inadequate access to medical services and considerable difficulty in retaining existing health care workers. The turnover of primary care practitioners in remote areas is about 30% per annum, compared to 14% per annum, in urban areas.²

Dermatologists-ARIA

Any assessment of specialist workforce adequacy must take into account both the number and geographical locations of the specialist providers. Using the ARIA index, the accessibility to dermatologists by distinct communities is represented in the dermatologists-ARIA map⁵ (Fig 2). 88.5% of the Australian population reside within 80 km of the nearest dermatologist. The dermatologists-ARIA map further identifies 664 distinct populated localities (>200 persons) greater than 80 km from the nearest practicing dermatologist.⁵ The implication is that a significant number of populated communities within Australia have limited access to specialist dermatology services. It also becomes apparent that many of the populated communities fail to reach recognised specialist to population ratios (1:60,000) and consequently, do not have the population base to support a resident specialist.

Teledermatology

Whether or not teledermatology is able to fulfil its promise of bridging distances separating specialist health care services (predominantly urban) and rural and remote communities is actively being assessed. The technical viability of teledermatology was demonstrated in Australia in 1997.³ In 1999, the same group reported an 83% intra-observer concordance (agreement) rate in the primary diagnosis of 35 skin conditions using store-and-forward teledermatology.⁶ In a subsequent larger urban teledermatology study, an intra-observer concordance of 88% was obtained for primary diagnoses; and 96%, when the differential diagnoses were considered.⁷ This is comparable to the 80% mark achieved by most intra-observer concordance studies in store-and-forward teledermatology.⁶⁻⁹ To be effective and safe, the teledermatology process needs to demonstrate an acceptable level of accuracy and reliability. Accuracy is reflected by the degree of intra-observer concordance between the teledermatology and face-to-face diagnoses by the same clinician. Reliability is a measure of how consistently a set of results can be reproduced by different clinicians.

A recent Australian study has affirmed the reliability of the teledermatology process.⁷ In this study, the mean concordance (primary diagnoses) achieved by four dermatologists studying 53 store-and-forward diagnostic cases, originating from 49 referred patients, was 79% (range: 73% – 85%). When the differential diagnoses were taken into account, the variation across individual dermatologists narrowed further, with a mean of 86% (range: 83% - 89%).⁷ A key measure of telemedicine viability, seldom considered, is how this method of patient management by specialists (store-and-forward teledermatology) compares with GPs practicing under optimum face-to-face conditions.¹⁰ It has been demonstrated that the mean diagnostic agreement between face-to-face GP consultations versus face-to-face dermatology consultations is approximately 49%. This figure demonstrates a significantly worse correct diagnosis rate in GPs with face to face consultations compared to dermatologists using store and forward images.⁷ This suggests that in dermatology, the specialist telemedicine process can contribute significantly to improved standards of health care in the rural environment.

Real life studies

Broken Hill (in western New South Wales) is a dermatology-remote location by the ARIA-Dermatologists index.⁵ Since 2001, it has served as a trial site for teledermatology as the primary method of access to dermatologists. Prior to the teledermatology trial, the Broken Hill community was serviced by a visiting-dermatologist for one-and-a-half days in every two months. The institution of store-and-forward teledermatology has reduced the dermatologist attendance by 50%.¹¹ In both the urban and rural (ongoing) teledermatology studies, there were no reported adverse patient outcomes.^{7,11} An adverse patient outcome is defined as any inappropriate management course or unsatisfactory clinical progress at the end of the three-month follow-up. However, patients with an incorrect initial diagnosis that were recalled for interim review during the three-month period, either by the dermatologist or the GP, and subsequently managed appropriately, were not considered to have an adverse outcome. We feel that the ability to request face-to-face visits by dermatologists, combined with GPs maintaining primary care of the referred patient, serve as additional safeguards for patients using telemedicine.

Benefits

Qualitative patient surveys have shown the intangible benefits of telemedicine, such as savings in travel and time for the patient.^{7,11} We have also found potential measurable cost savings with faster access to specialist services. Repeat visits to GPs can be the expected consequence of inaccurate initial diagnosis and management, adding to the healthcare cost burden. We found a significant increase in the number of GP visits by patients, the longer a given dermatological condition remains undiagnosed. In one study, patients were four times

more likely to have multiple GP visits (three or more), when a given dermatological condition remains undiagnosed or incorrectly diagnosed, after one month, prior to specialist management.¹² The same study also demonstrated that the longer a given skin condition remains undiagnosed or incorrectly diagnosed, the more likely money is to be spent on haphazard selections of over-the-counter products. Patients were trying up to four times as many over-the-counter products when the duration of their skin condition exceeded one month.¹²

Limitations

Teledermatology has advantages in comparison with conventional practice, but it also has some limitations.

Not as accurate as face-to-face

Despite, the reduced accuracy of teledermatology relative to face-to-face consultations, specialist input via teledermatology remains a valuable support service for GPs, particularly in rural Australia where access to dermatologist is restricted. We have previously demonstrated that the teledermatology process remains significantly more accurate than GPs practicing under optimum, face-to-face conditions.⁷ It is on this basis that the largest medical indemnity protection society in Australia continues to indemnify, on a case-by-case basis, Australian dermatologists practicing telediagnosis.¹¹

Lack of doctor-patient interaction

While acceptable levels of accuracy and reliability of teledermatology have been established, critics argue that the lack of direct doctor-patient interaction remains a significant drawback. We acknowledge this to be an important aspect of the therapeutic process and correspondingly, emphasise the fundamental role of GPs in maintaining primary care of the patients, with the specialist playing a secondary advisory role to the GP.⁷

Remuneration

Remuneration remains an important issue that is unresolved in Australia. Australian Medicare, funded by the Commonwealth government through general taxation, provides full rebate for teleradiology services. This is based on the assumption that the quality of operating and transmitting digital images is comparable to traditional methods of reporting.¹⁰ Presently, there is no rebate for other types of telemedicine services such as teledermatology that is being practiced *pro bono* by Australian dermatologists. A recent survey indicates that up to 10% of Australian dermatologist have been involved in teledermatology consultations.¹³ There is a growing case for formal Medicare rebates in teledermatology consultations given the accumulating local evidence that teledermatology has the potential to increase the standard of community health care, particularly in areas where access to dermatologists may be restricted.

Lack of education for participants

Studies on patterns of image viewing indicate that dermatologists should receive training in effective image diagnosis. We found that effective and systematic scanning did not routinely occur when dermatologists viewed teledermatology images.¹⁴ We found that a skin cancer is six-times more likely to be correctly diagnosed when it is located in the centre of an image, as opposed to the periphery.¹⁴ Radiologists are routinely trained to scan an entire image systematically in order not to miss any incidental peripheral signs. These findings suggest that similar training should be considered for dermatologists undertaking telediagnosis.

GPs and their appointed assistant should also be sufficiently trained in the basics of clinical photography. The single most frustrating experience for the dermatologist is the poor quality of photography making any attempt at teleradiology extremely difficult.

Patients should be aware that teleconsultations are not as accurate as face-to-face consultations. There is the general assumption by patients that teleradiology is at least as accurate as face-to-face consultations.¹⁰ It is important for patients to understand that their GP remains the cornerstone of their overall management and a close GP-patient relationship should be maintained. Effective and safe telemedicine can only occur in this context where the GP-patient relationship is primary, with specialist playing the secondary role of advisor to the referring GP.⁷

Lack of acceptance amongst potential users

Australian GPs as a group remain reticent about employing this novel method of referral. Patient recruitment in both the urban and rural teleradiology trial was unexpectedly slow. While acknowledging the potential contribution of teleradiology, many GPs have been slow to exploit the technique, even when there are clear and obvious patient benefits, as in the rural teleradiology trial.¹¹

Patient inconvenience

An unexpected barrier to the use of teleradiology in Broken-Hill was the increased net cost to teleradiology patients. Patients referred to the traditional hospital-based outpatient dermatology clinics for a face-to-face consultation with the visiting dermatologist, made no direct payment, as the dermatologist elected to receive payment from the Australian government (Medicare). On the other hand, none of the rural GPs accept direct payment from Medicare and instead, levy a consultation fee (fee for service) that is significantly higher than the Medicare payment. Consequently, a proportion of patients were unwilling to be involved in the teleradiology process, as it required a follow-up GP visit for the results, for which an additional GP consultation fee was charged.

Conclusion

A significant number of rural Australian communities continue to experience formidable geographical barriers to both basic and specialist health care. In 1997, the Australian Medical and Workforce Advisory Committee (AMWAC) report acknowledged the lack of adequate supply of medical practitioners in rural and remote Australia to be the single most important medical workforce issue facing Australia.⁵ The AMWAC report put forward 20 recommendations, none of which included telemedicine. In the last few years there has been considerable interest and activity in assessing the benefits of telemedicine. Dermatology is one discipline that has recently demonstrated the benefits of this method of health care delivery. However, there are bureaucratic and procedural hurdles that may prevent optimum use of telemedicine in Australia. Nevertheless, in specific instances, telemedicine may be a viable and valuable option in improving the health care of rural and remote communities.

Acknowledgements

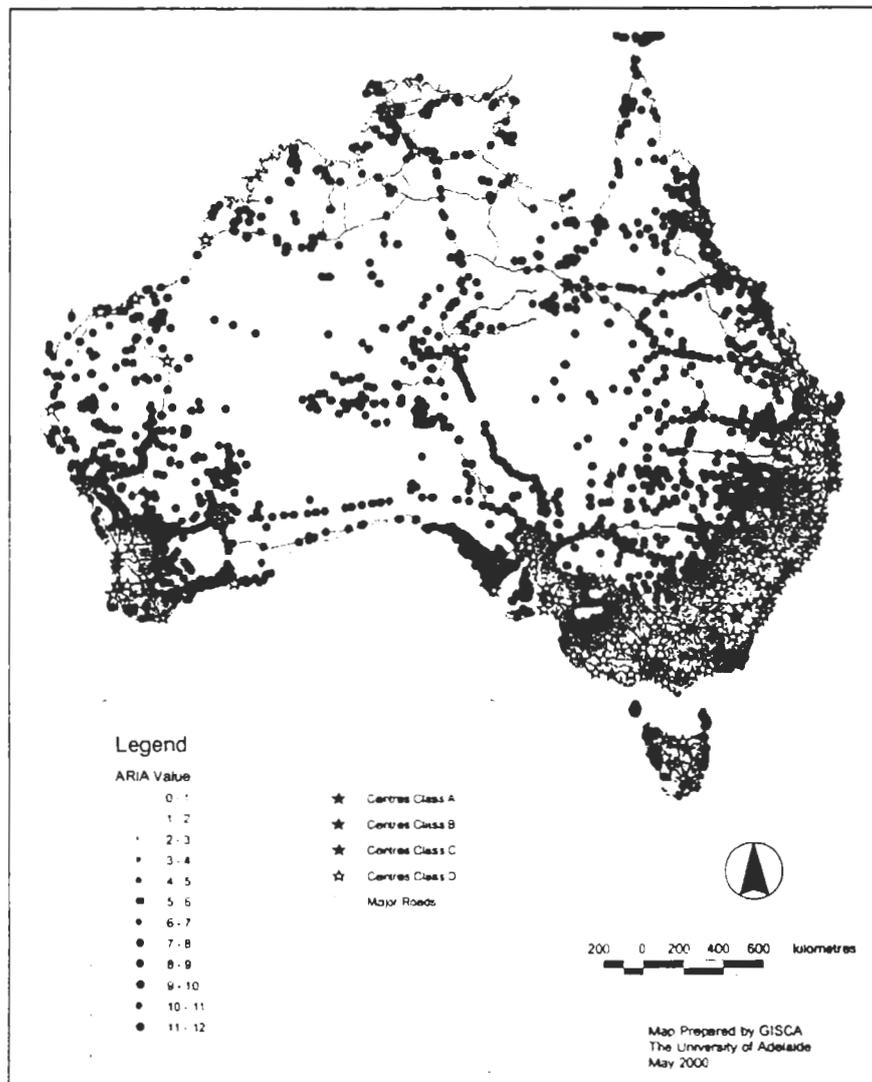
Fig 2 is reproduced by permission from the *Australasian Journal of Dermatology* 2000; 41: 264

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Fig 1. The Accessibility/Remoteness Index of Australia (ARIA) map. Australian population localities are represented with reference to proximity to service centres. The ARIA index of 0 – 12 (0 = least remote; 12 = most remote) gives a measure of the 'remoteness' of populated localities within Australia. (From Department of Health and Aged Care. Accessibility/Remoteness Index of Australia (ARIA). Canberra: The Department, March 1999 (Occasional Papers Series No.6). Reprinted by permission of GISCA, University of Adelaide)



21. Teledermatology in the Waikato Region

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Summary

Teledermatology consultations over a video link began at Health Waikato in 1995. Clinical trials involving about 500 patients have demonstrated diagnostic accuracy, patient satisfaction and economic gains. Yet six years on, out-of-date equipment remains under-used. There has been no expansion of the network and no additional clinical teleconsultation services.

Possible reasons include the excessive capital cost of videoconferencing equipment, clinician overwork, inconvenience, lack of reimbursement, administrative and governmental inertia, and little demand from patients and their doctors. Knowing that many general practitioners have access to the Internet, and some have already purchased digital cameras, we established a pilot online tele-advice service. With the increase in online health information and electronic communication, we assumed it would be popular. But, despite up to six-month waits for patients to be seen in the dermatology outpatient clinic, few patients have been referred to the service. Explanations have included time constraints, unavailability of a camera, no Internet access at the time of consultation and lack of reimbursement. Can we look forward to a future in which all doctors have high-speed access to the Internet at their desktop through their practice management systems? Who will pay? Will they continue to prefer conventional referral?

Introduction

Fifteen percent of the total population of New Zealand (3.8 million) lives more than 80 km from a dermatologist. Patients with skin diseases usually consult their general practitioner (GP) in private practice initially. The consultation is variably subsidised according to patient age and income. They may be referred to a dermatologist in private practice or at a public hospital clinic. The latter is free of charge but often entails a wait of several months for an appointment. Many rural patients with significant skin disease never see a specialist and may therefore receive sub-optimal management.

In 1994, Health Waikato's Information Systems Department commissioned a comprehensive telemedicine feasibility study. It concluded that a videoconferencing system linking the main hospital to our peripheral hospitals (Tokoroa, Te Kuiti, Thames and Taumarunui) could improve access of rural patients to specialist medical services and might be affordable. Dermatology was selected for pilot studies and a videoconferencing system was installed in the outpatient clinic of the Department of Dermatology at Waikato Hospital in August 1995. A similar unit was installed at the furthest hospital in Taumarunui, a town with 6000 inhabitants located 3 hours' drive south of Hamilton (180 km). In collaboration with staff at the Institute of Telemedicine and Telecare of Queen's University in Belfast, UK, we took part in several of the UK Multicentre Teledermatology trials to evaluate whether teledermatology was effective and economic.

Like elsewhere, in the last few years, New Zealand medical practitioners have adopted the Internet as an information resource and routine means of communication. Members of our department have been responsible for the New Zealand Dermatological Society's informative web site DermNet¹, which during April 2001 received more than 130,000 visitors viewing 800,000 pages. This interest in the Internet has led to a number of requests from local GPs for advice by email. To widen our referral base without the inconvenience of videoconferencing, we decided to offer a secure browser-based dermatology tele-advice service to our referring GPs. In mid-2000, about five rural GPs who owned digital cameras and had expressed interest were invited to access the test site.

Methods

Our videoconferencing equipment in Hamilton and Taumarunui initially was a V-Tel S-Max system run on a PC486DX, with a 25" TV monitor and a Canon VC-C1 camera with ×8 zoom capability. It was installed in a specially designed room and communicated via ISDN at 128 kbit/s with a similar unit at Taumarunui Hospital. In 1998, for a research project, with the aid of Ministry of Health and industry sponsorship, the dermatology clinic computer was upgraded to Pentium 166 running V-Tel SmartStation software. Desktop SmartStations were supplied to GP practices in Taupo (160 km) and Rotorua (120 km). Later relocated in clinic space next to the helicopter pad, we lost the ability to control the remote camera (unimportant) or to receive still "snapshots" taken using original software in Taumarunui (which can be expected to have reduced diagnostic ability). Using a Sony Handycam and NetMeeting software, quite good still images could be sent from the GP practices.

Our Internet-based store-and-forward teledermatology system has been established using a server owned by Pinnacle, one of the larger Independent Practitioner Associations (IPAs) responsible for primary health care in the region. Requiring username/password access⁷, approved GPs are expected to complete a detailed on-line form regarding their patient's demographic details and skin problem, and attach images if available and appropriate. A dermatologist will provide an on-line report within a few days and arrange face-to-face review of the patient if necessary. We have not to date received specific funding for this project.

Results

The results of our videoconferencing trials have been published elsewhere.²⁻⁶

We were satisfied that rural patients would be prepared to participate in teledermatology consultations and we demonstrated that diagnosis was possible in more than 75% of cases who were examined initially using the videoconference equipment and then seen immediately face-to-face.²

A two-hour teledermatology clinic has been scheduled at Taumarunui Hospital each month for more than five years. For the first two years a visiting consultant physician presented 5-6 patients to the dermatologist, but an outpatient nurse has performed this task since then. The majority of consultations are satisfactory and patients report they save time and money.^{3,4} However, there is a significant rate of non-attendance (>10%), and several patients have requested face-to-face follow-up. This is in addition to the approximately one-in-ten the teledermatologist has asked to see in person.

To improve patient care, it seemed logical to put teledermatology on the GP's desk. A sponsored randomised, controlled trial compared teledermatology consultations in GP surgeries in Taupo and Rotorua with conventional consultations at Waikato Hospital, and established that patients could make significant cost savings.⁵ The GPs have been enthusiastic about the service and their educational gains. Monthly clinics for 5-6 patients continue in each location. Because the patient's primary care physician participates in the consultation and is responsible for on-going care, few patients need to be seen face-to-face. The GPs are responsible for maintenance and communication costs so charge a premium for consultations.

Despite the success of individual consultations, few patients have access to these videoconference facilities. In one of our studies, we found that in more than 50% of cases, accurate diagnosis and management could be made by using the referral letter and digital still images (unpublished data). A store-and-forward "teleadvice" service was therefore set up. As part of this store-and-forward teledermatology service, we request more patient information than is usually supplied in a standard referral and we expect high quality images. However, apart from a small number of test cases, the service has not been used. Pinnacle, the local independent general practitioner organisation, has issued a general invitation to its members to visit the site but this has resulted in no interest whatsoever.

Discussion

Our video teledermatology clinics have been hard to co-ordinate. The medical participants are now experienced but received little initial training. Not all patients referred to the service have been appropriate - we are unable to reliably diagnose small skin lesions, rashes in small children and genital eruptions. Temporary technical failures have been frustrating, particularly as expert assistance is not available immediately. Other hospital specialists have shown little interest; the wound resource nurse, a plastic surgeon, and a psychiatrist have conducted single consultations. However, two newer videoconferencing facilities on campus are used daily for administrative and educational purposes.

Modern high quality compatible equipment communicating via higher bandwidths situated in a better-lit room could significantly enhance image quality and the general experience of videoconferencing. Not specifically funded, and unsupported by a Business Case, the "pilot" service has been continued out of a sense of loyalty to the participants and communities that appear to value it.

We have been disappointed in the lack of interest from GPs in our Internet teleadvice system, which we had intended to broaden to include several other specialist services. We were unable to engender enthusiasm for a face-to-face training session and few have bothered to visit the web site. Had they done so, they may have found the templates too time consuming to complete in the absence of reimbursement. By phone and email, we asked our initial group to identify barriers to use. Responses included:

- "I don't refer many patients to a dermatologist."
- "It is easier to write a conventional referral letter."
- "I haven't got time - I type too slowly."
- "The templates should be part of my practice management system."
- "My digital camera doesn't have macro facility."
- "I keep my camera at home."
- "I access the Internet at home."
- "The modem's too slow for image transfer."
- "Can't I just send you an email?"

Nearly all rural GPs access the Internet via dial-up modems and the ordinary telephone network. Access to Asymmetrical Digital Subscriber Line (ADSL) and Integrated Services Digital Network (ISDN) services is limited to urban centres. The expense of under-use is a disincentive to upgrading. Many of these concerns can be expected to disappear in time - when practice management systems (PMS) and hospital electronic medical records (EMR) will communicate with each other using secure broadband systems allowing on-line referral to all departments.

We have not specifically marketed our teledermatology service to the public but there have been several presentations by local and national media. Even though patients have expressed general satisfaction after a videoconsultation, this has not resulted in significant consumer demand. Non-attendance at telemedicine clinics is common, as is true for face-to-face outreach services (personal communication), thought to relate to poverty, apathy and lack of transport. On the other hand, those of us whose email addresses are published on the World Wide Web have received numerous unsolicited requests for help from patients all over the world despite indicating we do not offer an online consultation service.

Funding for telemedicine is the biggest issue, and depends on the political will of the Ministry of Health and the newly established District Health Boards. To date, we have demonstrated that interactive teledermatology offers savings for the patient, but not to the health service. This is in keeping with British⁸ and Norwegian studies (personal communication) which have been unable to present an economic case for routine interactive teledermatology.

Despite demonstrated clinical need, and political lip service to the need for equality of access for rural residents, increasing access to public health service specialists escalates costs. As it is, contracted patient volumes have been exceeded and extra consultations receive no reimbursement. Budgetary constraints are severe and there are other clinical and technological priorities, such as an integrated EMR and an enhanced broad band network. There has not been a proper analysis of the potential costs and economic gains of setting up multispecialty telemedicine consultations. In addition, no thought appears to have been given to the need to pay the primary care provider as well as the hospital for a telemedicine consultation. However, recently a steering committee has been set up at Waikato Hospital to evaluate "e-conferencing" and telemedicine, led by a newly appointed Chief Information Officer who recognises the need for all stakeholders to be involved in planning new services and for equipment to be portable, flexible and fully integrated.

For teledermatology to be effective it needs to be seamless, integrating referral and response into hospital EMR and doctor's PMS with instant communication and high quality images.

We may have to be patient and hope for an economic miracle and a paradigm shift in funding arrangements. Our initial concerns about the ability to diagnose and manage patients by telemedicine have turned out to be less important than practical issues of implementation. The poor uptake of the web based still image system is a reminder of the principles of marketing. The product clearly has the potential to save money and time but that alone does not guarantee success. By staying away, GPs in the Midland area have indicated that the problem solved by the product is insufficiently burdensome to warrant investing in the time to learn new technology and changing their current practice. It may be that teledermatology needs to become a discrete component in a comprehensive referral and advice system before it is generally accepted.

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22. The Georgia Statewide Telemedicine Programme: some lessons learned

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In Georgia a long-standing goal is to use telemedicine to weld the state's medical resources into an integrated primary, secondary and tertiary healthcare network. Such a network would enhance the ability of Georgia's clinicians to provide health-related services at both the point and time of need. Georgia is a rural state, with a few areas of major urban concentration. While primary care clinicians are reasonably well distributed throughout the state, specialty clinicians tend to concentrate in urban areas. This discrepancy was expected to favour telemedicine. However, Georgia has an excellent highway infrastructure. Access to face-to-face specialty care is available, assuming that the case is not an emergency, if the patient has the ability and the means to travel a few hours, or if the community is serviced by a visiting specialist.

Although it may be intuitively clear that an integrated network will enhance the health of the citizenry, the cost of infrastructure and its management, operation and maintenance can obscure the system's value, either delaying or preventing its implementation. In addition, immediate deployment of a full network based simply on its predicted value to patient care does not guarantee that clinician practice patterns will change accordingly. Success requires that each community thoroughly define the clinical service requirements of its population, and then match those requirements against existing, economically viable local clinical services. Development of telemedical services is then a reasonable approach to closing service gaps without the cost and inconvenience of moving patients or specialists; rural communities can also use telemedicine to export local expertise. Importing the required services by telemedicine enhances continuity of patient care by the primary provider. Finally, networks that use a single telemedical technology are less likely to maximize their potential for success. Maximum success requires a flexible suite of telemedical tools that are updated regularly as technology advances. The most appropriate technology can then be selected for the clinical task at hand.

23. Online eye care in prisons in Western Australia

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Summary

In prisons, prison medical officers provide general medical care. However, if specialist care is needed then the prisoner is transported to a specialist medical centre. This is a costly procedure and prison escapes occur during transportation. We have trialled our Internet-based eye care system in prisons in Western Australia. Medical and ophthalmic history, visual acuity and intraocular pressure were stored in a browser-based multimedia database. Digital images of the retina and the external eye were recorded and transmitted to a central server. Based on the medical data and the digital images the specialist ophthalmologist can provide a diagnosis within 24 hours. Eleven patients (mean age 48, range 30-82 years) were reviewed during two separate visits to a maximum security prison in Western Australia. Our main aim was to train prison medical officers and nurses to operate the portable ophthalmic imaging instruments and to use the Internet-based eye care system. The outcome of the pilot study indicates that considerable savings can be made in transport costs and the security risk can be reduced. The Ministry of Justice in Western Australia has decided to implement telemedicine services to provide regular ophthalmic consultation to its prisons.

Introduction

A disadvantage of realtime telemedicine using videoconferencing is that it requires high bandwidth telecommunication and relatively expensive equipment. The image quality is also poor and therefore not adequate for ophthalmology where high resolution, colour images are necessary for the accurate diagnosis of eye diseases.

An Internet-based multimedia database system has been developed and tested in Western Australia. It stores patients' demographic data, images, video recordings and audio annotations. This information can be transmitted via the Internet to a centralised disease control centre. Since this software utilizes low bandwidth links for image transmission it is cost effective. If Internet access is not available at the time of image capture then an offline system can be used to enter the patients' demographic data, capture still images and video recordings. This information can be transmitted to the central database at a later stage when Internet access is available.

Generally, prison medical officers provide medical services to the prisoners. If specialist care is needed, the prisoners will be transported to specialist medical centres. This is a costly procedure and prison escapes occur during transportation. For security reasons the prisoners may have to wait a long time to get an appropriate specialist appointment. In the present study, the Internet-based online eye care system developed at the Lions Eye Institute (LEI) was tested in prisons in WA to provide specialist ophthalmic care to prisoners without transporting them to external hospitals. The prison medical officers and nurses can be trained to use equipment to screen prisoners for anterior segment and retinal diseases.

Previous studies on managing eye diseases using telemedicine in prisons^{1,2} have indicated that it is a viable alternative to transporting the prisoner to a specialist hospital. Several other studies^{3,4} have estimated the cost savings of telemedicine in prison system in USA and reported that the activity is successful.

Methods

Eleven patients (mean age 48, range 30-82 years) were reviewed during two separate visits to a maximum security prison in Western Australia. These patients either had prior appointments at public hospitals for ophthalmic assessment or were known to be diabetic, with probable ophthalmic pathology. Initially, medical and ophthalmic history documentation, visual acuity testing and intraocular pressure measurement using a portable air flow tonometer (Keeler Pulsair T2000 Model 10 hand-held tonometer, Clewer Hill Rd, Windsor, Berks, UK) were obtained. A Snellen letter chart at a six-metre distance was used to test the visual acuity, which was rechecked using a pinhole. Acuity was recorded using distance spectacles for each eye. The information was registered in the browser-based database system.

Thereafter, digital images of the retina and the external eye were recorded. During the first session, a Nidek NM100 hand-held fundus camera was used to obtain retinal images in a darkened room (Nidek Ltd, Chiyoda-ku, Japan). A digital camera (Sony Mavica FD88) using a +3 dioptre accessory close up lens was used to obtain images of the external eye.

In the second session, a Nidek NM-100D digital non mydriatic camera was used with the eyes of three of the patients dilated using tropicamide 1% to examine the physiological lens. This also allowed a comparison of the retinal images with those obtained with Nidek NM100 camera during the first visit. A prototype hand-held digital slit lamp (patent pending: PQ7625) was used to capture still images of the external eye including corneal scarring and physiological lens for cataract assessment.

The images (320x240 to 640x480 pixels) were captured and stored using a laptop computer with a PCMCIA frame grabber (MRT, Oslo, Norway). All clinical information and images were transmitted to a central server.

Results

Six of the patients screened during the two sessions had ophthalmic appointments at the public hospitals. One of the patients was asked to maintain his ophthalmic appointment. He had had argon laser photocoagulation for diabetic maculopathy. However, it was not visible on the digital images. The second patient had pterygium which had advanced onto the cornea. The ophthalmologist after reviewing the digital images of the external eye referred the patient for surgical removal of the pterygium. Four other inmates either did not need hospital appointments or were given appropriate medications.

The maximum security prison is about 25 km from Perth and usually two guards and one driver accompany the prisoner to a public hospital. Generally, it takes 5-6 hours for each trip. The estimated cost for a medical consultation to be performed at the specialist hospital is about \$500. The cost for a medical consultation via the Internet-based system is about \$60.

All patients except one were known to be diabetic. The retinal images of these patients were captured with either NM100 or NM-100D Nidek hand-held cameras. Both cameras were able to image the posterior pole including the optic nerve head with good resolution. The quality of retinal images obtained from either camera with or without dilation was considered either moderate or poor for diabetic retinopathy diagnosis but was adequate to assess optic disc cupping. It was not possible to identify any indication of diabetic retinopathy from the retinal images.

The quality of images obtained using the prototype digital still slit-lamp was not adequate for diagnosis. It was possible to capture only still images. The external eye images obtained using a digital still camera with a +3 dioptre accessory close up lens were considered to be of acceptable quality.

Discussion

The Internet-based eye care system was successfully tested from the maximum security prison in Perth. The patients' demographic details, clinical and family history and images were successfully transmitted to a central server. The ophthalmologist received automatic email messages about each patient and sent back his reply within 24 hours as promised. In this type of Internet system, security of patients' information is important. Appropriate security was implemented at the client and the server side and during the transmission.

There was a cost saving of \$440 per medical consultation for the maximum security prison in Perth. The total land area of Western Australia is ten times larger than UK, so these savings can be much larger if prisoners have to be transported from the northern part of WA to a main hospital.

Our main aim was to train prison medical officers and nurses to operate the portable ophthalmic imaging instruments and to use the Internet-based eye care system. The imaging instruments have to be low-cost and easy-to-operate. The Nidek hand-held fundus cameras are easy-to-operate but comparably expensive (A\$26,000). Our previous experiments⁵ indicated that the Nidek hand-held fundus cameras (NM-100 and NM-100D) are not adequate for identification of diabetic retinopathy. After the trials the hand-held slit-lamp was further developed to produce diagnostic quality images of the anterior segment. This low-cost device is being tested in our clinic for its sensitivity and specificity of detection of anterior segment diseases. The latest device produces better results.

After these successful trials, the Prison Medical Service has decided to implement a tele-ophthalmology service to 20 prisons in WA in order to control health-care costs and improve security. In Australia, tele-ophthalmology consultations cannot be reimbursed through Medicare. However, the prison medical system is independent of Medicare. The Prison Medical Service has made an agreement with the Lions Eye Institute and it will be paying the telemedicine consultation fees directly to it.

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24. Successes and failures in videoconferencing: a community health education programme

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Summary

Women's Health Queensland Wide commenced delivery of community education programmes for rural women via videoconferencing in the year 2000. A series of three, 90 min sessions were videoconferenced from Brisbane to 13 northern Queensland sites. The sessions related to health issues for women at midlife. The sessions were delivered by health experts in Brisbane who provided a short presentation on their topic with the majority of the videoconference dedicated to questions from the participants. Each site was supported by a technical coordinator who ensured that the equipment functioned properly and a local health worker who facilitated women's participation in the videoconference as well as providing a local services perspective. Women's Health Queensland Wide was responsible for overall planning and promotion of the sessions. Feedback from these programmes demonstrated women's and health care professionals' acceptance of videoconferencing as a mechanism for receiving health information. Sustainability of these programmes depends upon the following issues: cost, delivery model, and the availability of appropriate technology and women friendly sites.

Introduction

Women's Health Queensland Wide (WHQW) is a non-profit health information and education centre. The services include a state-wide toll-free Health Information Line providing up-to-date information on women's health issues and a free lending library covering topics on a wide range of health matters. The centre produces women's health information resources and conducts health education activities for the community and for health professionals. The WHQW website contains relevant articles, factsheets and other information.

In late 1996, WHQW developed a state-wide focus for its services. Most of the services, including the Health Information Line and the central library as well as the distribution of resources, lend themselves to a statewide approach relatively easily. However, this is more difficult for health education.

For a number of years, WHQW has conducted community health education seminars, talks and workshops in south east Queensland. Due to funding and physical access constraints, a state-wide approach was practicable until the year 2000. Access to information technology and pre-existing telecommunication networks, specifically telemedicine networks, provided WHQW with the means to offer community health education to women living outside south east Queensland.

Telemedicine networks use videoconferencing equipment to deliver clinical services to patients in rural and remote communities^{1,2,3,4}, training and professional development activities to the health care workforce^{5,6,7}, and continuing support to individuals with specific health needs^{8,9}. Literature searches, e-list inquiries and other searches failed to identify any other projects world wide to suggest that videoconferencing technology is being used to deliver health education programmes direct to health consumers in rural and remote communities. Consequently, WHQW approached Queensland Telehealth (formerly Queensland Telemedicine Network) (QT) and received permission to offer a community education programme via its videoconferencing facilities.

Methods

In the second half of 2000, a series of three, 90 min sessions were videoconferenced from Brisbane to 13 northern Queensland sites. Topics consisted of Menopause and Hormone Replacement Therapy, Diet in the Middle Years, Alternatives to Hormone Replacement Therapy and Breast Health. Each session involved one or two speakers with no live audience at Brisbane. Speakers included a gynaecologist, dietitian, naturopath and breast physician. The sessions were videoconferenced one month apart via QT, using two multipoint bridges. All sessions were interactive with viewers being able to address questions to the speakers.

WHQW was responsible for: the programme development; the production of fliers and media publicity; confirming the presenters and familiarising them with videoconferencing, and ensuring that their presentations were appropriate for the medium; the booking and cost of the bridges; and locating a technical support person and health worker at each site and orientating them to their roles. Written material relating to the topics was made available by WHQW either via the website or by women forwarding a resource request form with the information then being posted to them.

For each broadcast, every site had an identified technical support person and a health worker facilitator. The technology person was responsible for the venue and managing the equipment during the broadcast. The health worker's tasks involved: the promotion of the programme in their community; taking bookings for each session; directing women to the venue; attending each session to complete the registration form; assisting the women in completing the feedback form; providing local service information to the participants; and forwarding the attendance sheet and feedback forms to WHQW in a reply paid envelope. Each site was responsible for their connection costs.

A self-administered questionnaire was developed for participants to complete at the end of each session. The health worker at each site facilitating the session was asked to encourage the women to complete the questionnaire before leaving and to return the completed forms and the registration list to WHQW in the reply-paid envelope supplied. It was anticipated that completing the questionnaire would take no more than a few minutes. The questions related to whether the participants: found the session interesting and informative; whether they knew more about the topic; whether they would use WHQW services again; what they liked least and best about the session and how it could be improved; and whether they had used videoconferencing before and, if so, how. Sociodemographic information was also requested.

The participants were also asked: "Considering your answers to the above questions, is videoconferencing a suitable means of getting information on today's topic?" and "I would attend other Women's Health Queensland Wide videoconferenced sessions" in an attempt to ascertain their acceptance of videoconference seminars.

The series of programmes and model of delivery was repeated in early 2001 for 13 sites in central Queensland and is currently being conducted for another 13 sites in southern Queensland.

Results

The data about attendance and feedback was not wholly accurate, because it depended on the health worker at each site keeping accurate registration figures, encouraging the women to complete an evaluation form and then returning the forms to WHQW. Even though a number of follow up telephone calls were made and at each broadcast the health workers were again reminded to complete and return the paper work, this did not always happen.

Feedback from the evaluation forms received by WHQW from women who participated in the northern Queensland programme indicated that over 95% found the sessions informative and interesting. Approximately 90% said they knew more about the topics, and 96% found videoconferencing a suitable method for health education and would attend another videoconference seminar in the future.

The fact that the sessions were interactive was important to the women, and the question and answer section of each session was often valued the most. When asked what they liked the most, the comments included: "The opportunity to hear other ladies concerns and questions" and "Interaction by women all over the State". Other women valued the opportunity to obtain this information within their own community and not having to travel hundreds of kilometres to hear experts discuss relevant health issues. "We would not have access to this up to date information otherwise" and "Convenient, no travel".

Issues relating to the technology and question time comprised most of the comments from the women about what they liked the least in the sessions. "Individuals who used question sessions as a personal consultation. Not coming back to sites who haven't put questions and taking loads of questions from some sites" and "The sound was terrible – people not speaking loud enough and feedback – however the topic was good".

Discussion

No method of health education is without its constraints and WHQW identified a number of problems relating to videoconferencing. These were primarily related to accessibility, the model of programme delivery, technological limitations and costs.

The majority of QT sites are located in hospitals and community health centres. In some towns these are accessible to the local community. However, in other places the sites are difficult to find and not very inviting to use. WHQW was concerned that the location of some receiving sites would discourage women from participating in the sessions. In some instances, the QT sites had not previously been used by the general community and some health workers had to seek approval for this type of use.

The model of programme delivery was labour intensive for WHQW. A general fax was sent to health workers and technical support persons at possible sites, asking them to respond by return fax if they were interested in participating. This method was then followed up with telephone calls to answer any questions and to confirm their participation. This process could be delayed by a worker's availability, follow up response time and level of knowledge of

videoconferencing technology. It was sometimes difficult to locate a health worker who could incorporate the facilitation role for these sessions into their already busy workload.

WHQW developed a generic leaflet for each programme that asked women to contact the centre in Brisbane for local contact details for registration. This meant a two-step registration process, found to be unsatisfactory by some. However, because promotion in newspapers and on radio stations covered a number of viewing sites it was not possible to make the registration process any simpler.

Originally, each site was sent a pack of written material including: registration and evaluation forms; relevant journal articles and fact sheets; brochures relevant to WHQW's services and reply-paid envelopes. The cost of postage and photocopying and the time taken to post the material to each site made this impractical. Therefore, the resource support component for the programmes was reduced by using the written material available on WHQW's website.

The constraints of videoconferencing demonstrated the need for consistent application of costing and accessibility across all QT sites, and the need for the development of partnerships to embed the facilitation of the education programmes into health workers' roles.

Access to the bridges by WHQW for transmission of the videoconferences also posed some difficulties. WHQW attempted to offer the programme at a given time on the same day of the week each month (eg. 13:30 on the first Wednesday of the month). It was felt that afternoons would be preferable for women participants and that it would be easier to remember the same day and time of the month. However, the lead in time to make this consistency in the booking was not possible and the northern Queensland programme was conducted in the morning and at varying times.

At some sites, there was duplication of requests for use of the QT premises and, usually, WHQW videoconference participants were informed that the programme would not be broadcast or would be terminated earlier to accommodate use by health professionals.

One of the biggest barriers was cost. Each site seemed to have its own implementation of Queensland Health's policy regarding videoconferencing. For example, some sites suggested that they were encouraged to use the facility this way and the cost of the telecommunication was available in their budget. Other sites said that they were not permitted to dial up for any programme and, therefore, could not participate in WHQW sessions. Some sites questioned WHQW's estimation of the costs of the programme. Based on current information from the service provider, it was estimated that no site would pay more than \$200 for the entire programme, yet a number of health workers questioned this and said they had never received an invoice for less than hundreds of dollars per dial up connection. Some health workers declined to participate because no funding was available to cover the cost.

For community use of QT videoconferencing to be sustainable, accessibility policies for Queensland Health need to be developed and implemented consistently across all sites. This relates to: the booking and prioritising of venues and equipment; adequate financial resourcing of telemedicine for community use; including the facilitation of community access to videoconferencing in health workers' roles; and Queensland Health policy and procedural support for activities that the community have identified as priorities (eg. health topics using a broad definition of health).

It is important to place these comments within the context of constantly changing technology and to recognise that as these changes occur, the issues of access for community education will also vary. If telemedicine is to become a platform for community education then the needs of the community must be considered as well as those of health professionals.

Conclusion

The provision of health information to women via telemedicine is an uncommon application. There appears to be little or no published evidence to show that this is being attempted anywhere else in the world. The women who participated in the programme valued the opportunity to hear from and question a number of health experts without leaving their communities. The interaction with women throughout the State was also highly valued by the women participants. For WHQW, this technology enabled the organisation to meet its objectives of providing health information to rural and remote women. This method of service delivery is likely to become an integral part of WHQW services in future. Because of its success, WHQW will continue to enhance the implementation of its videoconferencing programme for health education for women and health care providers in rural and remote Queensland.

Acknowledgments

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25. Telemedicine and clinical genetics: establishing a successful service

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Summary

There is a surprising lack of published experience on the use of videoconferencing in clinical genetics practice. Patients were randomly allocated to either a telegenetic (cases) or face-to-face (control) conventional clinic. The telegenetic consultation was done by videoconferencing, using ISDN lines at 384 kbit/s. Evaluation by the doctor and counsellor took place immediately after each appointment. The patient was asked to evaluate the appointment by telephone questionnaire about four weeks after the event. 42 patients were invited to participate and 33 (79%) returned their consent forms. Four patients declined to participate and were seen in ordinary face-to-face clinics. Preliminary results showed that for the telegenetics consultations, the assessment by the doctors, counsellor and patient were very favourable when asked if they would be happy to use telemedicine in the future. For use in selected consultations, videoconferencing does appear to fulfil a useful role in clinical genetics.

Introduction

Genetic counselling has been defined as, "the process by which patients or relatives at risk of a disorder that may be hereditary are advised of the consequences of the disorder, the probability of developing or transmitting it and of the ways in which this may be prevented, avoided or ameliorated."¹ Pharmaceutical or procedural interventions rarely occur in clinical genetics consultations. The core of a clinical genetics consultation is thus the exchange of information between a health professional with specialist knowledge of genetics and a health consumer. The information that is exchanged can be complex, confidential, and emotionally charged.

Queensland is the most decentralised of all the Australian states. The Queensland population is about 3.5 million people. There is one clinical genetics service in the state, the Queensland Clinical Genetics Service (QCGS). All the doctors and most of the genetic counsellors in this service are based in Brisbane. The QCGS has regular clinics in nine hospitals in regional Queensland. The use of the existing Queensland Health telemedicine network appeared to be a natural extension of this visiting service. The successful use of telemedicine for many years by psychiatry services in Queensland was another incentive to adopt the same approach for clinical genetics practice.²

There is a surprising lack of published experience on the use of videoconferencing in clinical genetics practice. A report by Gray et al described a small study of eight patients. All the patients in this Welsh study had a high level of satisfaction with their telegenetics consultation.³

Methods

Patients were selected for inclusion in the study if they did not need a physical examination as part of the consultation. Patients with dysmorphic and neurological signs were excluded. Selection for inclusion was made on the basis of the information in a referral letter. Most patients who were included were referred because of a family history of cancer. An information sheet and consent form were posted to the patient. After return of the consent form, patients were randomly allocated into either a telegenetic (cases) or face-to-face (control) clinic.

Face-to-face sessions took place in an out patient clinic at the Royal Children's Hospital in Brisbane. Telegenetics sessions took place in the Centre for On Line Health at the Royal Children's Hospital. The location of the appointment was thus the same for the two groups.

Pre-clinic contact by a genetic counsellor was the same for both groups. This telephone contact helps gather important background family information and assess the patient's expectations. A family tree was drawn up. The family tree could be displayed by document camera, but it proved helpful to have a copy in the room for the patient to refer to during the appointment. The family tree is usually drawn on a single A4 page so that it can be faxed to a remote location easily. The genetic counsellor was in the room with the patient, but not on screen for the doctor to see. This counsellor took on the important responsibility of managing the videoconference equipment. This removed the burden of any technical duties from the patient and the counselling doctor. A document camera, paper and a thick black pen were available to transmit any written information during the consultation.

The telegenetics rooms had a single camera in each. The framing was close enough to allow good resolution of facial features and some hand gestures. Both facial features and hand gestures are helpful to pick up on non verbal cues. Telecommunication was by ISDN lines at 384 kbit/s, between two rooms that were in fact only 10 m apart.

Evaluation by the doctor and counsellor took place immediately after each appointment. The patient was asked to evaluate the appointment by telephone questionnaire about four weeks after the event. One counsellor (IM) and two doctors (MG and JM) were involved. The hospital ethics committee approved the study. Recruitment started in Sept 2000 and will finish in June 2001.

Results

42 patients were invited to participate and 33 (79%) returned their consent forms. Four patients declined to participate and were seen in ordinary face-to-face clinics. Twenty four patients have so far completed follow up. Sixteen of these patients were seen in telegenetics appointments and eight in face-to-face appointments.

The sample sizes are small and statistical analysis is not complete, but there were no obvious difference between patients seen in telegenetics or face-to-face groups. The participants were asked to rate agreement from one (strongly disagree) to five (strongly agree) for the following:

- communication was easy
- I was able to maintain eye contact
- the room was comfortable
- I was satisfied with the clinic format.

The results are summarised in Figs 1 and 2.

For the telegenetics consultations, the assessment by the doctors, counsellor and patient were very favourable when asked if they would be happy to use telemedicine in the future.

Discussion

The findings in this study are in keeping with Gray et al.³ For use in selected consultations, videoconferencing does appear to fulfil a useful role in clinical genetics. There are obvious advantages in telegenetics in decreasing the travel time and cost for patients to see a specialist. The present study was designed to remove this advantage for telegenetics by having the control and study groups both seen in Brisbane. The study was designed to assess the satisfaction with telegenetics in comparison with a face-to-face consultation.

A concern expressed by QCGS regional staff was that telegenetics clinics might replace current face-to-face clinics. It was important to reassure staff this was not the intention of this study. Videoconferencing should enhance rather than replace existing services. For example, telegenetics consultations have taken place from the regional centres of Toowoomba and Townsville to smaller and more remote locations.

There are limitations in videoconferencing. One limitation was that multiple family members are difficult to fit on screen at the same time. If the telegenetics consultation was one to one, this worked best. With a patient and partner telegenetics was acceptable, but with any more people telegenetics did not work well. It was difficult to select a better camera view whilst at the same time focusing attention on what was being said.

There can be some unexpected benefits from telegenetics. Hospital environments intimidate some patients. Hospital clinics can be associated with distressing events such as the treatment of cancer in a dying relative. Videoconferencing can take place in a wider variety of settings, and may one day be possible in many homes. Some patients maybe shy with a doctor face-to-face, yet more at ease and less inhibited in front of a television screen.

One barrier for telegenetics to overcome is funding. New funding is hard to get in the public health system and so existing budgets (which are often contracting) have to cover costs. Some regional centres have requested that the QCGS calls them, so that the telecommunications costs are not charged to the local budget. Savings to patients (and patient transport schemes) may not be obvious if people currently do not travel to obtain genetics advice. Genetics advice maybe important to people in regional Queensland but for many it remains a difficult service to access. Perhaps one day a rural health professional will request a clinical genetics consultation for a patient who can simply attend their local general practitioner surgery, or local hospital. Such consultations present valuable teaching opportunities. The videoconference facilities for this to happen already exist in many Queensland hospitals, but not one such request has yet been made by a rural health professional to the Queensland Clinical Genetics Service. The barriers are not just financial.

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Fig 1. Average score of agreement (1=strongly disagree, 5=strongly agree) attributed to statements by geneticists, counsellors and patients.

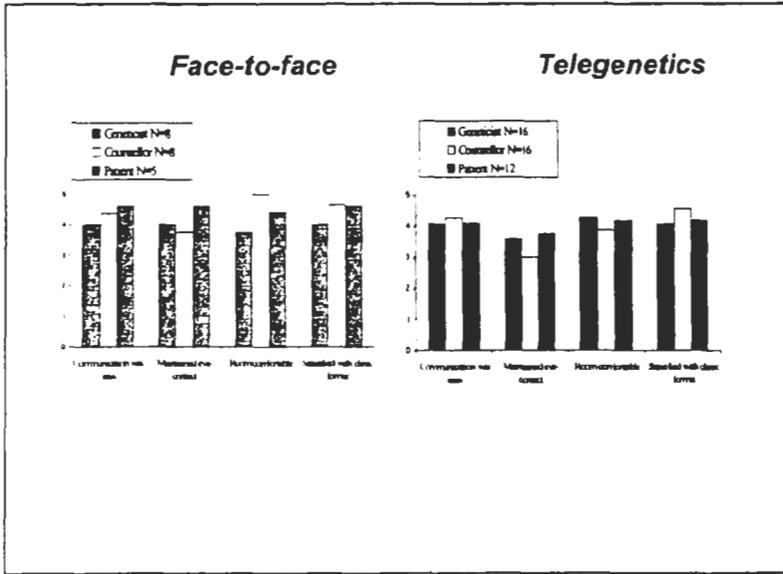
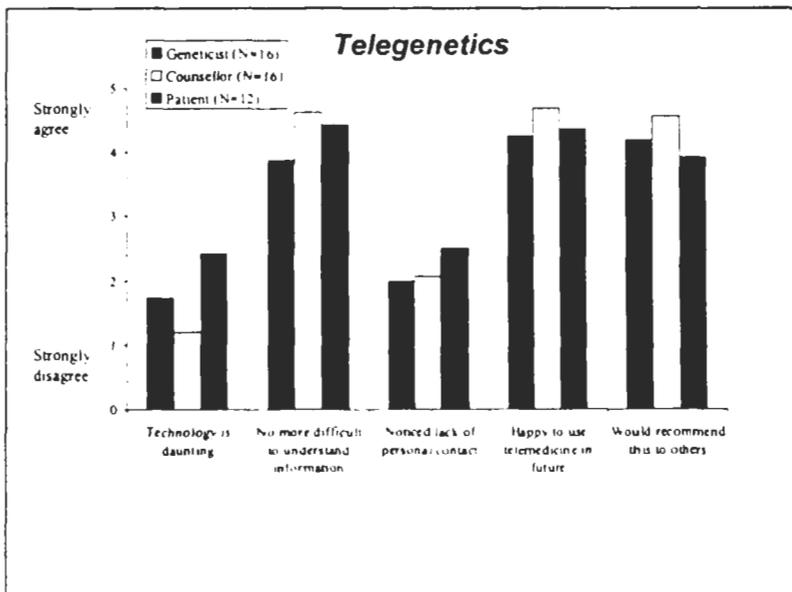


Fig 2. Average score of agreement (1=strongly disagree, 5=strongly agree) attributed to statements by geneticists, counsellors and patients for telegenetics consultations.



26. Pathology Grand Rounds by videoconferencing

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Summary

The development of a Queensland-wide videoconferencing network provided an opportunity to develop telepathology. In 1999 weekly videoconferences commenced with remote laboratories and clinical staff in four peripheral hospitals and the Royal Brisbane Hospital and in 2000 bi weekly videoconferenced Pathology Grand Rounds commenced Queensland wide with up to six sites from Cairns to the Gold Coast joining in or presenting. The average number of sites connected was 3.0 in 1998, 3.5 in 1999, 4.4 in 2000 and 4.5 in 2001. Problems included the complexity of the system, timing and need for bookings, coordination of presenters and presentations, time needed to organise sessions, set up linkages and advertise sessions and to attend the telepathology conference. Successful meetings have been associated with well prepared cases, time for discussion, attendance by all sites, timeliness of cases and responses and presence of experts to respond to questions as well as effective linkages and trouble free hardware. Future needs include better infrastructure and trained staff to coordinate the linkages and presentations. Telepathology has an important part in the provision of cost effective medical care in Queensland.

Introduction

Telepathology can be defined as the "Performance of pathology at distance using telecommunication links (optic fibre, communication satellite, ISDN)"¹. It may involve a frozen section service and consultation at a distance or conferences (using displays). The development of telepathology has been required due to shortages and disproportionate distribution of pathologists. Telemicroscopy involves remote control microscopy and is expensive. The use of a video camera on a microscope connected to a frame grabber of a PC and appropriate software can allow image distribution via the Internet to all connected clients. A chat function to exchange text and undertake discussions enables image structures to be highlighted.²

Telepathology is not a new concept. It was first described in 1924 in the magazine "Radio News" but it was not until 1980 that the first working demonstration was available. The cost at that time was prohibitive.³ A recent Medline search revealed 346 references related to telepathology with the majority reviewing methods of remote reporting of histopathology slides. This paper reviews the use of weekly and bi-weekly videoconferences between a base laboratory and 4-5 remote laboratories. The successes and failures of this service are analysed.

Methods

In 1998 Queensland Health set up a network of videoconference facilities across the State. These facilities and trained staff were based in remote, rural and major public hospital facilities. At the same time, the public hospital pathology laboratories were linked under one Queensland Health Pathology Service with a view to improving the standard of pathology services while not increasing the costs. A component of this was a single integrated computer system which enabled tests performed in any laboratory to be viewed by medical and laboratory staff at any other public laboratory. This facilitated results transfer between laboratories and decreased turnaround time as the validated result was immediately available to the requesting laboratory on line.

In order to improve the skills of the rural and remote laboratories and to break down communication barriers, it was decided to set up weekly videoconferencing from the Royal Brisbane site to discuss the pathology issues of ICU patients, and any other pathology issues that remote staff wished to discuss. All pathology disciplines except anatomical pathology were involved. A week before the conference, each participating laboratory was sent details of the discussion topics by email. Expert discussants were invited by the medical conference chairperson at the Royal Brisbane campus. Videoconference staff were responsible for making the bookings, soliciting topics for discussion and setting up and controlling the equipment for each meeting.

After the first six months the weekly Pathology Grand Rounds were also linked twice a month to the remote sites and the videoconferencing reduced to bi-weekly sessions (alternate weeks to the Grand Rounds). The Grand Rounds Programme was organised by pathology staff from the Royal Brisbane campus with passive participation from the remote sites except when they volunteered to present topics remotely (three different remote sites each year).

Results

50 videoconferencing meetings were held between 28/08/98 and 25/05/01, totalling 48 hours. There were nine meetings in 1998 (28/08 – Dec 98), 22 meetings in 1999, 15 meetings in 2000 and four meetings to 25 May in 2001 (alternating with Pathology Grand Rounds). The highest number of sites connected was seven and the lowest was two. The average number of sites connected was 3.0 in 1998, 3.5 in 1999, 4.4 in 2000 and 4.5 in 2001.

The highest number of topics in a session was 10 and the lowest was 1. The topics have included 133 related to microbiology, 31 to chemical pathology, 5 to haematology, 3 to immunology and 2 to anatomical pathology. There were eight management topics relating to the times and dates of the meeting, alternating with Pathology Grand Rounds and equipment issues. Five policies were developed. These included diagnosis and treatment of community acquired pneumonia, sepsis diagnosis and treatment, investigation and treatment of skin ulcers, ventilation acquired pneumonia diagnosis and treatment, and laboratory processing of fluid aspirates.

The presentation modalities included use of PowerPoint slides (precirculated), case discussion presented orally by junior medical staff, question and answer sessions, reviews of previously-faxed documents, use of digital photographs and expert comment from pathology staff or invited guests (infection control, infectious diseases, leprologist and parasitologist) on specific pre-set topics.

Attendance records were not kept for all meetings, but those that were often included the local rural medical superintendent, consultant physician, pathologist, laboratory staff, registrars, medical students, infection control staff, videoconference coordinator and anyone else interested, or free at the time the meeting was held. Inability to attend was more often related to equipment failure or pressure of work than to lack of interest.

Discussion

The ongoing support for the conferences, the differing presentation modalities, the variety of topics, cases and types of discussion and support from expert visitors has ensured the success of the telepathology sessions. The use of telepathology for rural and understaffed areas has been mooted since 1998⁴. The technique has been used for administrative issues, continuing medical education and video case conferences. Unresolved problems include problems associated with individual consultation preferences, State laws and ethics, privacy and confidentiality, concerns regarding malpractice claims, and reimbursement for private practitioners and other non-state government resources.

The use of PCs for videoconferencing and the image quality and transmission speed facilitate remote primary diagnosis, remote referral, remote teaching, remote presentation including post mortem and microscopic findings. The circulation of quality assurance images and feedback, and consensus diagnosis for clinical needs have all been advocated as part of telepathology.³ The technical problems include transmission speed (band width) and software, the complexity of the equipment, its relative lack of portability, the prior organisation required to ensure smooth running of the conference and the costs of maintaining staff and up to date and trouble free hardware.

Do the telepathology sessions provide value for the time and effort involved?

Videoconferencing is a relatively easy and quick way to disseminate new information widely, it allows remote sites to access a variety of expert opinions and for the learning experience to be widely shared. It can ensure that evidence is available to support decisions and add weight to decisions already made in some circumstances. It is cheaper than flying the patient to the base hospital or the consultant to the rural or remote site.

Nonetheless, the future of telepathology is not totally certain. Staff with expertise and commitment are required. Additional equipment, including digital cameras, additional PCs and other hardware (microphones, cameras) and improvement in bandwidth would all improve the technical infrastructure and communication. It is difficult to quantify the value of telepathology. The networking, trust and confidence built up over weeks of face-to-face communication spill over into after hours calls for advice and support and presumably better

and more cost-effective evidence-based patient care in remote areas lacking subspecialist pathologists. This may be hard to prove.

Acknowledgements

I thank the remote clinical and laboratory staff for persisting with the programme in spite of technical problems. I am also grateful to John Bryant for providing the support and drive for 2 ½ years and the clinical consultants who have willingly attended, often at short notice, to share their expertise.

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27. Some successes and limitations with telehealth in the Canadian health care system

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Summary

Canada has taken important steps towards establishing telehealth within its health care system. However, in many areas telehealth in Canada has yet to progress beyond the feasibility stage. A recent survey of eight Canadian telehealth programmes that are using videoconferencing indicated that so far there is little evidence of either clinical or economic benefits compared to conventional care. There are examples of sustainable, routine telehealth services in Canada. However, overall, the number of patients seen by telehealth is still very small in comparison to the number of face-to-face visits. 'People related' factors seem dominant in determining the degree of success of telehealth applications.

Introduction

Interest and involvement with telehealth in some parts of Canada is well established, with substantial planning and input to telehealth applications by different levels of government. However, while much activity has been evident at the research and pilot project level, this does not really reflect the success of telehealth as an area of health care technology. Success in telehealth can be taken to mean the extent to which it has made a sustained, worthwhile contribution to the operation of health services and the maintenance or improvement in health status. Appraisal of success in these terms faces difficulties because of the shortage of information. Watanabe et al.[1] have pointed out that while telehealth is increasingly evident in every Canadian province and territory, evidence for its effects on staff, use of health resources and health management is very limited.

Well documented, good quality studies which demonstrate the success of telehealth in the routine situation are still uncommon[2]. On the other side, information on failures and limitations of telehealth applications tends to be sparse due to the sorts of publication bias that affect descriptions of other health care technologies. This paper therefore can only present impressions gained from the recent literature and contacts with persons currently engaged in telehealth activities in Canada, with some emphasis on the province of Alberta. A more comprehensive view would require detailed health services research that has yet to be carried out.

Methods

Relevant reports relating to telehealth applications in Canada were reviewed. In particular, information was drawn from a recent report from the Canadian Coordinating Office for Health Technology Assessment[3], a systematic review of literature on controlled studies on telehealth applications[2], and selected articles that reported Canadian experience.

Results

Some indication of the status of videoconferencing applications in Canada is provided by the recent report by Noorani and Picot[3]. This study included a survey of eight programmes, which operated 150 of approximately 250 videoconferencing telehealth sites in Canada. There has been considerable activity in these programmes, which are using videoconferencing for consultations, patient and staff education, patient therapy and health administration. Six programmes have added more applications since their implementation. Most are expanding in scope and activity, though one programme had been cut back, because of a lack of interest by the regional hospitals in the teleconsultation services offered.

Videoconferencing use had an effect on the utilization of face-to-face assessments in six programmes, on the timing of care in five, and on the certainty of diagnosis in four. In five programmes videoconferencing use had an effect on other measures of quality of care, including patient acceptance/comfort level and long distance travel.

While there are successes in these programmes, and development is continuing, the level of activity so far is not all that high. The eight programmes between them had 2493 patient-related sessions per year. Annual numbers of patients per programme varied from 240 to 1224 with a median value of 408. In addition, 1812 education sessions per year were provided (224 per programme). Noorani and Picot commented that in comparison with face-to-face visits, the number of patients seen by telehealth in Canada is relatively small.

Responses to the survey indicated that there are still a number of unresolved health professional issues in several programmes. There are also some familiar practical difficulties,

including increased workload for coordinators and other individuals, telecommunication problems, lack of medical practitioner support and higher equipment costs than anticipated.

The survey results suggested that establishing systems for patient care using videoconferencing is feasible, but there is little evidence of either its clinical or economic benefits compared to conventional care. Noorani and Picot suggest that organisational change and medico-legal issues are probably the two areas where videoconferencing in telehealth in Canada still faces its greatest challenges. In their view, videoconferencing in telehealth in Canada is in a state of transition between pilot project and programme status.

Looking at individual programmes, there is a similar indication of a mixture of success and limitations. Some telehealth centres have operated for many years, giving a good indication of sustainability. Memorial University of Newfoundland has been continuously involved in telemedicine activities since 1975[4]. The Hospital for Sick Children in Toronto established the feasibility and cost savings associated with telemedicine consultations for paediatric cases some years ago[5], and continues to be active in this area. A controlled study by Finley et al.[6] considered the effects of echocardiogram transmission in paediatric cases, with six regional hospitals being linked to a tertiary-care hospital in Halifax. They were able to demonstrate net cost savings through transportation avoided. Use of telemedicine prevented unnecessary patient transfer in 31 cases over a two year period. The quality of the transmitted data was acceptable, with no important discrepancies between telemedicine and repeat, 'in person' studies.

However, even long term programmes may face pressures that will prevent successful operation. Elford et al. noted that while child telepsychiatry was well established and accepted in Newfoundland by the provincial government, it is no longer being conducted on a regular basis because the number of child psychiatrists has decreased and those that remain are overworked[7]. If there are not enough health professionals to use a telehealth system, its full potential cannot be realized.

In Alberta, telepsychiatry has been shown to be a sustainable service that has improved access to mental health services for persons living in small communities at a realistic cost[8]. The telepsychiatry network coordinated by the Alberta Mental Health Board (AMHB) has now expanded to include 20 sites in the province. Satisfaction with the service by patients and health professionals remains high. One of the limitations is the poor coverage of clients at some sites. Low utilisation of the network by some centres was a feature in earlier experience with this application[8] and currently five of the videoconferencing centres in the network have fewer than 10 consultations per year. Features associated with this low usage include the telehealth coordinator not being directly involved in mental health service delivery, changes in the coordinator and increased local availability of psychiatric resources (Stayberg, personal communication).

The AMHB has also been involved in a successful tele-education initiative. There are currently links to 37 sites including 12 in remote locations in the Northwest Territories and Nunavut. Usually, 8-10 sites register for each session. In the year to March 2001, the AMHB participated in 97 sessions (Stayberg, personal communication). This service has been received enthusiastically and will continue. Limitations have been the relatively poor distribution of educational material from the remote sites to local communities and minor participation by some health professionals.

Remote radiology consultations in Alberta have also shown promise. Johnson et al. evaluated the adequacy of a tele-ultrasound service in High Level, a small community in the north of the province, with remote sonographer supervision from Edmonton[9]. The tele-ultrasound service was helpful to the referring physician, made transfer unnecessary for 42% of patients, and influenced management in 59%. Another remote region in Alberta, Keeweenaw Lakes,

developed a system to transfer ultrasound images from a small rural hospital a radiology clinic in Calgary[10]. This service seemed to be acceptable to clients and reduced the 'no show' rate, but had the limitation of being expensive, at least in the initial stages, with a breakeven point well above any likely caseload[11]. With both of these tele-ultrasound services, there have been some continuing challenges in maintaining provider coverage.

A final example from Alberta provides a reminder of the continuing importance of applications that use the ordinary telephone network. Brown et al. evaluated the effect of support for telephone caregiver groups compared with face-to-face, on-site caregiver groups in a Brain Injury Programme at a major rehabilitation hospital in Edmonton.[12] They were able to demonstrate similar improvements in outcomes from both groups, with the telephone group having fewer difficulties on all measures at all measurement intervals. The cost per person for those in the telephone groups was \$375, whereas the cost of sending a professional to a rural group 300 km from the city would be \$500. Telephone groups offer a realistic method of providing support and education to rural caregivers in a situation where it is not possible to bring them to hospital or provide local support on a regular basis. In the two years since publication of the study, use of telephone groups has increased and now extends to a Spinal Cord Injury Programme.

Discussion

The Canadian examples described above give some indications of successes and limitations of telehealth services under current conditions. As in other health care systems, the degree of success is associated particularly with factors related to the degree of need for the service, the structure of local health care and, crucially, on 'people' factors including acceptance by clients, health care professionals and operators of the telehealth services.

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28. The point of referral barrier - a factor in the success of telehealth

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Summary

A feasibility study has been carried out to test the hypothesis that for an effective telehealth service, a full-time coordinator is required to act as a single point of contact for consultation requests. By shifting the responsibility for telepaediatrics from the referrer to the provider, the telehealth process becomes equally (or more) attractive than the conventional alternative. Preliminary results show that within six months, telepaediatric activity increased to an average of 8.5 hours per month (13 consultations). Not only have certain health care services become more accessible to children and their families in remote areas of Queensland, but significant savings have been made. At least 12 patient transfers were avoided to and from the tertiary facility.

Introduction

Queensland is a large state and subspecialist services are concentrated into the south-eastern corner. There is an extensive telemedicine network. However, usage data[1] suggests that activity is mainly educational and that telemedicine is significantly under-utilised as a method of delivery of clinical services. This is symptomatic of a wider problem: telehealth usage in Queensland – and elsewhere – is patchy, and it is self-evident that the technique is not being used to its full potential. One reason is the disincentive to use telehealth at the point of referral – it is not as convenient to set up telehealth consultations as it is to refer a patient through the conventional system. What is required therefore is a new approach in which, by shifting the responsibility from the referrer to the provider, the telehealth process becomes equally (or more) attractive than the conventional alternative.

Pioneering work in the field of telepaediatrics was carried out at the Royal Children's Hospital (RCH) in 1997/8 and the feasibility of a range of clinical applications was established[2]. However, subsequent adoption of telepaediatrics as a routine method of service delivery did not occur and the latest data from Queensland Health indicate that activity has now almost ceased. In May 2000, clinical activity accounted for only 8% of total videoconference usage in Queensland[1].

Methods

A six-month feasibility study began in November 2000. The telepaediatric service was established at the RCH in Brisbane. The service was offered to two regional Queensland hospitals - in Mackay and Hervey Bay. Both intervention sites were given exclusive access to a single mobile telephone number. This number was a direct link to the telehealth coordinator. The telehealth coordinator received all referrals from these areas and was responsible for facilitating the most appropriate response.

The telehealth coordinator liaised with the clinicians and coordinated the necessary response. Responses varied and included either a return telephone call from a specialist, an email message, or a consultation with specialists via videoconference. Once a referral was made, a response was confirmed within 24 hours.

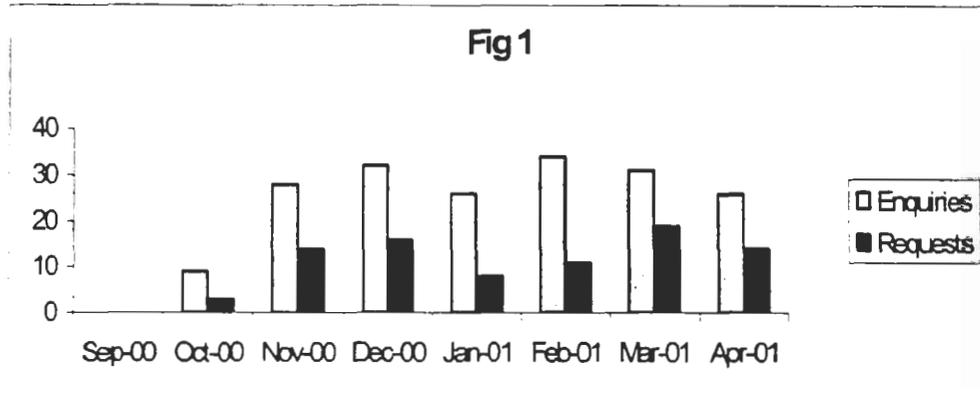
As part of the study, the existing videoconference equipment at the intervention sites was assessed. Improved videoconferencing facilities were required for effective clinical consultations to take place. Each site also required direct access to three ISDN lines for a bandwidth of up to 384kbit/s.

Equipment was loaned by the Centre for Online Health and the Royal Children's Hospital. The equipment included a 5100P (Sony) videoconference system, large screen monitors, PC scan converters, and a document camera. Two videoconferencing systems were built in the Centre for Online Health, transported and installed in Mackay and Hervey Bay.

Results

In the first six months the telepaediatric service facilitated 85 consultations, of which 81 (95%) involved direct/indirect clinical care. The remaining 4 consultations involved point to point clinical education sessions (Fig 1).

Fig 1. Activity

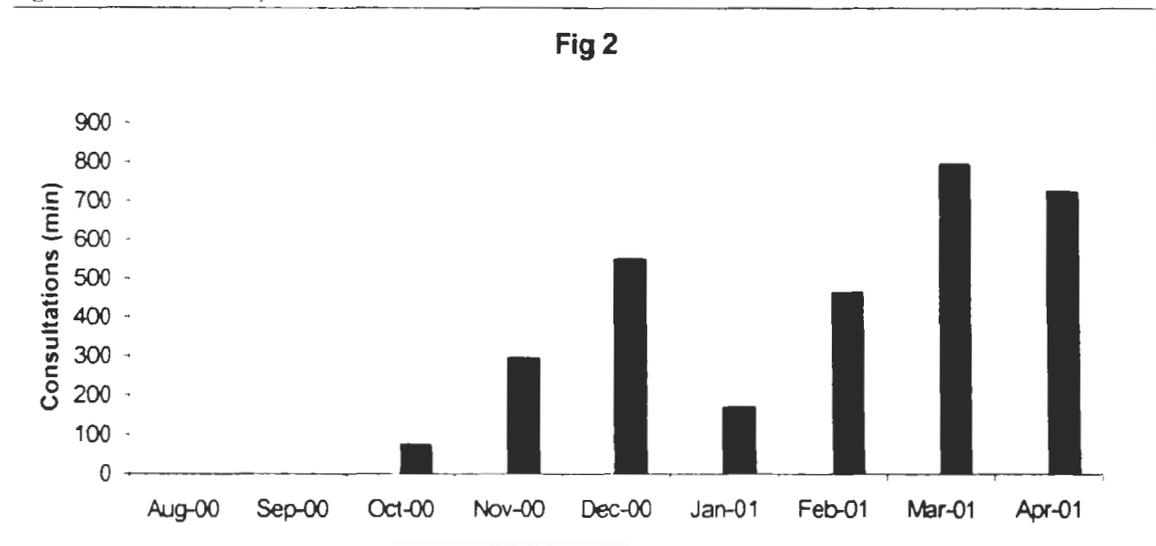


67 (80%) telehealth referrals initiated from the intervention hospitals. 18 referrals (20%) initiated from other sites, mainly through growing awareness of the project at the RCH. A number of consultations outside of the scope of the study were facilitated as a means of helping local clinicians gain confidence and understand the value of this technology in their practice.

Clinical consultations

In April 2001, six months following the commencement of the telepaediatric project, clinical consultations via videoconference increased to an average 7.8 hours per month with the principle purpose being direct indirect patient care (total 46.7 hours) (Fig 2).

Fig 2. Clinical activity



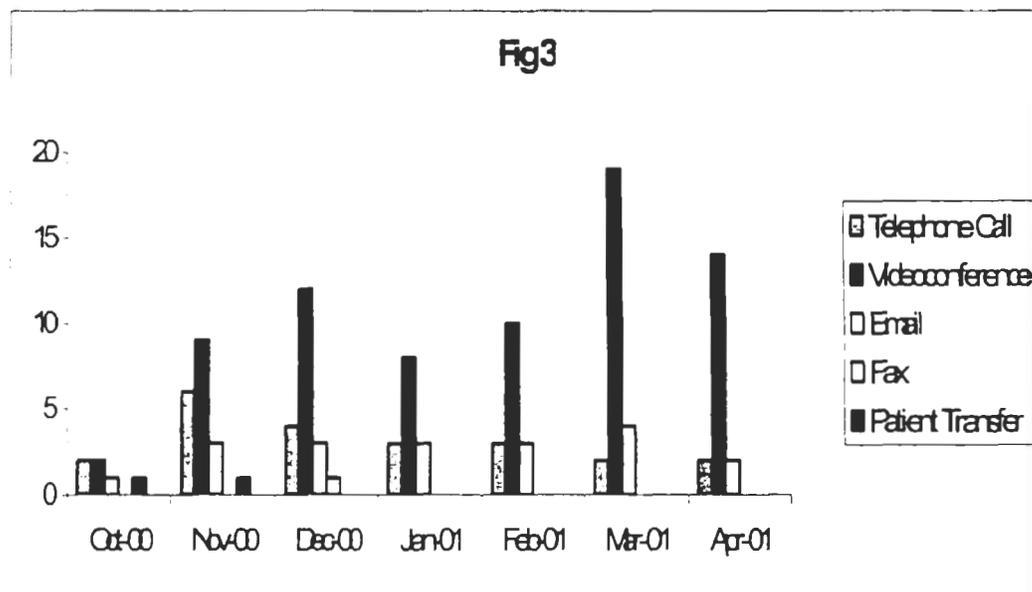
The telepaediatric project provided a range of multi-disciplinary services, including:

Cardiology	Haematology	Psychiatry
Burns	Diabetes	Respiratory medicine
Oncology	Gastroenterology	Physiotherapy
Nephrology	Rheumatology	Dermatology
Rehabilitative Medicine	Orthopaedics	Infectious diseases
Endocrinology	Neurology	Speech pathology

Applications

Clinical consultations via videoconference accounted for over 85% of referral responses. Other responses included either the transfer of information via fax, mail, telephone or in the rare circumstance, direct patient transfer (Fig 3).

Fig 3. Referral outcomes



Interesting telehealth applications included:

- real time transmission of echocardiograms for assessment by a cardiologist (tele-cardiology)
 - transfer of CT images, X-rays and case notes via a video document camera (eg. neurosurgery)
 - transfer of digital photographs (eg. tele-dermatology, burns) (Fig 4)
 - observation of gait analysis via preset camera views (rehabilitation)
 - patient education and demonstration of medical equipment (asthma/cystic fibrosis education)
 - full day patient clinics with tertiary based specialist team (eg. diabetes)
 - patient examination and neurological assessment (eg. tele-neurology)
- patient education sessions and follow up consultations (eg. tele-oncology)

Fig 4. Telepaediatric session in progress - burns consultation



Savings

A review of the case reports showed that the telepaediatric project prevented at least 12 transfers to the RCH. Savings were estimated by determining the cost of air travel of the patient accompanied by one parent and accommodation for a one-night stay. The savings made between November 2000 and April 2001, amount to \$18,000. This is a conservative estimate.

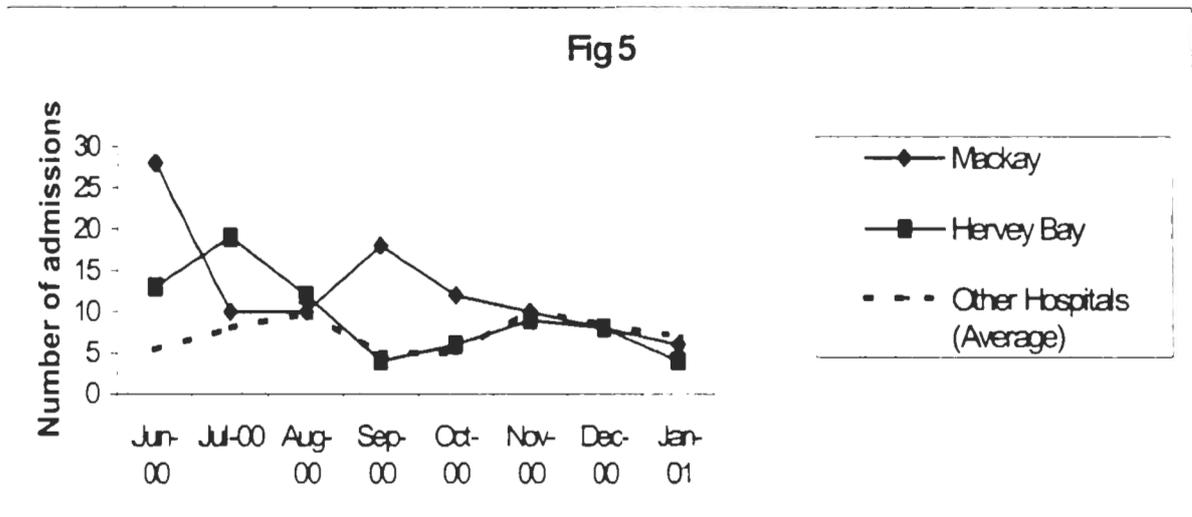
Health service delivery

Other benefits included improved planning and coordination of outpatient and inpatient services. Patients requiring admission following a videoconference with the specialist were able to discuss the admission and better understand what would happen once they arrived at the hospital. Clinicians were also able to plan tests and investigative procedures, thus avoiding unnecessary delays following the arrival of the patient.

Patient admissions

Data were collected from both the intervention hospitals and a number of other hospitals throughout Queensland for comparison. This information was useful for distinguishing general patterns in the number of admissions/outpatient appointments from intervention sites and activity in other regional areas. Other hospitals included Bundaberg, Cairns, Mt Isa, Rockhampton and Townsville (Fig 5).

Fig 5. Admission activity of intervention and other hospitals



Discussion

The telepaediatric service proved valuable for the coordination and delivery of health services to patients in rural and remote areas of Queensland. We found that by providing a direct and convenient tele-referral service for the referring practitioner, telepaediatrics became an increasingly popular technique. By transferring the responsibility of telehealth coordination from the referring practitioner to a central telehealth coordinator, clinical consultations at a distance became an easier option versus the conventional method of transferring a patient to Brisbane.

A challenge in the process of encouraging clinicians to consider telehealth, was gaining a good understanding of what was required for an effective consultation. Depending on the discipline, requirements were generally based on the type of information to be transported and the quality of transmission required. With this information, we were then able to adapt the technology to best meet the needs of the specialist.

Clinicians at the RCH in Brisbane have been very supportive of the service as have staff in the regional hospitals. The potential for continued growth in telepaediatrics is evident and we aim to gradually develop the service to include a larger number of hospitals.

Acknowledgments

The telepaediatric project is a joint initiative of the Royal Children's Hospital and Health Service District in Brisbane and the Centre for Online Health at the University of Queensland. I thank the site coordinators in Mackay (Dr Michael Williams) and Hervey Bay Hospital (Dr Jasper Van der Westhuyzen) and Professor Richard Wootton for their contributions to the study. I am also grateful to the clinicians who have contributed their time and expertise.

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29. Online consulting. The experience of a commercial service

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Summary

Doctor Global Ltd commenced online consulting in April 1999. It was one of the first online medical consulting services in the world. Doctor Global does not derive a significant portion of its income from providing or supervising online consultations via its website, although experience with enabling them has been important for the development of its core product, a consumer-centric web-based electronic medical record.

Introduction

Doctor Global Ltd commenced online consulting in April 1999. The rapid growth in web traffic, the majority health related, was the incentive for the development of a service to allow members of the public to ask advice of specialist clinicians via the Internet. The rationale was that consumers would realise that they were unable to assess the validity of health data obtained from the web and would require the assistance of a clinician for interpretation and application of the information to their circumstances. With an increasing number of consumers using the web to seek information and the total online health market forecast to be worth billions of dollars it was felt that the capture of a small proportion of this growing market was both achievable and commercially viable. This paper describes the lessons learnt from this experience.

Doctor Global was one of the first online medical consulting services in the world and was two years ahead of any other such service in Australasia. It has arguably the most extensive experience in this form of practice of any enterprise in the world.

Methods

A website was developed that allows access by a nominated clinician to patient information placed on a secure server by way of the consumer completing a consultation form. The site also allows access to the clinician opinion after auto-notification. The website provides very little in the way of generic medical content being solely for the purpose of consulting a clinician and developing a personalised medical record. Appropriately-qualified practitioners were sought to act as consultants and sub-specialty clinics were created. Consumers can choose their consultant of choice after viewing a photograph and reading a short biography.

To gather the maximum amount of information on which to base advice during the first transaction, questionnaires were designed which were related to each particular sub-specialty. A systems review is included to elicit information that the consumer may not view as relevant to the consultation. Based on the answers to the screening questions, supplementary questions to expand on symptoms detected by first level questions are automatically asked. For example if fever is elicited on symptom review, further questions are automatically asked to help determine the cause of the fever.

After completion of the consultation form, consumers are required to pay by entering their credit card details onto a secure financial transaction site contracted by Doctor Global. Doctor Global has no knowledge or record of the credit card details. Individual practitioners are free to set their fees for initial and follow-up consultations and can change these via the website. By a similar automated process clinicians can also notify users of times when they are not available to consult.

The Doctor Global service was developed in a regulatory vacuum with no laws or professional guidelines to assist development or define standards. The Doctor Global Clinical Advisory Board[1] (CAB) developed a code of conduct adapted from conventional medical ethics on which to base its processes. A significant part of this code was subsequently used by the New Zealand Medical Council to write its *Guidelines for Doctors Using the Internet*.

The design of Doctor Global medical services has been guided by experienced clinicians. From the outset it was decided to adopt the business ethic of "what is best for the patient is best for business". Doctor Global views online consulting as just one part of the patient-doctor communication continuum, designed to enhance conventional care. As simply another form of communication alongside face-to-face communication, the radio, telephone and the fax machine it has its own advantages and disadvantages. The guiding principles for Doctor Global services are to maintain privacy and confidentiality, to act in the consumers best

interests, to support and enhance the consumers' normal health care network and to educate the consumer to be proactive in managing and taking responsibility for their own health.

Doctor Global's privacy policies reflect those of the Australian National Privacy Principles,[2] and give consumers the ability to read and contribute to their record, control who can view the record and view an audit of when and who accessed the record. Doctor Global's code of conduct and security policies are readily available from its website. High level security measures maintain the privacy and integrity of stored data and all data are encrypted during transfer to the server. Information is not sent by email. Access is restricted by unique passwords controlled by the consumer and granted to providers. A medical record cannot be viewed by a clinician without the prior (automated) approval of the consumer.

To ensure quality of care, clinicians undertake a process of authentication, skills assessment, training, certification and ongoing peer review. This process is supervised by the CAB and is both labour intensive and time consuming. Clinicians are provided with five trial consultations and after completing them, they are given two model replies of different style plus feed back on any deficiencies in their own reply. The key assessment areas are comprehension and understanding of the issues that need to be addressed, accuracy of medical advice and degree of empathy with the patient's situation. In a process of continuous quality improvement, the first twenty consultations by the clinician are monitored for quality by the CAB with patient identifying data removed to ensure privacy. After this period consultations are audited at random.

Doctor Global does not derive a significant portion of its income from providing or supervising online consultations via its website, although experience with enabling them has been important for the development of its core product, a consumer-centric web-based electronic medical record. To date the web site has been used for development purposes and little money has been spent on advertising Doctor Global consultation services. All visits to the site have been prompted by media articles, word of mouth or contact through search engines. Using the web-based medical record and an application service provider model, our business focus has been to enable every health provider and consumer to exchange information via the Internet whether that be for conventional outpatient or hospital care, preventative health programs, executive health services, occupational health and safety or enhancing the risk management of an insurance product.

Results

Financial and business outcomes

In the past, the number of hits or unique visitors to a website were frequently used to measure the success or otherwise of a website. This was based on the most common revenue model of advertising to as many eyes as possible. The more visitors you have the more likely you are to sell advertising space on your site. This model has proved unsuccessful and is not relevant to Doctor Global as it does not seek to attract advertising nor to provide free content.

What is more significant to online providers is the number of people who proceed to a consultation. Our statistics show that approximately 5% of visitors to the site register as clients and approximately 10% of these proceed to a consultation over a twelve month period. Strategies have been developed to increase these conversion rates.

As expected, the return from consultations generated by a unique and isolated web-site based health service does not alone sustain the investment required to build infrastructure, develop questionnaires, train practitioners and maintain quality. It is doubtful whether the marginal cost of adding more consultants, developing more clinics and reaching more clients with

advertising would be low enough to reach a breakeven point with greater volumes of work at this stage of market maturity. The reasons for this are discussed later.

Privacy and confidentiality

There have been no episodes of patient data being viewed by unauthorised people or of the data base being hacked. System availability has been greater than 99.8% with authorised access to data available seven days a week, 24 hours a day.

Quality of providers and quality of advice

An interesting aspect of the Doctor Global experience is that it has attracted high quality consultants who are both keen to extend their care to a wider audience and are prepared to be pioneers in a new process of care. By necessity applicants have been entrepreneurial, open to new ideas and prepared to practice under intense scrutiny. Their confidence is backed by broad experience and an excellent knowledge base. The Clinical Advisory Board has been impressed by the quality of their care. Applicants assessed unsuitable by the registration process have been rejected as consultants.

Doctor Global has not received any negative feedback about the quality of advice given by the consultants and the level of positive feedback has been high. For privacy reasons, only feedback that patients have nominated as available for promotional use can be given as examples.

“Dear William, I wrote to my insurer and thanks mainly to your email (sic) I got a cheque in the mail within a week, no further questions asked. Thanks again, with kind regards, WB.”

“Dear Dr Peters

Just a note to thank you for your advice. I now have a new GP, an appointment with an endocrinologist next weekend (sic) then off to a neurologist after that. This was all within 20 mins of meeting the new GP. I'm not usually one to give up on people and thought that I would try my old GP one more time, only to end up very distressed by his attitude. I think, like your father, I have been telling everyone just how great the new one is. Being able to print off my consultation from Dr Global has been very helpful. I'm feeling pretty exhausted by the whole thing - I now tend to get so nervous when I see someone that I freeze. I will now go off to my specialists armed with my notes (and my mother) and hopefully get this sorted out. I really appreciate the help and advice you have given me. I really like the idea of having my health record on-line. It seems such a sensible step. I intend to organise all our records with Dr Global. If each Doctor or Specialist that members of my family have seen had access to the it would have made things a lot easier for us. As my husband has travelled a lot his medical (sic) notes are sitting somewhere gathering dust in some forgotten medical practise. He very seldom goes to the doctor, so when he became very ill with pancreatitis, there was no history to go on and no notes were now want to have records like this in a place where they are easily accessed and I believe Dr Global can offer this amongst many other services. Anyway, thanks again. Kind regards Name withheld.”

Many journalists and medical groups have sent Doctor Global questions to test our competence and entice us into making unwarranted or “incorrect” diagnoses or to prescribe drugs of addiction. We have passed all these tests without adverse comment.

In a televised report of survey by the public affairs program “Holmes” in New Zealand Jan 2001 which tested five sites with two “dummy” questions each, Doctor Global was rated good for both whereas three of the sites were regarded as unacceptable or downright dangerous

The NZ Herald made the following observations in May 1999:[3]

"A new Internet doctor service launched last week for patient consultations is giving sound advice, says a medical expert. But he doubts whether the New Plymouth-based Doctor Global is worth the \$30 fee on top of seeing your own GP. The cyber doctor got back well within the promised 48 hours after being contacted by a reporter and the New Zealand Herald's expert, Associate Professor Ross McCormick of the Auckland University School of Medicine, said his computer diagnosis of a throat ulcer was spot on. Doctor Global correctly stated that there were a number of causes for mouth ulcers including infections from viruses, bacteria and yeast (thrush). The cyber doctor said an ulcer might also be caused by trauma such as swallowing a bone or drinking a hot drink. Usually those ulcers would have settled within two weeks. Professor McCormick, a doctor and lecturer in primary health care, said: "Doctor Global has given good, sensible advice. I like the recommendation that you see your GP, but I would suggest it reads a bit like the advice you get from a doctor in a women's magazine and perhaps the role for this particular service is as the agony aunt of the medical profession. I would suspect that people may prefer to get advice such as this by ringing their practice nurse who knows them or their family. I don't really see it being worth \$30."

Glynis Horning of *Femina* magazine in South Africa was very impressed.[4]

"CALL ME OLD-FASHIONED, but I like my doctors looking me in the eye when I regale them with my intimate physical details. I take comfort in the cold press of a stethoscope on my skin, the hiss of a blood pressure cuff inflating around my bicep. And I don't start feeling better until we've compared notes on our kids, the economy and the latest cinema releases. Yet house calls are giving way to mouse calls, and online doctors, who dispassionately dispense diagnoses and treatments through cyberspace from across the globe, are proliferating faster than you can say 'ah'. It's been estimated that the Internet now has more than 15000 medical websites, and it's disquieting news to many folk -not all of them simply old-fashioned. Any website may shelter charlatans, but when medical advice is dispensed, the consequences could be deadly.

It was, then, with a mix of curiosity and naked suspicion, that I took three different ailments to three different medical websites to try them out.

Fortunately I was not genuinely afflicted, as just accessing the most appropriate sites, let alone navigating them and registering for payment, raised my blood pressure and brought on a headache.

Here are the symptoms I presented to cyber doctors, along with their responses, and critiques of these by the GPs who had kindly furnished me with the symptoms in the first place.

The ailment

Ovarian cysts. It was agreed these would be a good test of any GP's ability, cyber or otherwise. They're often asymptomatic, but can include pain in the lower abdomen, slight bleeding between periods and discomfort with deep intercourse. These complaints should draw a diagnostic range from appendicitis, spastic colon, or urinary tract infection, to malignant or benign ovarian cysts. "At www.doctorglobal.com I found Dr Denise Limby. In her cyber waiting room, I admired a portrait of a young woman wearing doctorly white and smiling engagingly. Limby, it seems, has a diploma in Obstetrics and Gynaecology, and has conducted sexual health and family planning clinics for more than five years. I was treated to a short public health quiz, considerably more entertaining than the tired gardening magazines in most waiting rooms: 'Could I get crabs on a toilet seat? Could my partner who's never had an STD give me one? Could I still get STDs with a condom on? Could thrush treatment make condoms ineffective?'

To receive 'some honest, accurate, straightforward and confidential advice on any sexual medical matter', I was invited to 'proceed to the consultation room'.

Inside, I was greeted by a multiple-choice Female Consultation Questionnaire on which I had to tick everything from my sexual orientation to my contraception method, 'Safe sex practice,' and STD history: 'Warts, chlamydia, genital herpes, syphilis' . and other shades of Monty Python's Cheese Shop. Then came a list of 'Other important health conditions', from pregnancy to diabetes, and it was finally time for me to type in my 'Current medications/ drugs/ current problems/symptoms' and 'Question to be answered'.

Minutes later I received an e-mail thanking me for my consultation request and promising a reply within 48 hours. This was Friday afternoon. By Sunday the same time I'd received a lengthy email from Dr Limby.

Her diagnosis astonished me with its accuracy, detail, and readable, even caring manner. 'Dear G,' she began, 'There are a number of possible diagnoses.' (Spot on!) 'I wouldn't be able to give you a definite diagnosis without a) more information and b) examination and investigation' (cautious and sensible), 'but I can tell you about the most likely possibilities and how you can best sort out the problem.' She did just that, in depth. 'You need to see a doctor for an examination,' she concluded. I felt I could trust this woman, and would have considered the NZ\$30 (about R95) fee well spent even if the credit card I'd used were my own and not the FEMINA Financial Manager's.

The local GP

My doctor was as impressed and surprised as I was. 'I would never have thought it possible to arrive at a diagnosis as accurate as this without a personal consultation,' she conceded. 'This doctor's good. There's nothing misleading here, and she's left nothing out, even listing the probable conditions in the most likely order. It's obvious that she has considerable clinical experience and isn't just an academic. She's responsible too, referring you for an examination. I doubt even a top local gynaecologist could improve on this.'

Doctor Global has received one adverse opinion from a self professed medical ethicist who stated that: [5]

"The key claim I am making is that Doctor Global is morally wrong. It is morally wrong because, with today's limited technology, the method of service delivery exposes patients to greater risk (than the face to face alternative) without compensating benefits. If this is true, then I believe the Medical Council, as the statutory body responsible for keeping the public safe from doctors, has a duty to close the site down."

Help desk support

In general we have had to provide little help support from our "help desk" for users to negotiate the online process. It is not certain whether the low conversion rate from being a registered client to actually doing a consultation reflects a significant impediment to users whether that be a usability issue, lack of need or cost.

Provider satisfaction

Providers have commented on the ease of use of the system and the satisfaction with being selected by a patient in great need of a solution to their problem. They find they can readily empathise with the patient's situation and empower them with knowledge to interact more effectively with their local health care infrastructure, both important components of care. Surprisingly there is a real sense of an effective doctor-patient relationship. This is reinforced by the high rate of positive feed back from clients.

Many replies take considerable time and research to ensure the best of advice and remuneration may at times be marginal. This can be addressed by triaging the problem to the most suitable consultant. It is possible to respond to three or more consultations per hour.

When the lack of overheads and the ability to practice from “no fixed address” are taken into account, the returns can be very satisfactory.

If the frequency of consultations are very low the task of checking for consultations daily can become onerous. However most doctors review their email messages daily for other reasons.

Reduction in morbidity and mortality

The number of consultations performed, the variety within them and the lack of a control group has made it impossible to assess other than anecdotally whether there has been an actual reduction in morbidity or mortality from the advice given by Doctor Global's consultants. Similarly measurements of cost savings by more efficient use of, or reduced access to, other healthcare services has not been possible.

Discussion

Many factors are acting to discourage wider consumer acceptance of online health services. The most important factor is lack of trust in security arrangements and a general inability by the public to understand the risks involved with new technology. While accepting travel in motor vehicles that approach each other at speeds of 200 km/h and pass each other metres apart, some consumers perceive the risks of storing health data or using credit cards on line as being much higher. Security for medical records using electronic means far exceeds the security afforded to current paper records. Most records in hospitals are accessible by all medical and nursing staff without audit and general practice files are open to loss and theft from a simple act of breaking and entering a non secure office.

As with any major process change, user resistance is to be expected irrespective of the potential benefits. This needs to be managed carefully. For example our experience has brought to light group of conservative, technophobic members of the medical profession who have immediately assumed that by the mere fact of communicating with patients via the Internet, clinicians will perform incompetently and make ill conceived and dangerous diagnoses. Maintenance of clinical standards is a matter of concern across the health industry and is certainly not confined to e-health. Perhaps the anarchic nature of the Internet engenders a lack of confidence and fear in some. The processes of medical practice are information driven and with time, experience and familiarity, the providers' and consumers' perceived risk of information technology will equate more closely to the actual risk. Only then will medicine realise the full potential of the Internet's communication abilities.

Online services are not yet integrated into the complete process of care. Patients respect the opinions of their carers and unless Internet transactions become a recognised way for data to be exchanged in health, uptake will be slow. The health industry lacks far behind other sectors in the use of the Internet for information exchange, largely because of the sensitivity of the information conveyed.

In the Australian market in particular with a government funded health insurance scheme the expectation is for “free” medical care. There are no barriers to obtaining multiple opinions from various providers with no direct cost to the consumer.

Regulations to support Internet practice especially in the USA, Canada and Australia which have multiple state-based regulations, require country-wide medical registration to deal with cross border issues and to allow patients to obtain redress for advice given by doctors not registered in their home state. International data flows also need to be considered. As an example of a restricted trade practice, 40% of Doctor Global consultations were from the USA initially but these have been restricted due to US laws that prevent citizens of some states being treated by physicians not registered in that state.

There has been little published information to confirm the effectiveness of online consultations. This is necessary to encourage third party payers like Medicare, district health boards, health maintenance organisations or health insurers to fund online consultations. Insurers in the US have begun to fund e-health care in certain situations.

The media tends to promote a version of events that encourages controversy and promotes divided opinion within the profession. Most media reports stress the contentious issues, and create unrealistic perceptions about privacy risks rather than convey the concept that there is a broad acceptance within the profession that improved information transfer supported by appropriate standards will do much to enhance health care.

Measures of success for a private business venture in health are ultimately reduced to profitability and return on shareholder investment rather than improved patient outcomes. In most cases those products that result in better health outcomes lead to higher demand and therefore business profitability. However, because of the difficulty a consumer has in measuring the quality of their own care this is not always the case. As an example, despite little or any evidence for the effectiveness of the complementary therapy of homeopathy many consumers continue to invest in such services. Thus the pressure to maintain and improve standards of care often comes from within the medical profession itself or via regulations imposed by the government and sponsored by interested consumer advocates. A successful private health enterprise therefore requires input both from ethical medical practitioners and a proven business management team.

Based on this concept and the available measures of service quality Doctor Global Ltd has had considerable success with developing an effective online consultation model although it seems clear that the model of consumers going to an unadvertised website not linked to the patient's conventional health system is not in itself financially viable at present. By all other measures including patient perception, provider satisfaction and proof of the effectiveness and useability of the concept, the exercise has been very successful. Doctor Global is concentrating its resources on providing its communication facility and electronic health record to all doctors as an efficient means of staying in touch with clients, administering evidence-based care with rules, documenting non face-to-face interactions, enabling care plans with multiple provider inputs from different locations, providing automated recall systems, facilitating the application of online wellness services and surveys, and as a way for individuals to input data longitudinally from the home either directly or via electronic sensors for subsequent remote viewing by clinicians.

By adhering strictly to the medical ethic of maintaining confidentiality and acting in the patients' best interest Doctor Global has progressed from a stage at its launch where it was perceived by a representative of the New Zealand College of General practice to be "snake oil peddler". It is now an acknowledged and respected organisation within the medical profession. For the same reason we have avoided the commercial pitfalls of other Dot Coms that have fallen into disrepute by attempting to generate revenue from unethical practices such as prescribing sight unseen, selling patient data without consent and inappropriate advertising to consumers.

Acknowledgements

I thank Tom Mulholland for his vision and enthusiasm, my fellow members of the Clinical Advisory Board for their contribution to the development of Doctor Global and Ashley Smith for assisting in the collation of the material required to write this document. Doctor Global is a registered trademark.

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30. The development of a pilot telemedicine network in Scotland: lessons learned

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Summary

A pilot telemedicine network was established in eleven sites using funding provided by the Department of Trade and Industry. The main purpose of the project was to develop and evaluate clinical and educational links between central and peripheral sites in Scotland. The results were very encouraging and clinical services were established in accident and emergency, tele-ultrasound and clinical psychology. An undergraduate medical education teaching service was also successfully established. All of these services are to be continued after the completion of the project. Many lessons were learned during the establishment of this network which will be useful in future projects. These included the importance of training for telemedicine users, the importance of identifying a telemedicine champion, the pitfall of health economics and the fact that services must be needs driven.

Introduction

Telemedicine has developed rapidly over the last decade and is now becoming accepted as an effective means of delivering clinical care and education¹⁻⁷. Funding for the initial development of a small telemedicine network was provided by the Department of Trade and Industry. Sufficient funding was provided to purchase ten telemedicine systems (Sony 5100 videoconferencing units with a 51 cm display monitor and a purpose-built trolley). The main purpose of the project was to develop clinical and educational links between central and peripheral sites in Scotland.

Methods

Ten sites were identified to receive videoconferencing systems. These sites were selected on the basis that they were prepared to provide or receive a telemedicine service. The systems were located as follows (Fig 1):

Central sites

- Accident and Emergency Department, Aberdeen Royal Infirmary
- Royal Cornhill Psychiatric Hospital, Aberdeen
- Ultrasound Department, Aberdeen Maternity Hospital
- Remote Health Care Unit, University of Aberdeen

Peripheral sites

- Gilbert Bain Hospital, Shetland Isles
- Balfour Hospital, Orkney Isles
- Peterhead Community Hospital (Grampian)
- Dr. Gray's Hospital Elgin (Grampian)
- Turriff Community Hospital (Grampian)
- Huntly Community Hospital (Grampian)
- Raigmore Hospital Inverness (system already in place).

The services provided from central sites included accident and emergency advice, clinical psychology, tele-ultrasound and medical education. A data collection form was developed and distributed to the central and peripheral sites. Data were collected for a period of 15 months relating to general network information and the four main services.

Results

General network

The total number of registered calls was 1003. These comprised clinical (553), test or training (260), education (150) and administrative (40). There was a high level of user satisfaction recorded. Technical faults comprised <2% of calls. One site recorded no clinical or educational use of telemedicine systems.

Accident and emergency

A high level of user satisfaction was recorded. Local clinical management was possible in 89% of cases.

Clinical psychology

Almost all clients found it easy to communicate via teleconferencing. Clinical improvement was demonstrated in all cases.

Medical education

Five of the six subject areas were very satisfied. 200-250 consultant days/year were saved. There was no statistical difference in the examination results for telemedicine teaching

Radiology

The transfer status of the patient was not altered when teleradiology was used. There was no significant difference in clinical management when teleradiology was used.

Discussion

The project overall was deemed to be a success since a high degree of user satisfaction was demonstrated and the clinical/educational services are to continue after the completion of the project. There were however a number of areas that caused concern and could thus be described as lessons learned.

Training of the telemedicine users was taken very seriously in the project. Problems were still encountered however when new members of staff were used without our knowledge and no formal telemedicine training was given. This aspect is so important that we are about to introduce a telemedicine licence without which you will not be able to practice. Only one of the sites failed to use the telemedicine systems to any client/provider advantage. After careful examination of the possible causes it was felt that the lack of a telemedicine champion at that site was the fundamental reason. In the current financial climate it is very difficult to justify services which are more expensive. The clinical psychology service to Shetland did not previously exist and by definition introduced a new cost, although without doubt increasing the quality of care. Thankfully this was recognised and the service is to be expanded. One of the educational topics taught by telemedicine was much less successful than the other five. One of the main reasons for this was that it was felt that this subject could have been taught using local expertise.

Acknowledgements

We thank the Department of Trade and Industry for funding the project and Grampian Health Board, Grampian University Hospitals Trust, Grampian Primary Care Trust, Raigmore Hospital, Shetland Health Board and Orkney Health Board for allowing the project to proceed.

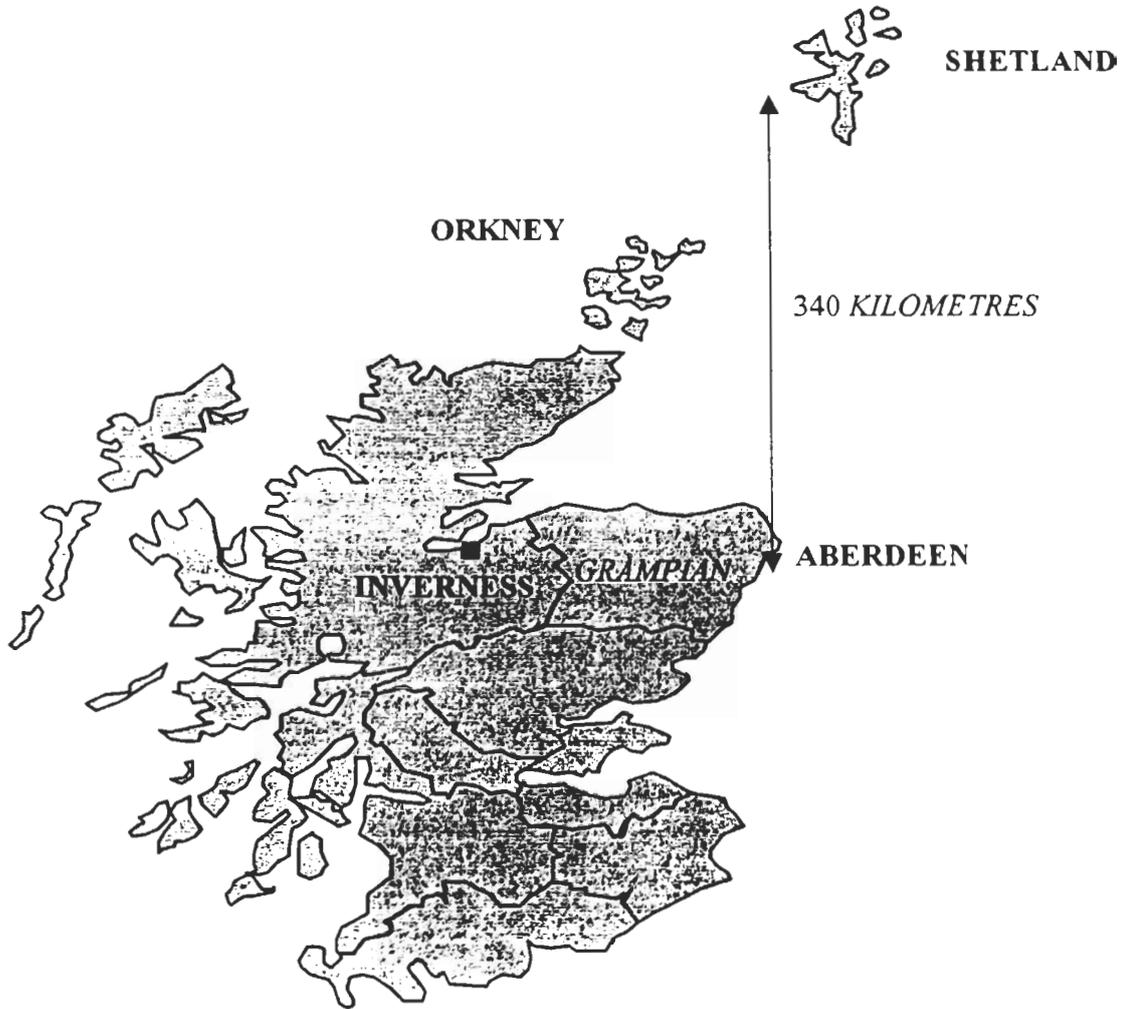
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Fig 1

TELEMEDICINE SITES



52. Patient satisfaction using telemedicine: a comparison study in geriatric patients

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Summary

Studies of patient satisfaction are continually needed to provide feedback to the medical community about rapidly changing telemedicine technology. We accumulated data during 1998 from geriatric patients living in a retirement community based on their experience with telemedicine (1 encounter/week for eight weeks). Comments were generally positive based on responses recorded using a Likert scale. A similar study was conducted with random patients at the same site (2 ½ years later). The results were once again positive and appear to show an even better response than those obtained with the previous study. With this in mind, though the pilot study was small (20 patients- 18 reporting), this trend may reflect an increased acceptance for telemedicine applications among geriatric patients. Larger studies are needed to substantiate this claim.

Introduction

As interest in telemedicine grows so do its potential applications. Increasingly telemedicine advocates are asked to provide objective evidence that patients feel comfortable using the equipment, that the equipment provides accurate information, and that patients find the equipment user friendly and reliable. Assessments of patient satisfaction are constantly needed because of the rapidly developing technology[1,2].

In approximately 1997 the Mayo Clinic in Jacksonville developed a telemedicine programme to assist in remotely assessing patients with chronic medical problems that included hypertension, diabetes mellitus, chronic lung disease and congestive heart failure. The program focused on people living in retirement communities in the Jacksonville area. An initial study was performed in the summer of 1998.[3] The experiment was repeated using the same protocol in early 2001.

Methods

In both studies (1998 and 2001) 20 volunteers were recruited from the Cypress Village Retirement Community in Jacksonville. The volunteers were selected at random from those who attended a 30-min orientation session that described the experiment and a general overview of telemedicine. Participants then presented once a week for approximately 15 min to a central location where the telemedicine equipment was located. Participants connected with a health care professional at the Mayo Clinic located approximately 3 km from the retirement community.

The telemedicine equipment was either connected by ISDN (Electronic House Call, Cybercare) or by the ordinary telephone network (Aviva, American Telecare Incorporated). Using ISDN or PSTN-based videoconferencing the telemedicine visit consisted of recording the patient's temperature, blood pressure, pulse oximetry, weight and listening to the patient's heart and lungs. Following their eight weeks of visits, patient satisfaction was recorded using a five-point Likert scale (a response of 3 was neutral).

During the 1998 study, only the CyberCare Electronic House Call model 400 and 600 were used, while during the 2001 study, both Cybercare's (updated) 400 and 600 model were used along with the American Telecare Aviva Model.

Results

18 of the 20 volunteers completed a questionnaire in both 1998 and 2001. The results are summarised in Table 1. Patients were more comfortable using the telemedicine equipment in the more recent study. Patients were better able to see and hear the health care provider and there were fewer technical problems that could have prevented completion of the visit. More patients reported that they felt the equipment recorded their vital signs accurately in the recent study. None of the participants experienced discomfort using the equipment and more participants would agree to pay a fee for telemedicine services than previously recorded. As in the 1998 study, the majority (72%) felt that using telemedicine equipment had a positive effect on their relationship with the health care provider and none felt that there were negative effects.

Discussion

Over the last few years there have been significant advances in information technology[4]. Different kinds of communication media are becoming more widespread and less expensive[5]. Because of these developments more and more individuals are coming into contact with advanced technology. Their opinions and views are changing as new

applications are being introduced. Based on the results of the present study, patients are more satisfied with their telemedicine experience than two years previously. Factors that may explain this include: improved, more reliable and patient friendly equipment, technology-aware patients who have had longer exposure to information technology, a change in people's perceptions that computers can be used in the delivery of medical care, and the rapid developing interest in Internet activity.

The acceptance of telemedicine into the mainstream of medical care will require a change of the current model of patient care[6]. Patients who demand increased medical care, availability, convenience and lower costs will probably drive the introduction of home care using telemedicine. Physicians, on the other hand, may be less inclined to accept this form of medical care delivery. The perceived increased risk for malpractice, unfamiliarity with computer technology, reimbursement issues, costs for set up and user fees are all issues that will have to be addressed – not to mention a fundamental change in the patient care model that relies heavily on the healing touch of the physician. Nevertheless, the public can be expected to demand home telemedicine and physicians will be challenged to provide it.

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Table 1. Patient satisfaction using telemedicine: results from 1998 and 2001

	Comment	No. agreeing	% (95%CI)	No. agreeing	% (95%CI)
		1998	1998	2001	2001
1.	I am comfortable using the telemedicine equipment without assistance	11	61 (36-83)	15	83 (59-96)
2.	I need assistance while using the telemedicine equipment	6	33 (13-59)	5	27 (10-53)
3.	I could clearly hear the health care provider at Mayo Clinic Jacksonville	8	44 (21-69)	18	100 (81-100)
4.	I could clearly see the health care provider at Mayo Clinic Jacksonville	5	28 (10-53)	17	94 (73-100)
5.	Sometimes there were technical problems with the equipment	14	78 (52-94)	4	22 (6-48)
6.	Problems with the equipment sometimes prevented completion of the videoconference with the health care provider	5	28 (10-53)	0	0 (0-19)
7.	The telemedicine monitors correctly recorded my vital signs.	13	72 (46-90)	17	94 (73-100)
8.	I experienced pain or discomfort while using the telemedicine unit..	1	6 (0.1-27)	0	0 (0-19)
9.	Using the telemedicine equipment had a <u>negative</u> effect on my relationship with my health care provider	1	6 (0.1-27)	0	0 (0-19)
10.	Using the telemedicine equipment had a <u>positive</u> effect on my relationship with my health care provider	11	61 (35-83)	13	72(46-90)
11.	I would use the telemedicine equipment again.	14	78 (52-94)	13	72(46-90)
12.	I would use the telemedicine equipment again, but only with assistance.	5	28 (10-53)	7	39(17-64)
13.	I would be willing to pay a fee to have the telemedicine unit in my home	2	11 (1-35)	8	44(21-69)
14.	I would be willing to pay a fee for an expanded version of the telemedicine unit that would provide access to a Mayo Clinic Jacksonville physician 24 hours a day, 7 days a week.	4	22 (6-48)	8	44(21-69)
15.	I would participate in this type of study again.	15	83 (59-96)	11	61(35-83)

*of 20 participants, 18 reported results. CI= confidence interval

53. Connecting the primary and the acute health care sectors

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A recent project to implement electronic clinical messaging between General Practitioner (GP) clinics and a hospital outpatients department has been unsuccessful. Nonetheless, the project has facilitated the formation of relationships between vendors and hospital departments from which has developed a more satisfactory model of message delivery. The GP Links project commenced in 1999 to implement secure electronic messaging between sites using dedicated software and Internet email. Electronic referral letters were generated by the GPs and sent by email to a selected outpatient clinic at the hospital. The outpatient clinic sent an appointment summary back by email. Five large group practices close to the hospital were to participate in the project. These practices were chosen because they were deemed to have the appropriate IT infrastructure and were moving towards the use of electronic clinical records.

Theoretically the software should have been able to support the simple messaging. However a series of problems developed during the implementation phase that were never resolved. These included problems with the software, change management within the outpatient department and also the GP clinic, lack of organisational support, personality conflicts and inter-state technical support. Finally, the vendor ceased operating and the project stopped. The project failed to deliver in its original model.

In endeavouring to maintain the relationship with the GPs, alternative means for electronic linkages were sought. The GPs requested integrated software instead of having to use a separate package. Utilising developments in the GP's desktop patient management software, the project continues today with an integrated solution, using public key infrastructure and email. Further integration at the hospital end is being explored.

56. Minimum acceptable standards for digital compression of a fetal ultrasound video clip

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Summary

If the Internet could be used as a method of transmitting ultrasound images taken in the field quickly and effectively, this would bring tertiary consultation to even extremely remote centres. The aim of the study was to evaluate the maximum degree of compression of fetal ultrasound video recordings that would not compromise signal quality. A digital fetal ultrasound video recording of 90 s duration was produced, resulting in a file of 512 MByte size. The file was compressed to 2, 5 and 10 MByte. The recordings were viewed by a panel of four experienced observers who were blinded to the compression ratio used. Using a simple seven-point scoring system, the observers rated the quality of the clip on 17 items. The maximum compression ratio that was considered clinically acceptable was found to be 1:50 - 1:100. This produced final file sizes of 5-10 MByte, corresponding to a screen size of 320 x 240 pixels, running at 15 frames per second. This study expands the possibilities for providing tertiary perinatal services to the wider community.

Introduction

Queensland has a population of about three million people, and is the second-largest state of Australia. Much of this population is concentrated in the larger centres of Brisbane, Cairns and Townsville, but many communities are remote, with little, if any, timely access to specialised services. Obstetric ultrasound is an accepted method of diagnosis and assessment of fetal anomalies, but the quality of the service varies widely between tertiary and peripheral units. Telemedicine offers the opportunity for real-time specialist referral, with reductions in anxiety for delayed referral, disruption to family life, and travel costs.

Current telemedicine communication mainly relies on ISDN lines. They are relatively costly and are limited to larger centres where ISDN access is available. If the Internet could be used as a method of transmitting ultrasound images taken in the field quickly and effectively, this would bring tertiary expertise to more remote centres, using just a portable ultrasound machine, a lap-top computer and modem. The aim of the present study was to investigate whether fetal ultrasound analogue video clips could be compressed to a stage where they could be emailed to tertiary centres for expert opinion, without significant degradation of the image, and loss of diagnostic certainty.

Methods

Five fetal ultrasound video clips, including views on normal brain, four-chamber of heart (normal grey scale), power Doppler of heart, colour Doppler of heart, and fetal abdomen were selected from a de-identified normal fetal morphology videotape. These segments of the original videotape were played on a video player, which was connected to a digital camera. The digital camera digitised the clips and stored them on a PC in an uncompressed format. The five clips were then linked together to make a single clip of 90 s duration, with a file size of 512 MByte. This 'normal morphology' clip was then compressed from the original file size of 512 MByte down to 2, 5 and 10 MByte respectively. Each of these file sizes corresponded to a frame rate of either 15 frames per second or 25 frames per second, and in a screen size of 320 x 240 pixels or 640 x 480 pixels. There was thus a total of 10 recordings, including the uncompressed version.

The ten recordings were played to a panel of observers in random order. Four experienced tertiary ultrasound specialists, blinded to the compression factor, evaluated the image clarity. Using a simple scoring system of 1-7, the observers rated the quality of the clip on 17 items. Twelve of the items referred to the clarity of specific fetal structures such as the cerebellum, ventricles, interventricular septum and outflow tracts. A score of 7 denoted image quality the same as the digitised uncompressed video. A score of 1 denoted image quality as uninterpretable, and a score of 4 as just clinically acceptable. Five further items were scored to reflect the overall image quality. These included: overall image clarity; screen size used; cropping of the image (whether the area of anatomical interest was displayed adequately on the screen); whether the observer could tell what he/she was looking at; and whether he/she was happy to rate the structure as normal or abnormal. These five items were also scored on a scale of 1-7, with a score of 1 being very poor, 7 being very good, and 4 as just acceptable. This method of scoring has been validated in a previous study[1]. The examiners were instructed not to discuss their assessments with one another, and an independent observer was present during the assessments to ensure this. The results were collected, collated, and entered into a database by an investigator who was unaware of the study code at that time. Analysis was then performed using the statistical package SAS[2].

Results

Table 1 summarises the specifications, including compression factors, for the video clips generated in this study. The mean score for each video clip was calculated for each observer,

and the factors that could affect the mean scores were evaluated. The Duncan's Multiple Range Test for variable was used for the multiple comparisons, with $p < 0.05$ considered to show statistically significant differences.

Table 1. Compression ratios of normal morphology clip

Clip number	File size (MByte)	Frame rate (fps)	Frame size (pixels)	Compression ratio
1	10	15	320 x 240	1 : 51.2
2	5	25	320 x 240	1 : 102.4
3	10	25	640 x 480	1 : 51.2
4	512	Uncompressed	Uncompressed	1 : 1
5	2	15	640 x 480	1 : 256
6	5	15	320 x 240	1 : 102.4
7	10	25	320 x 240	1 : 51.2
8	10	15	640 x 480	1 : 51.2
9	5	25	640 x 480	1 : 102.4
10	5	15	640 x 480	1 : 102.4

Inter-rater error

The overall mean scores (and standard errors) for the four observers were 3.80 (0.40), 4.02 (0.33), 4.03 (0.36), and 4.32 (0.26) respectively. The inter-observer variation in the mean scores was not significantly different ($P > 0.05$). All observers (except observer 1) scored the clips as clinically acceptable, and the standard error increased as the mean score decreased.

Frame rate

The mean score for a frame rate of 15 per second was 3.85; and that for 25 frames per second was 3.85. They were not significantly different from each other ($P = 0.96$).

Screen size

When comparing screen size using Duncan grouping, the 320 x 240 pixel screen was rated significantly better (mean score 4.39) than the 640 x 480 pixel screen (mean score 3.42), $P = 0.0006$.

File size

Since the screen size (but not the frame rate) significantly affected the mean scores, the effect of file size was analysed according to each screen size used (Tables 2 and 3). When the screen size was large (640 x 480 pixels), the mean performance scores for the uncompressed clip, and the compressed clips (10, 5 and 2 MByte) were all significantly different from each other (Table 2). Both the scores for the 5 MByte and 2 MByte clips were below 4, and were considered clinically unacceptable. In particular, the score for the 2 MByte clip was very poor (2.38).

At the smaller screen size of 320 x 120 pixels, the uncompressed clip (512 MByte), with a mean performance score of 5.74, still performed significantly better than the compressed clips. However, at this screen size, the 10 and 5 MByte clips were not significantly different from each other, and the mean performance scores were both above 4 (4.67 and 4.12 respectively), indicating that they were both clinically acceptable.

Table 2. Overall performance of normal fetal morphology clips with 640 x 480 pixel screen size

File size (MByte)	n	Mean performance score	SE	Duncan grouping
512	4	5.74	0.39	A
10	8	4.09	0.27	B
5	8	3.27	0.12	C
2	4	2.38	0.32	D

Duncan's Multiple Range Test for variable was used for the comparisons. With alpha = 0.05, Duncan grouping with different letters (A, B, C and D) indicates that the mean scores are significantly different from each other ($p < 0.05$). A mean score greater than or equal to 4 implies that the clarity of the clip was clinically acceptable.

Table 3. Overall performance of normal fetal morphology clips with 320 x 240 pixel screen size

File size (MByte)	n	Mean performance score	SE	Duncan grouping
512	4	5.74	0.39	A
10	8	4.67	0.18	B
5	8	4.12	0.23	B

Duncan's Multiple Range Test for variable was used for the comparisons. With alpha = 0.05, Duncan grouping with the same letters (B) indicates that the mean scores were not significantly different from each other. Both the 10MB and 5MB video clips had mean scores greater than 4, indicating that the clarity of the clips were clinically acceptable.

Discussion

The advantages of access to tertiary-based experts for those in peripheral centres are well recognised. The possibility of complications in pregnancy places significant stresses on parents, and prompt referral to a tertiary centre can reduce parental anxiety in most cases, and maximise the quality of counselling by those with ongoing care of the patient. Telemedicine enables such pathways of care without the stress of physical removal from a familiar community for the patient, and facilitates easier discussion by the attending obstetrician with the tertiary-based expert. In the majority of cases, a definitive diagnosis could be made via the telemedicine link[3].

Unfortunately, telemedicine in its current format still has some disadvantages. Many systems are still relatively expensive and not necessarily user friendly. Most clinicians are unwilling to operate the systems without some technical assistance, which can be expensive and difficult to obtain. Consultations can be time-consuming. Establishing and maintaining rapport with the patient can be difficult without the personal contact of a consultation in the flesh, although many of these disadvantages have not been borne out in studies examining these aspects of telemedicine[4].

There are several advantages of using the Internet for fetal telemedicine consultations. Firstly, most clinicians are familiar with electronic mail. Second, the speed at which compressed video clips can be transmitted means that, if the first recording was found to be inadequate by the expert, new recordings could be made and resubmitted for examination. Third, the ability to transfer video clips easily opens up possibilities for teaching and education not hitherto possible. Finally, the vast distances of Australia, coupled with the

ready access to the Internet, make this a particularly suitable format for disseminating clinical information.

The file sizes for uncompressed ultrasound video clips are usually very large. In the present study, a single clip of 90 s duration was 512 MByte. For efficient transfer in the Internet, compression needs to be performed. Compression runs the risk of loss of clinical information, and may affect the diagnostic accuracy.

Inter-rater (observer) variability

We found that the inter-observer variations were not significantly different.

Frame rate

Frame rate normally has a significant effect on video quality. At a given data rate, higher frame rates produce smoother motion with lower image quality while lower frame rates produce sharper images with "jerkier" motion. The present study showed that frame rate did not significantly affect the mean scores. This may be because the difference between 15 frames per second and 25 frames per second was only 1.7-fold, and the eye can easily compensate for the differences.

Screen size

At a given a data rate, the larger the screen size, the lower the image quality. This is because the total number of pixels remains the same, so that each pixel is larger in a larger screen. In the present study, the 640 x 480 pixel screen performed significantly worse than the 320 x 240 pixel screen. The images in the 640 x 480 pixel screen size were much more "blocky", as one observer described it, and deteriorated further with fast moving images such as in fetal cardiac examination, or those requiring a faster frame rate such as with colour or power doppler. In the present study, screen size affected the image quality much more than the frame rate. This may be explained by the fact that increasing the screen size from 320 x 240 to 640 x 480 pixels is actually a four-fold increase, which is much greater than the 1.7-fold difference between 15 and 25 frames per second.

File size

The file size is proportional to the degree of compression applied. At compressions of 1:50 to 1:100, where the original clip size of 512 MByte was compressed to 10 and 5 MByte, the scores for image quality were not significantly different to the uncompressed control ($P>0.05$) at the smaller screen size. Both scores were above 4, indicating that they were clinically acceptable. At the larger screen size, the image quality was further compromised, and only the file sizes of 10 MByte or the initial uncompressed clip were considered clinically acceptable (scores 4.09 and 5.74). When the compression was 1:256 (final file size 2 MByte), the image quality was assessed to be clinical unacceptable, with a very low mean score (2.38).

The maximum compression ratio that was considered clinically acceptable was therefore determined to be 1:50 to 1:100. Final file sizes of 5-10 MByte, with screen size of 320 x 240 pixel, running at 15 frames per second, were therefore determined to be the minimum acceptable standard for digital compression of a fetal ultrasound video clip.

Conclusion

The results of the present study show that video clips of fetal ultrasound can be digitised, compressed and displayed on the computer without clinically or statistically significant loss of diagnostic certainty or image clarity. Specifically, favourable compressions produce clips

of 5 or 10 MByte file sizes (i.e. compression factors of 1:50 – 1:100), displayed at a frame rate of 15 frames per second and a screen size of 320 x 240 pixels. Further evaluation in the form of clinical trials for diagnostic accuracy when dealing with fetal anomalies is therefore justified.

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Index

B

Barry, CJ	113
Begg, L.....	161
Blignault, I.....	33
Bowater M.....	41
Bratton, RL.....	156
Brebner, EM.....	151
Brebner, JA.....	151
Brooks, P.....	3

C

Chan, FY.....	15, 161
Coles, W.....	127
Collins, R.....	33
Constable, IJ.....	113
Cook, D.....	32
Cowell, S.....	90
Crowe, BL.....	96

D

Doolittle, GC.....	32, 79
Dossetor, D.....	63
Duffill, M.....	107

E

Eddie, G.....	161
---------------	-----

F

Faoagali, J.....	127
Faulkner, K.....	117

G

Gasser, L.....	33
Gattas, MR.....	122
Gelber, H.....	57
Gogler, J.....	160
Gulube, SM.....	85

H

Hailey, D.....	131
Hawker, F.....	74
Hebert, MA.....	5
Henderson, C.....	113
Hockey, R.....	161
Howard, A.....	27
Hughes, E.....	23

I

Isles, AF.....	1
----------------	---

K

Kavanagh, S.....	74
Kopel, H.....	63

L

Leslie, S.....	142
Lim, AC.....	99
Loane, M.....	122

M

MacMillan, JC.....	122
McCrossin, R.....	44
Meinecke, I.....	122

N

Nunn, K.....	63
--------------	----

O

Oakley, A.....	107
----------------	-----

P

Price, L.....	127
---------------	-----

R

Rademaker, M.....	107
Ruddick-Bracken, H.....	151

S

See, AC.....	99
Short, TM.....	156
Shumack, SP.....	99
Siebert, D.....	127
Smith, AC.....	136
Soong, B.....	15
Stachura, ME.....	112

T

Tually, P.....	90
----------------	----

W

Walker, J.....	90
Watson, D.....	15
Watson, J.....	33
Whitehall, J.....	15
Whitten, P.....	32
Wootton, R.....	5, 122, 151, 161
Wynchank, S.....	85

Y

Yellowlees, P.....	52
Yogesan, K.....	113

