Telemedicine across the ages

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ABSTRACT

- Telemedicine can help improve access to health care for people in rural and remote communities, but its uptake has been slow and fragmented.
- A telepaediatric service in Queensland, initiated in 2000, has made use of mobile "robot" videoconferencing systems. It has been cost-effective and well accepted by patients and clinicians.
- Telegeriatric services were instigated in Queensland in 2005, principally using videoconferencing. Telegeriatrics has been ideal for frail older patients in remote areas.
- For telemedicine to become a mainstream service, its focus must move beyond simply the provision of equipment and network connectivity.
- Telemedicine must be funded adequately if it is to be successful.

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The "tyranny of distance" presents significant challenges for the Australian health industry, and is often a central reason for inequity of access to specialist services in rural and regional communities.

The health care choices for patients in these areas are usually limited, particularly for patients with prolonged acute or chronic illnesses. The problems are amplified when communities are widely dispersed, and Queensland is a classic example. Queensland, the second largest state in Australia, spans about 1600 km from east to west and 2400 km from north to south. More than two-thirds of Queensland's 4.2 million people live in the south-eastern "corner" of the state, about 18% (770 000) live in major towns along the east coast, and 15% (650 000) are widely dispersed in remote townships.[1] Many smaller towns developed around rural properties, mine sites or Indigenous communities.

Patients from rural and regional areas usually have no choice but to travel, and this generally means an inconvenient and costly journey far away from home, often with an end result of a 5- or 10-minute specialist appointment. Alternatively, specialists or specialist teams may travel to regional centres for outreach clinics. These visits are usually short (1 or 2 days) and intermittent, and involve the sacrifice of valuable clinician time during transit to and from the regional centres.

For many years, there has been much promise for the widespread use of telemedicine (the delivery of health services across a distance using communication methods such as videoconferencing and email) to support patients, especially in remote areas. The opportunities and benefits of telemedicine have been researched and discussed previously.[2,3] Logical reasons for conducting telemedicine include the large distances involved and centralisation of specialist services in major cities. However, the uptake of telemedicine has been disappointingly slow.

Success in telemedicine

In our experience, once the appropriate infrastructure is established, the success of telemedicine depends on the administrative and clinical systems supporting it. Attention must be given to scheduling, clinician and patient preparation, ease of access to telemedicine facilities, and sharing of clinical data and reports between sites.

It is important to consider the incentives for clinicians to participate in telemedicine. The conventional method of patient referral to a specialist is well entrenched and highly efficient for clinicians, with the cost and inconvenience of travel borne by patients or their families. When the distances are large, the health service may assume responsibility for patients' travel costs, which may be substantial. Queensland Health provides funding of about $30 million per year towards the Patient Travel Subsidy Scheme (PTSS).[4] This scheme has an important role in helping offset some of the costs associated with travel to see a specialist. But because the PTSS is well established and relatively easy to use, we believe that clinicians are more likely to choose this option than to opt for telemedicine. Without an incentive for clinicians to conduct telemedicine, this will probably remain the prevalent model.

For almost 10 years, we have shown the feasibility, clinical benefits and economics of a unique telemedicine service model, specifically in the area of paediatrics. More recently, some of the relevant principles of this telepaediatric service model have been applied to telemedicine in the field of geriatrics. Here, we provide an overview of our experience and recommendations.

Telepaediatrics

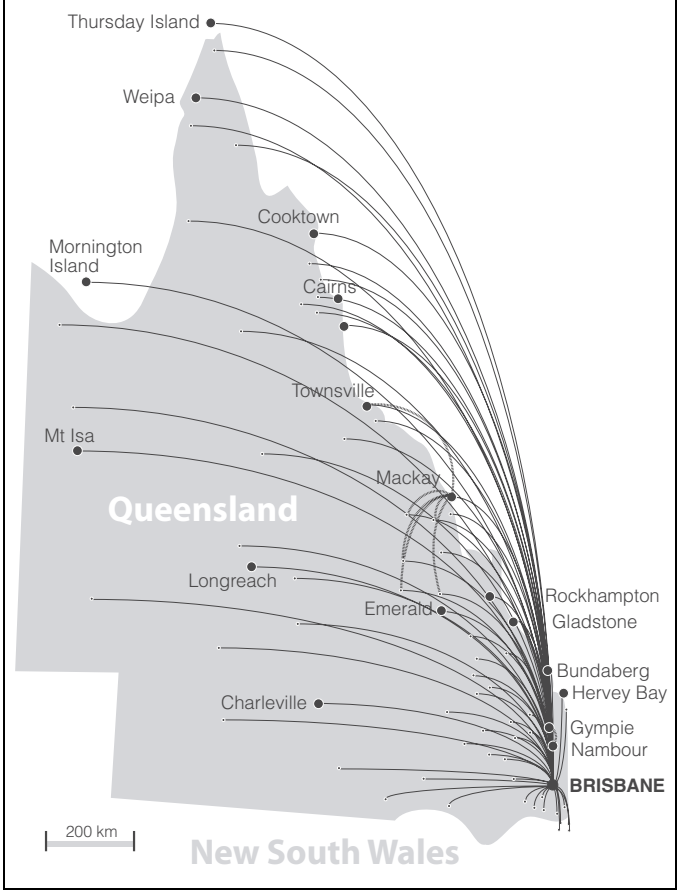
In November 2000, we commenced a trial to determine whether we could encourage regional clinicians to use telemedicine instead of referring patients to specialists in the traditional way. A telepaediatric model was crafted by the University of Queensland's Centre for Online Health (COH) in close collaboration with the Royal Children's Hospital (RCH) in Brisbane.[5,6]

The telepaediatric service is configured around a centralised referral centre based in Brisbane, with selected regional centres across Queensland. If a specialist consultation is required, the referring clinician calls a toll-free telephone number, which links them to a telepaediatric coordinator. Once a referral is made to the service, a specialist response is guaranteed within 24 hours.[7]

The telepaediatric service is a clinical support program that directly benefits children, their families and the clinicians delivering services. Since the service began, over 7000 consultations have been conducted for thousands of children in Queensland, many of whom may have otherwise travelled hundreds or thousands of kilometres to see a paediatric specialist in Brisbane.

The COH currently delivers telepaediatric services to 82 regional hospitals in Queensland and several health centres in northern New South Wales (Box 1). A range of communication methods are used, including email, telephone and videoconference. About 90% of telepaediatric referrals result in a videoconference consultation (Box 2 and Box 3). Most videoconferences are conducted using systems owned and managed by Queensland Health, of which there are about 500 available statewide. Other

1 Scope of telepaediatric services in Queensland



sessions require dedicated videoconference systems installed by the COH, including mobile units (see below). Some telepaediatric consultations have also required videoconference links to specialists in Western Australia, Tasmania and the Northern Territory.

Since the service began, much of the work coordinated through the centre has become routine, with a broad range of clinics now scheduled 12 months in advance. The telepaediatric service, now a specialist outpatient department at the RCH, delivers all of its services online.

The telepaediatric service covers 37 different subspecialist areas and involves more than 240 medical, nursing and allied health staff. Subspecialist services offered by the telepaediatric service include cardiology, dermatology, diabetes, general paediatrics, neurology, oncology, orthopaedics, post-acute burns care, psychiatry, and surgery.[8,9]

Telepaediatric robots

The use of mobile and wireless videoconferencing systems has proven to be an extremely useful method for engaging clinicians and patients. Instead of relying on videoconferencing systems in lecture rooms or staff meeting rooms, we developed mobile systems that can be wheeled around and used in areas where clinical services are most likely to be needed (ie, at the bedside or throughout the immediate ward area).

In 2004, we designed and built our first mobile system in the shape of a child-friendly robot. The robot was delivered to a paediatric ward that had no full-time paediatrician on staff. The robot was used to conduct daily ward rounds (via videoconference) with paediatricians based at the RCH, Brisbane.[10] During the rounds, the robot could be wheeled to each patient's bedside. A clear advantage of the mobile system is that everyone — the parents, child, local doctors and nurses — can communicate directly with the specialist, who appears as the "face" on the robot's television monitor (Box 4). A high-quality videoconference camera and built-in microphone enables the specialist to see and speak with everybody at the remote site.

Once feasibility of our mobile robot system was proven, we received valuable funding from mining company Xstrata to deliver four robot systems to hospitals in Queensland (Box 5). For some hospitals, the telepaediatric service has been used mainly for consultations with paediatric specialists in Brisbane. For hospitals with a paediatric ward but no full-time paediatrician, the systems have continued to be used for videolinks with paediatricians from Brisbane and nearby hospitals.

An important feature of the mobile systems is the remote management capability — the systems are fully maintained by coordinators in Brisbane. Regional clinicians are spared the task of navigating remote controls and complicated videoconference menus. Unlike standard videoconferencing services, all connections to the mobile systems are managed remotely, including call connections and daily quality tests.

User satisfaction

The acceptance of this system by patients and clinicians has been very encouraging. Parents in regional and remote areas appreciate being "seen" by a specialist and receiving the same attention they would normally only expect if they had travelled to see the specialist in person. For patients and families, the telepaediatric service has resulted in substantial savings and high levels of satisfaction because they are saved the cost, stress and inconvenience of having to travel to Brisbane to see a specialist:

> The videoconference appointments have been a lifesaver. I can pick my child up from school for a 10-minute video-appointment with the burns team at the RCH and afterwards I can drop him back to school. Normally, we all [the family] do the 11-hour drive down to Brisbane, which means I have to take a few days off work and my son misses out on a lot of days at school.

2 Telepaediatric session with neurologist — standard videoconference

3 Telepaediatrics: a case study

. . . A 4-year-old girl presented in cardiac failure. The next day, via telemedicine, we discussed her case with and showed her to a paediatric cardiologist, before his overseeing her echo online. He was then able to discuss his assessment of severe rheumatic mitral valvular disease and his management advice both with us and the family. She stayed in Mackay with further telemedicine echos for the cardiologist to monitor progress.

With 9 years' experience, telepaediatrics is a regular part of our service in Mackay. All team members are involved, with a registrar and our chronic illness nurse presenting and coordinating our subspecialty clinics with the paediatric consultants 1100 km away. It brings all the tertiary subspecialty services to the patients in Mackay, supporting us, their case managers, to oversee their management in Mackay. If there is a need to travel to Brisbane, the families have met the Brisbane consultant, discussed and planned the trip. Similarly, we provide monthly paediatric services to patients in our outlying towns, especially good for following up patients who we have previously seen in Mackay up to 300 km from home. *(Dr Michael Williams, Director, Child and Adolescent Health, Mackay Base Hospital, Queensland)* ◆

> This is so much easier . . . we love it! *(Parent of child with burn injury, Emerald, approximately 900 km from Brisbane)*

The children always enjoy the opportunity to chat and interact with one of our robots. Feedback from children who have been involved in robot appointments has always been very positive:

> Eliza [the robot] was cool — I really want one at home because then I would use it to talk to all of my friends. It was funny because the doctor [on screen] could see everything I was doing. He [the doctor] talked to the nurses and then I got better. *(Patient, 9 years old, Mt Isa Hospital, approximately 2500 km from Brisbane)*

Apart from the clear advantages of being able to give regional patients access to specialists with the reduced need for extensive travel, there are other inherent benefits that should be acknowledged. Telemedicine consultations not only connect patients with specialists, but also strengthen the partnership between regional staff and specialists. The interactions serve as a device to upskill staff at rural locations:

> When describing the telepaediatric service I use the acronym PPEET — patients, professionals, education, economics and technology. The kids love the links, especially seeing themselves on the screen. They are generally surprisingly happy to talk to the consultant on the "other side". The cost saving and the saving of time and effort for families are fantastic. It really is a great system! *(Dr Jasper Van der Westhuyzen, Director of Paediatrics, Hervey Bay Hospital, Queensland)*

From the specialists' perspective, it has become clear that a substantial proportion of subspecialist outpatient appointments can be performed at a distance. One of the leading examples of telepaediatrics involves post-acute burns care, where about 17% of all outpatient services are now mediated via telepaediatrics. This represents a major shift in the way outpatient services are delivered for this unique group of patients, where follow-up care may last for months or years. We calculated the total travel distance saved for a group of burns patients during a 5-year period as being 1.4 million kilometres. This distance is equivalent to a direct trip from Brisbane to London 86 times, or a return journey from the Earth to the moon — twice.[11] Reduced travel equals reduced carbon emissions, so we should actively promote the environmental benefits of telemedicine.[12]

Economics

Our research has demonstrated substantial savings for the health department due to reduced patient travel, with concurrent benefits for rural and regional families, who are saved the inconvenience and costs of travel away from home. A cost-minimisation analysis of telepaediatric services for two hospitals over a 5-year period showed that the actual cost of providing telepaediatrics was about $1 million. Had all of these patients been sent to Brisbane instead of using telemedicine, we calculated the potential cost to be around $1.6 million. This represents a 37% reduction in costs for Queensland Health.[13]

A study of family costs showed significant savings for families who "see" a specialist in their regional hospital (via videoconference), compared with families who travelled to the RCH to see the specialist in person. Families were also spared time, personal expenses and stress associated with travel to Brisbane.[14]

Telegeriatrics

The success of the telepaediatric network of services in Queensland spawned our research and development agenda at the other extreme of the life cycle, in geriatric medicine. There are almost no geriatric specialists practising outside of the south-eastern corner of Queensland — of about 30 geriatricians in Queensland, only three operate outside of the south-eastern corner, all in Cairns.

Geriatricians play an important role in hospital geriatric and rehabilitation units; they consult in ambulatory settings in the areas of cognitive impairment, falls and other geriatric syndromes; and they work with multidisciplinary teams to support assessment and care planning of older people with complex medical, functional and psychosocial problems.

4 The first robot system was used in the paediatric ward at Gladstone Hospital to deliver specialist support

5 Telepaediatric robot consultations may be done directly at the bedside

Older people are more likely to have chronic illnesses, potentially requiring repeated visits to specialists. Their illnesses are often accompanied by disability, a further impediment to travel. When in hospital, transfer to a city specialist for consultation is impractical. This combination of factors creates considerable inequity of access to specialists for frail older patients.

Our research and development program in telegeriatrics commenced in 2005. A series of demonstrations was used to establish technical specifications and operational protocols to support inpatient and outpatient consultation, and geriatrician interaction with multidisciplinary teams.

There are special challenges for older people in using videoconsultation. Many patients have impaired vision, hearing or cognitive function, although this is also a problem with "live" consultation. In our experience, older patients interact well, usually taking only a few seconds to engage in conversation:

> It was just like sitting talking to you now and I don't know why they don't do it more often for people who live in outback places like this ... *(Patient, 86 years old, Karumba, more than 2000 km from Brisbane)*

A minority of patients, usually those with significant hearing impairments, require a person at the bedside to repeat the conversation.

The primary mode of telemedicine utilised is videoconferencing (Box 6). The protocol for preparing sessions imitates that used in telepaediatrics. An enhancement is the development and use of web-based standardised assessments, which enable records to be reviewed and progress notes recorded at both the clinical and distal locations. This substantially reduces the need for duplicate records and faxing of documents before consultation.

Numerous telegeriatric demonstrations are now in operation (Box 7), including a memory disorders clinic serving patients in north-western Queensland; geriatrician support to multidisciplinary case conferences in Rockhampton (Aged Care Assessment Team and an inpatient rehabilitation service at a private hospital); and transition care and a full ward service to a geriatrics and rehabilitation ward in Toowoomba. In addition, systems to support standardised geriatric consultations online have been established in two hospitals. Many aspects of these services have been subject to evaluation, with a focus on stakeholder acceptance, reliability of clinical decisions, cost and sustainability. Assessment of cognitive function appears particularly amenable to videoconference assessment.[15,16]

A needs assessment of geriatric services and the associated geriatrician workforce (or lack of it) has recently been completed. This will provide a template for expansion of the service models across Queensland.

Online case assessments and electronic records

An important aspect of telemedicine is communication of clinical information between the various nodes where clinical interactions occur. Traditional strategies — verbal presentation of clinical histories or faxing of information — are expensive and potentially incomplete. To support assessment of older patients at a distance, we developed a web-based clinical decision support system that can be used to perform "online" assessments and to provide clinical information sharing during videoconsultations.[17]

Future opportunities

This article presents an overview of our experience with telepaediatrics and telegeriatrics. Further effort is required to explore the potential of our approach in all other medical disciplines, including adult outpatient services, where there is likely to be high clinical demand and commensurate potential for savings.

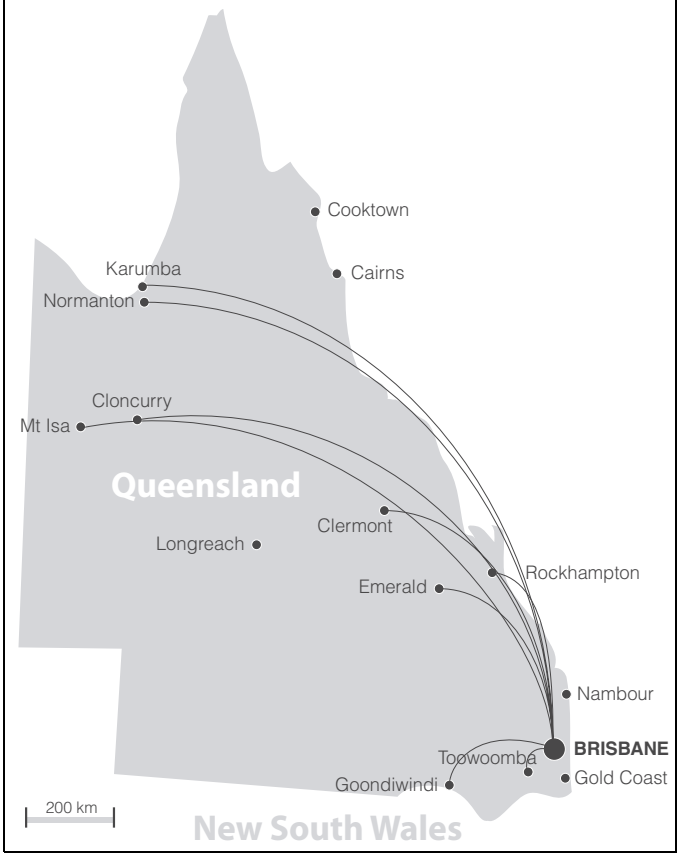
A major challenge for sustainable telemedicine programs is related to funding. Generally, government funding supports the purchase and maintenance of telemedicine infrastructure, which leaves little or no investment towards the operation costs of managing the service and formal evaluation. Apart from telepsychiatry, videoconference activities tend to operate within the public health sector. If this method of health care is to be propagated, it should be acknowledged as a Medicare fee-for-service schedule item. Unfortunately, there are numerous examples of telemedicine failures around the world where large telemedicine networks have been constructed, but underutilised. Our suggestions for developing a telemedicine service are summarised in Box 8.

Conclusion

Telemedicine provides enormous potential to improve equity of access to health services in a cost-effective manner. To be successful, the focus must move beyond simply the provision of equipment and connectivity. Telemedicine services should be easily

6 A geriatrician performing a videoconference ward round

7 Scope of telegeriatric services delivered from Brisbane



accessible, present no hindrance to the clinician, and should complement conventional outpatient services. Clinical processes may need to be re-engineered to ensure effective engagement of clinicians and efficient use of equipment. Attention must be paid to communication of clinical information, preferably in electronic format, to increase reliability and avoid wasteful duplication. We believe that our approach to telemedicine represents a serious attempt to meet these aspirations.

Competing interests

None identified.

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8 Key points

- The focus of telemedicine must move beyond simply the provision of equipment and network connectivity.
- Telemedicine services should be designed according to clinical needs and complement conventional outpatient services.
- Once the appropriate infrastructure is established, the success of telemedicine depends on the administrative and clinical systems that support its operation.
- To engage clinicians, telemedicine requires simplicity of use, ease of access to facilities, and at least financial parity with live consultations.
- Coordination of referrals and remote management of sessions are key factors in the success of telemedicine.
- The potential savings for government health departments are significant. These are predominantly related to reduced travel costs, and should be redirected into the operational costs of telemedicine services.
- Telemedicine services should be developed in conjunction with a robust research program to ensure clinical and cost-effectiveness. ◆

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