



May 6, 2014

Ms Sue Cawcutt  
Research Director  
Health and Community Services Committee  
Parliament House  
George Street  
BRISBANE QLD 4000

Dear Ms Cawcutt,

Thank you for the opportunity to contribute to the Parliamentary Inquiry into Telehealth Services in Queensland.

For more than 14 years, our clinical team have pioneered the delivery of telehealth services for patients referred to the Royal Children's Hospital in Brisbane - for burns treatment and other surgical conditions. Our service records show that around 2400 telehealth consultations have been carried out, for patients who otherwise would have travelled to Brisbane. This multidisciplinary telehealth service has been established in close partnership with the University of Queensland's Centre for Online Health (COH) and clearly demonstrates our role as a provider of specialist paediatric surgical services throughout Queensland.

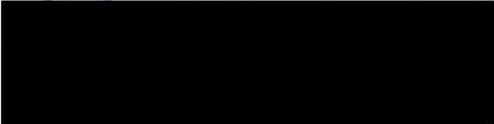
We use videoconferencing for the delivery of post-acute burns care for children living in rural and remote areas of Queensland. Instead of travelling back to Brisbane on a frequent basis, families travel to a hospital close to home, meet the local clinicians and have an appointment with our team in Brisbane. We also rely on the sharing of digital images to assess burn injuries and to monitor progress once patients return home. For surgical referrals, we use telehealth for pre-assessment and post-operative review of patients.

Specialist appointments via videoconference are not intended to replace face-to-face appointments, but represent a useful method for follow-up and supervision of post-acute burns care. Communication between local clinicians and specialists via videoconference are useful for emergency presentations by providing interim advice and assessment, pending transfer to the tertiary centre. Videoconferencing has an important role in providing greater access to specialist burns services to clinicians and families living in rural and remote areas of Queensland.

Key enablers to our growing telehealth service include the participation of regional clinicians and the telehealth coordination/expertise provided by the COH which is critical to the operation of the service (referral management, organisation of medical records, appointment scheduling – near and far-end, technical support and evaluation). Our clinics are scheduled 12 months in advance and capacity also exists for ad-hoc (urgent consultations). Key challenges include the availability of regional clinicians and long-term storage of clinical information such as digital images.

The service we provide is world class and frequently visited by international visitors to Queensland. Please find attached as an Appendix, four journal publications which report our work in telehealth.

If you require additional information, I would be more than happy to be contacted directly.

  
**Professor Roy Kimble**  
Director Paediatric and Neonatal Surgery  
Director of Urology,  
Director of Burns and Trauma  
Lady Cilento Hospital, Division of Surgery and Perioperative Services



## Review

# A review of three years experience using email and videoconferencing for the delivery of post-acute burns care to children in Queensland

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## Abstract

A virtual outpatient service has been established in Queensland for the delivery of post-acute burns care to children living in rural and remote areas of the state. The integration of telepaediatrics as a routine service has reduced the need for patient travel to the specialist burns unit situated in Brisbane. We have conducted 293 patient consultations over a period of 3 years. A retrospective review of our experience has shown that post-acute burns care can be delivered using videoconferencing, email and the telephone. Telepaediatric burns services have been valuable in two key areas. The first area involves a programme of routine specialist clinics via videoconference. The second area relates to ad-hoc patient consultations for collaborative management during acute presentations and at times of urgent clinical need. The families of patients have expressed a high degree of satisfaction with the service. Telepaediatric services have helped improve access to specialist services for people living in rural and remote communities throughout Queensland.

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*Keywords:* Burns; Telehealth; Telemedicine; Children; Videoconference

## 1. Introduction

The Royal Children's Hospital (RCH) is situated in Brisbane and is an important provider of specialist paediatric services throughout Queensland. About 35,000 outpatient consultations are conducted annually at the RCH for children and adolescents requiring tertiary level paediatric/adolescent specialist services [1].

Queensland's only specialist burns unit, the Stuart Pegg Paediatric Burns Unit (SPPBU) is based at the RCH and receives about 400 admissions annually from all around Queensland and northern New South Wales. Each year, about 1200 outpatient appointments are conducted in the SPPBU outpatient department.

When patients are discharged from the SPPBU a medical referral is sent to the referring GP and regional occupational therapist. The family is usually sent home with the dressings and medications required for a 2-week period and then returns for an outpatient appointment in the unit. During each follow-up appointment, the family will be seen by nurses, allied health staff and the treating doctor.

Following this appointment, the frequency of additional outpatient appointments will depend on the severity of the

injury and treatment requirements. This may constitute treatment lasting for many years. Appointments conducted in Brisbane are expensive and time consuming for families living outside of the metropolitan area [2]. A large proportion of costs related to travel and accommodation are met by the state health department through a patient travel subsidy scheme (PTSS) [3].

Telepaediatric services for children in selected areas of Queensland were established as part of a research project at the RCH in November 2000. The role and benefits (including cost-effectiveness) of the telepaediatric service have been examined [4,5].

We have explored the use of videoconferencing for the delivery of post-acute burns care for children living in rural and remote areas of Queensland. Instead of travelling back to Brisbane on a frequent basis, selected families travel to a hospital close to home, meet the local clinicians and have an appointment with the burns team in Brisbane (via videoconference).

## 2. Methods

We conducted a retrospective review of our experience with videoconferencing as a technique for delivering specialist paediatric burns advice, post-acute patient care and

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educational opportunities for patients and health professionals. Telepaediatric activity records (including video-conference usage data) were used to analyse the type and frequency of activity that took place. We attempted to contact all families within 1 week of their videoconference to assess satisfaction with the service. We explained the purpose of the study and sought verbal consent from all families. The participation rate of families was subject to availability at the time of the survey.

Consultations were conducted via videoconference. Standard commercial videoconferencing equipment (models 5100P and 1500, Sony) was used. The bandwidth for the majority of consultations (limited by the infrastructure at the remote sites) was 128 kbit/s. Four sites had access to three ISDN lines allowing a bandwidth of 384 kbit/s. Digital still images were sent occasionally (via email) for review by the burns team, or as a secondary resource during the videoconference.

### 3. Results

A total of 293 patient consultations were facilitated via videoconference during the first 3 years of operation. The number of burns outpatient consultations conducted per year in the conventional manner (face to face) remained fairly steady over the previous 3 years. There were 1329 patient consultations reported in 2001, 1108 in 2002 and 1256 in 2003. Videoconference consultations took place during a routine or non-routine (ad-hoc) clinic and involved links to 31 regional/remote hospitals situated throughout Queensland and northern New South Wales (Fig. 1). The main application involved post-acute burns care and routine follow-up for children, after admission in the SPPBU. We also coordinated videoconference appointments on an ad-hoc basis. Here, the burns team reviewed recent burn injuries and provided advice regarding treatment or interim management if transfer to SPPBU was deemed suitable.

#### 3.1. Telepaediatric clinics

All consultations described in this review took place via videoconference (Fig. 2). In 17 cases of 293 (6%), digital images were sent via email to assist with diagnosis or interim management (Fig. 3). In total 126 clinics were organised. Table 1 shows the number of patient consultations conducted at each of the 31 referral centres, travel distance to Brisbane (km) and proportion of activity per site. The median distance between the RCH and remote site was 640 km (IQR 350–1180). During the 3-year period a total of 78 h was spent providing clinical consultations via videoconference (Table 2).

##### 3.1.1. Routine

Eighty-nine percent (112) of all clinics were planned sessions that usually involved more than one patient. Up to six

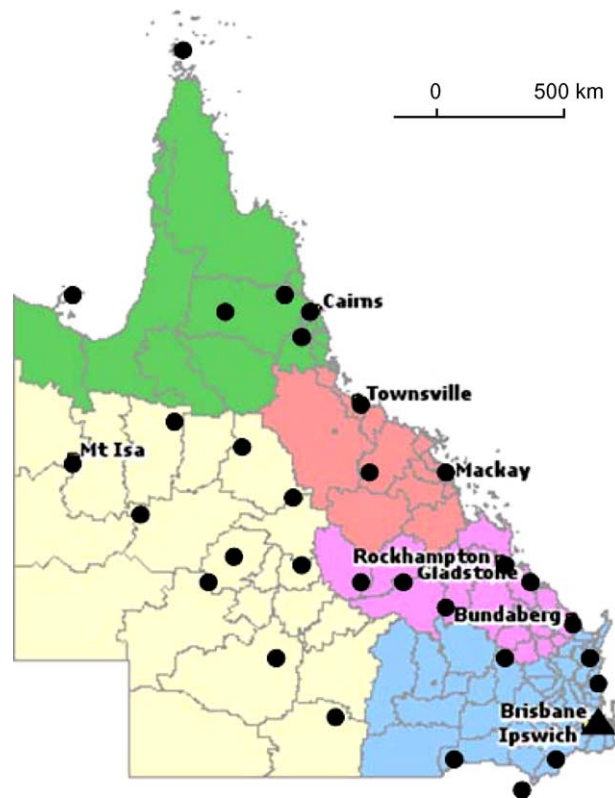


Fig. 1. Telepaediatric burns services have been provided to 31 sites throughout Queensland (via videoconference) from the specialist centre (▲) situated in Brisbane.

patients were seen during a routine clinic (mean = 2). The average duration of each patient consultation was 16 min.

##### 3.1.2. Non-routine (ad-hoc)

The remaining 11% (14) of sessions involved only one patient per clinic. Twelve ad-hoc videoconferences were arranged for semi-urgent advice immediately following a burn injury or within days of the burn injury. Two



Fig. 2. Burns consultation conducted via videoconference.





Fig. 3. Digital image sent via email for monitoring of scars.

videoconferences were conducted for patients being discharged from the SPPBU. Each consultation lasted for an average period of 21 min.

### 3.2. Service development

Telepaediatric sessions for the delivery of post-acute burns care are held at least on a monthly basis. The service was originally run on an ad-hoc basis, but within 3 months of operation, a routine clinic programme was developed. All four consultants based in the SPPBU provide a videoconference clinic scheduled each month. Clinics were arranged 12 months in advance, allowing for ongoing referrals. Clinics lasted for up to 1 h each and allowed for four-patient consultations involving multiple sites. Since the service began, the number of consultations has grown from 55 in 2000/2001 to 145 in 2002/2003 (Fig. 4).

### 3.3. Patient satisfaction

A total of 55 satisfaction surveys were completed, representing about 19% of the overall group. Patient satisfaction overall was very high in each of the categories assessed (Table 3). Picture and sound quality during the videoconference was adequate with the majority of families agreeing that they could see the specialist easily (95%) and that they had no difficulty hearing the specialist (95%). Ninety-six percent of families agreed that they were able to say everything that they wanted to during the consultation. Very few

Table 1  
Telepaediatric burns activity<sup>a</sup>

City/town	Distance from Brisbane (km)	Number of patient consultations	Proportion of activity (%)
Atherton	1730	6	2
Barcaldine	1070	6	2
Biloela	620	1	0.3
Bundaberg	350	34	11.6
Cairns	1710	46	15.7
Charleville	750	9	3.1
Charters Towers	1440	2	0.7
Chinchilla	300	3	1.0
Cunnamulla	950	1	0.3
Dalby	210	8	2.7
Gladstone	530	20	6.8
Gold Coast	100	1	0.3
Goondiwindi	350	6	2.0
Gympie	170	7	2.4
Hervey Bay	300	8	2.7
Inverell	440	1	0.3
Jundah	1420	2	0.7
Lockhart River	2550	1	0.3
Longreach	1180	8	2.7
Mackay	1100	32	10.9
Maryborough	260	2	0.7
Mitchell	570	3	1
Mt Isa	1910	5	1.7
Murwillumbah	130	1	0.3
Proserpine	1090	4	1.4
Rockhampton	640	48	16.4
Roma	480	17	5.8
St. George	540	3	1
Thursday Island	3040	4	1.4
Toowoomba	130	1	0.3
Tweed Heads	110	3	1
Total		293	100

<sup>a</sup> Location and number of patient consultations conducted between November 2000 and October 2003.

families (6%) agreed that the videoconference (TV camera) made them uncomfortable, and even fewer (2%) were worried that others may have been listening during the consultation. Eighty-seven percent of families agreed that the videoconference appointment saved them money and time. Eighty-two percent agreed that the videoconference saved them stress.

The majority of families (87%) agreed that they were confident that their child's condition could be sorted out via videoconference. When asked if they thought that the videoconference appointment was not as good as a face-to-face

Table 2  
Videoconference activity<sup>a</sup>

Session type	Number of sessions	Number of patient consultations	Total time (h)	Median time per consultation (min)	S.D. <sup>b</sup> (min)
Routine clinic	112	279	73	15	4.1
Non-routine clinic (ad-hoc)	14	14	5	20	4.1
Total	126	293	78		

<sup>a</sup> Telepaediatric patient consultations conducted between November 2000 and October 2003.

<sup>b</sup> Standard deviation.

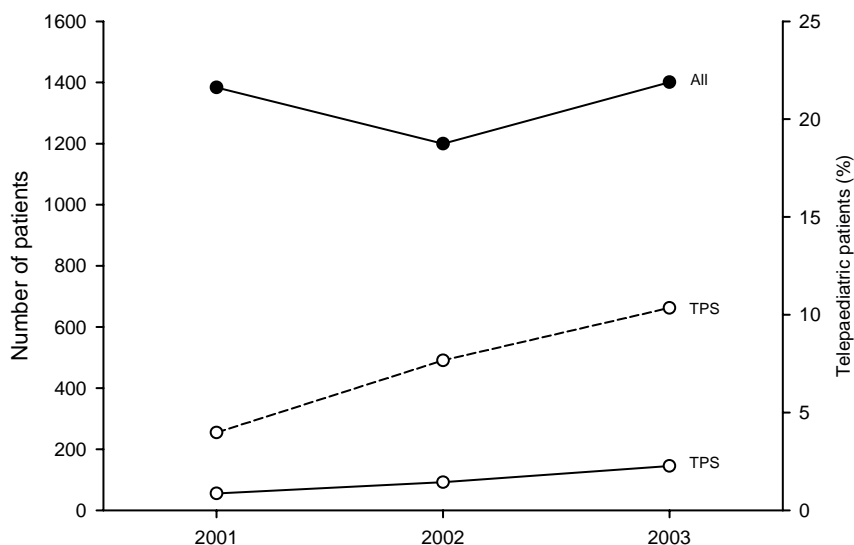


Fig. 4. The solid lines show the number of patients: (a) closed symbols represent total number of outpatient consultations; (b) open symbols represent the number of telepaediatric consultations. The dashed line represents the percentage of outpatient consultations managed by telepaediatricians.

Table 3

Proportion of parents' responses related to satisfaction of consultations conducted via videoconference (% values rounded to nearest whole number)

Questions	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)	Don't know (%)
I could see the specialist clearly ( $n = 55$ )	67	27	2	2	2	0
I had trouble hearing what was said ( $n = 55$ )	2	4	0	22	73	0
I was able to say what I wanted ( $n = 55$ )	58	38	4	0	0	0
I was worried that others may have been listening ( $n = 55$ )	0	2	4	33	62	0
The TV camera made me feel uncomfortable ( $n = 55$ )	0	5	4	29	62	0
The appointment saved me money ( $n = 55$ )	60	27	7	0	0	5
The appointment saved me time ( $n = 55$ )	60	27	9	0	0	4
The appointment saved me stress ( $n = 55$ )	53	29	13	2	0	4
I was confident that my condition could be sorted out via videoconference ( $n = 55$ )	44	44	11	2	0	0
The appointment was not as good as 'face to face' ( $n = 55$ )	4	13	35	42	7	0

appointment 49% of families disagreed in favour of videoconferencing.

Follow-up appointments via videoconference meant that the family travelled less frequently to the SPPBU in Brisbane. One family said:

We found the videoconference very useful. Normally we travel to Brisbane to see the doctor. This usually involves a 5 hour train trip and one night's stay in Brisbane. Then our outpatient appointment in the burns unit could last for around half an hour. The videoconference saved us a lot of time, not having to travel to Brisbane and we still had a chance to see our doctor. Overall we think it is a great service, especially when the appointment is only for a check-up.

#### 4. Discussion

The present study confirms that telemedicine is feasible for the delivery of post-acute burns care. There is some expe-

rience reported in the literature which confirms that communication technologies such as videoconferencing and email can be appropriately used for a substantial portion of the long-term management of patients following a burn injury [6–8]. At no stage have we considered that telemedicine will ever replace face-to-face consultations. Patients will still need to travel on occasions to the specialist burns centre for surgical interventions and more comprehensive examinations. We have found that interim follow-up to check on scar development and progress can be achieved without the patient (and family) having to travel great distances [8–10].

The development of a telepaediatric burns service in Queensland has presented some challenges. Given that the conventional method of follow-up burns care for children required that families return to the SPPBU for an outpatient appointment, limited burns outpatient services were available in the rural and remote hospitals.

Essentially, our service was transferring some of the responsibility for patients back to the primary referral sites.

So, one of the challenges was to locate a suitable clinician (preferably an occupational therapist or registered nurse) that was prepared to participate in a videoconference appointment. The second challenge related to the availability of clinical supplies (such as wound dressings) at the distant site. Again, because patients would normally have travelled to Brisbane, resources were limited.

Specialist appointments via videoconference allow families in regional and remote parts of Queensland greater access to specialist health services. Overall, patient satisfaction was very high with the majority of families agreeing that this service was valuable in terms of saving time, money and stress. A recent study conducted in Queensland has shown that families that travel to their local hospital for a videoconference spend less time and money than those that have to travel to the tertiary hospital, often situated hundreds of kilometres away [2].

Consultations via videoconference are useful for early assessment and decisions related to appropriate clinical management. In rural and remote areas, isolation is a major factor, so the support made available through the telepaediatric service is invaluable. The networking opportunity between regional clinicians and staff in Brisbane has generated a more collaborative approach to the delivery of post-acute burns care. Regional staff have gained a better understanding of the services available to them through the SPPBU, including convenient access to specialist staff via a hospital contact number, email and videoconference.

In effect, local case management has been encouraged with the direct support of specialists based in the SPPBU. Consultations via videoconference have provided an excellent learning opportunity for less experienced staff, particularly in relation to the development of skills related to burn assessment and scar management. The use of videoconferencing for the 'handover' of patients has helped to maintain continuity of care and emphasised the ongoing specialist support available to regional staff and the family.

Telepaediatric sessions involve the multi-disciplinary team of the SPPBU, so the involvement of multiple specialists in the one consultation is a unique benefit of the service. During consultations, patients have access to a wide range of experts including a paediatric surgeon, clinical nurse consultant, occupational therapist, physiotherapist and occasionally a social worker.

We have found that appointments via videoconference also assisted with the organisation of pending admissions to the RCH. Occasionally, during the videoconference the need for surgery was identified. The consultant was then able to discuss this procedure with the child (and family) and negotiate a timeframe which suited the family. Operating theatre

bookings and accommodation arrangements were confirmed in advance of the proposed admission.

## 5. Conclusions

Specialist appointments via videoconference are not intended to replace face-to-face appointments, but represent a useful method for follow-up and supervision of post-acute burns care. Communication between local clinicians and specialists via videoconference are useful for emergency presentations by providing interim advice and assessment, pending transfer to the tertiary centre. Videoconferencing has an important role in providing greater access to specialists burns services to clinicians and families living in rural and remote areas of Queensland.

## Acknowledgements

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# ▶ A feasibility study of email communication between the patient's family and the specialist burns team

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## Summary

We investigated whether the parents of burns patients could capture suitable clinical images with a digital camera and add the necessary text information to enable the paediatric burns team to provide follow-up care via email. Four families were involved in the study, each of whom sent regular email consultations for six months. The results were very encouraging. The burns team felt confident that the clinical information in 30 of the 32 email messages (94%) they received was accurate, although in 11 of these 30 cases (37%) they stated that there was room for improvement (the quality was nonetheless adequate for clinical decision making). The study also showed that low-resolution images (average size 37 kByte) were satisfactory for diagnosis. Families were able to participate in the service without intensive training and support. The user survey showed that all four families found it easy and convenient to take the digital photographs and to participate in the study. The results suggest that the technique has potential as a low-cost telemedicine service in burns follow-up, and that it requires only modest investment in equipment, training and support.

## Introduction

Queensland is a large state, with an area of over 1.7 million km<sup>2</sup>. The paediatric burns unit at the Royal Children's Hospital (RCH) in Brisbane services the paediatric population in Queensland and in areas north of New South Wales. About 300 patients are admitted to the unit annually and about 1200 outpatient consultations are conducted each year. The outpatient management of a burns patient may take a long time, up to 10 years or more, after the initial injury. Videoconferences have been used for the post-acute burns care of children in Queensland for several years<sup>1,2</sup> and there has been some experience in the use of digital photographs to complement videoconference appointments<sup>3</sup>. Telemedicine consultations involving transmission of clinical images by email between health-care professionals have proven valuable in many fields<sup>4-7</sup>. Other applications have shown the benefits of an email service that links patients directly to the specialist<sup>8,9</sup>.

We have conducted a feasibility study to assess whether the parents of paediatric burns patients can use email and digital

cameras in their follow-up care. Additional goals were to establish the imaging requirements and to find out how much training and support parents would need.

## Methods

The study was conducted at the RCH. Ethics approval was granted by the appropriate committees. Four families were invited to participate in the study and all agreed. Families were chosen in which at least one of the child's parents had some experience with computers. The families were told that the specialist burns team would contact them immediately if they found any changes in the child's condition that warranted urgent attention.

## Equipment

Families 1 and 2 had their own digital cameras and preferred to use them. Families 3 and 4 did not own a digital camera and had no experience in their use. These families were provided with a new camera (Coolpix 2100, Nikon). Different cameras were assessed according to functional user requirements specified by the Volere method<sup>10</sup>. The requirements included ease of use, satisfactory lens quality, a resolution of at least

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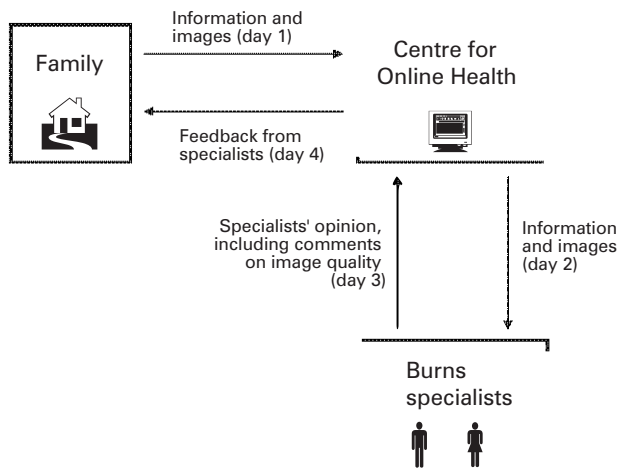


Fig 1 The email procedure.

2 million pixels, a macro of less than 10 cm for close-up images, automatic focusing, rechargeable batteries, image reproduction in JPEG format, the possibility of downloading images from the camera to the PC without installing any special software, and a reasonable price (not exceeding AUS\$400) (AUS\$1 is US\$0.7, €0.6). For the purposes of the study, 8 MByte of flash memory was deemed acceptable.

Table 1 Clinical information contained in the body of email communications

Item	Example entry
The patient number we have given you	002
Please tell us about any changes since last week's pictures	
Scars (pale/pink/red)	Pink scars—image 1
Thickening of scars	No thickening
Areas where the skin is tight	Tight around thumb—image 1
Movement	Cannot move thumb completely
Activity level	Good, except for using the thumb
Open sores	No open sores
Treatment	Pressure garment and cream daily
Any concerns you have	A bit worried about movement of thumb
The picture number, where on your child's body each picture is from, whether the picture was taken with or without the flash, inside or outside	Image 1: right hand, with flash, inside Image 2: right hand, without flash, inside

Table 2 Details of the families and the number of email consultations carried out

Family	Age of patient	Distance from Brisbane (km)	Estimated travel time by car	Images emailed from	Internet connection	Camera	Number of consultations
1	17 months	21	43 min	Home	Broadband	Canon Power Shot A70	4
2	16 months	2384	36 h	Work	Broadband	Sony DSC-S75	6
3	19 months	43	56 min	Grandparents' house 50%; own home 50%	Modem	Nikon Coolpix 2100	8
4	6 years	94	2 h	Home	Modem	Nikon Coolpix 2100	14

Procedure

Communication was by email (Fig 1). The families were asked to send a message to the specialist burns team each week for the first two months and then every second or fourth week. The messages were sent to an email account at the Centre for Online Health (COH). Research staff forwarded the email consultations collectively in a single message to the specialist burns team. This combined email also contained a checklist for the burns team to evaluate the quality of the images and the textual information presented in the patient email, and whether the information was adequate for diagnosis and clinical decision making. A chief physician and a registered nurse from the burns unit perused the email consultations and arrived at a joint decision regarding the quality, and returned the checklist to the COH email account. Staff at the COH forwarded the individual replies from the specialist burns team back to the respective families.

Participants were asked to include written information to explain their child's condition (Table 1). All the families were provided with an instruction manual that described the project procedure in detail. Patient confidentiality was maintained.

User survey

Five weeks after starting to use the email consultation system, all the parents were asked to give some feedback via email on their needs, expectations and experience so far, and to make suggestions on how the telemedicine service could be improved.

Results

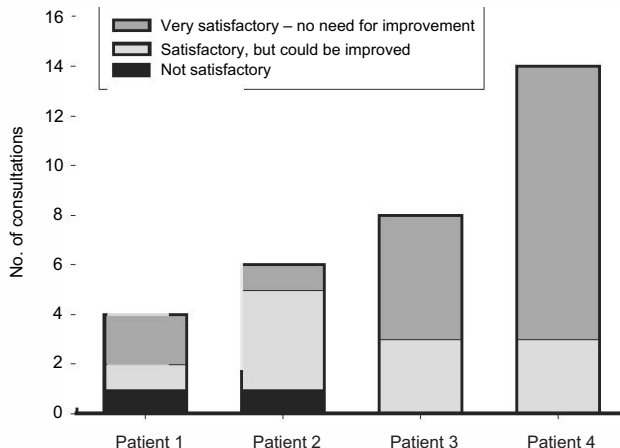
Between November 2003 and May 2004, 32 email consultations were carried out using three types of camera (Table 2).

Quality of the consultations

Of the 32 consultations, 30 (94%) were deemed by the specialist burns team to be adequate for diagnosis and clinical decision making (Fig 2). In 19 of these 30 cases (63%) the quality was very satisfactory and there was no need for improvement, while in the other 11 (37%) the burns team stated that there was room for improvement, although the quality was still sufficient for clinical decision making. The quality would have been improved if: more pictures had been



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**Fig 2** Numbers of consultations that were adequate or not for diagnosis and clinical decision making (*n*=32).

taken with dressings down (one consultation), some pictures had not been so blue (an error in patient 2's private camera, four consultations), and the focus had been improved for one or more of the pictures (six consultations).

Two of the consultations (6%) were not of satisfactory quality. In the first consultation from patient 1 the pictures were taken too far away and dressings covered up the areas that were most important. The family of patient 2 had a problem with their private camera that grew increasingly worse: more and more photographs appeared blue, and on the sixth consultation the burns team were unable to determine the colour of the scar.

In all cases the text was judged between good or excellent.

**Image size**

The sizes of the images that the families took are shown in Table 3. All the cameras used compression. For the Nikon Coolpix cameras the initial image quality used was set to 'PC screen' (1024 × 768 pixels, compression 1:8) for family 4, and for family 3 it was set to the lowest quality, called 'TV screen' (640 × 480 pixels, compression 1:8). All the images taken by families 3 and 4 were taken inside with use of flash.

Family 4 sent many more images per consultation than the others. This child had serious burns all over the body, while the other children had lesser injuries.

**Table 3** Details of the images taken by the families

Family	Total number of images received	Average (range) number of images per consultation	Average (range) size (kByte)
1	15	3.8 (3–4)	267 (100–524)
2	30	5.0 (5–6)	174 (144–290)
3	48	6.0 (4–8)	37 (19–65)
4	151	10.8 (5–16)	147 (54–179)

**Table 4** Time spent on training and support

	Start-up meeting and training (min)	Support by email (min)	Support by telephone (min)
Patient 1	40	20+20+20	0
Patient 2	10 (information over the Internet and by telephone)	35	10
Patient 3	90	10	10
Patient 4	120 (child present)	20+20	20

**Training and support**

The families did not need a great deal of training and support. For families 3 and 4 the training included how to capture images and download them to a PC. Despite the fact that little time was spent on training, in practice there was nonetheless little demand for technical support or questions regarding the procedure (Table 4).

**User survey**

All the families reported that they were happy to participate in the study, and that taking photographs was easy and convenient. The telemedicine service gave them the chance to show the specialists what happened with the burns. Sometimes they thought that there had been changes and wondered whether they should make an appointment. In circumstances like this the telemedicine service gave them the opportunity to 'show them in pictures when telling is hard to explain sometimes'. One parent said:

[the trial was] a pleasurable experience as it gives the opportunity to be more involved with your child's progress and makes you take more notice of the healing and how well your child is doing.

Another parent said:

it has saved a lot of time by not having to travel to the hospital as much. It has also saved my child a lot of upset as [the child] becomes very stressed at going to the hospital ... I hope it continues as it will benefit a lot of people.

One of the families found it to be a little disappointing that they twice did not receive a response to questions they asked, and said that 'it was quite frustrating not getting a response when a concern was raised'. The burns team could not remember that they had seen these questions, so they may have been overlooked.

The families also suggested how the telemedicine service could be improved. One suggestion was to regulate the sending frequency according to clinical needs. They found one consultation per week to be more frequent than necessary, since there were usually few changes during a single week. If they had a major concern or a query that could not wait, then they suggested having the opportunity to send in an additional email message — directly to the burns team — to

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obtain an answer. If the quality of the images was adequate for diagnosis they would also appreciate some feedback from the team about their child's prognosis.

### Discussion

The results of the present study show that parents are able to submit suitable clinical images and textual information to enable a burns team to provide follow-up care. In almost all of the cases, the burns team felt confident that the clinical information that they received was accurate. The study also showed that low-resolution images can be used for this purpose; even images that were only 37 kByte in size were satisfactory for diagnosis. As expected, the number of pictures included in a consultation depended on the area that was burned and the healing progress, and could not be pre-determined. The study also showed that families did not need much introduction, training or support to participate in the telemedicine service. The user survey showed that all the families found it easy and convenient to take the digital photographs and to participate in the study. The results suggest that the technique has potential as a low-cost telemedicine service, and that it requires only modest investment in equipment, training and support.

The present work represents a small feasibility study that, despite its success, cannot be generalized to the entire population without further research. The aim of future research should be to determine whether it is possible to provide paediatric burns patients with individually adapted treatment in their own homes without necessarily a burns team regularly seeing the patient in the outpatient clinic. An expected outcome of this approach will be a significant reduction in travel costs and inconvenience to the patient and family.

*Acknowledgements:* We thank the patients and their parents for their contribution and involvement in the research.

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Technology adoption takes time. Looking ahead, as well as the challenges of acceptance of telecare by both patients and clinicians, the legal framework and appropriate business models or funding mechanisms need to be defined.

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# ► A telepaediatric burns service and the potential travel savings for families living in regional Australia

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## Summary

In approximately six years we have conducted more than 1000 burns consultations for children living in 65 regional towns throughout Queensland and in northern New South Wales. Some regional towns are up to 2600 km from the specialist paediatric burns centre in Brisbane. We have calculated the potential travel distance saved, assuming that each consultation required a return journey to Brisbane, and that paediatric patients would have been accompanied by a parent or carer. The annual number of telepaediatric burns consultations conducted has grown from 64 in 2001 to 285 in 2006. The average time spent per consultation was 13 min (SD 2). In 2006, telepaediatric burns appointments accounted for about 17% of all burns outpatient appointments. The median distance of patients seen by telehealth was 600 km (interquartile range 300–1225). In six years, the estimated travel savings were about 1.4 million km, which is equivalent to a return journey from Earth to the Moon ...twice.

## Introduction

Children in Queensland who require specialist treatment for a burn injury are referred directly to the specialist burns unit at the Royal Children's Hospital (RCH) in Brisbane. Approximately 300 new burns patients are treated there

each year and there are more than 1400 outpatient attendances annually. The number and frequency of outpatient appointments required for an individual patient depends on the nature of the injury and scar treatment. Post acute management of burns injuries in children may last for many years.

For the last six years, telepaediatric services have been offered in Queensland through the Centre for Online Health at the RCH.<sup>1–3</sup> More than 35 different paediatric subspecialties are offered through the service including post acute burns care which accounts for about 20% of all telepaediatric

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activity.<sup>4</sup> We have conducted a review of the first 1000 burns consultations conducted by the telepaediatric service.

## Methods

Telepaediatric activity records (including videoconference usage data) were used to analyse the type, frequency and destination of activity that took place. We calculated the return distance between each of the regional centres and the RCH and multiplied this value by the total number of consultations done at each regional centre. This allowed the calculation of the potential travel distance saved if all patients and one parent or carer had travelled to Brisbane for their appointment.

## Results

In just over six years (January 2001–February 2007), there were 1000 telepaediatric burns consultations. The children lived in 65 regional towns throughout Queensland and northern New South Wales. The total videoconferencing time spent was 221 h. The average time spent per consultation was 13 min (SD 2). Annual telepaediatric burns activity grew from 64 consultations in 2001 to 285 consultations in 2006. Telepaediatric burns appointments represented about 17% of all burns outpatient activity at the RCH in 2006 (Table 1).

### Potential travel savings

The median travel distance of patients seen by telehealth was 600 km (interquartile range 300–1225). Assuming that each consultation required a return journey to Brisbane, and that paediatric patients were accompanied by a parent or carer, the total distance saved would be over 1.4 million km (Table 2).

Four sites (Cairns, Rockhampton, Mackay and Bundaberg) accounted for half of the travel distance avoided.

## Discussion

The use of telemedicine for the delivery of urgent and post acute burns care is not new. Some experience has been reported in the literature, mainly in adults, which confirms that online communication techniques, such as videoconferencing and email, can be used for a proportion of the long-term management of patients after a burn injury.<sup>5,6</sup> In Queensland, where there are long distances between regional towns and the specialist burns centre, telemedicine has resulted in substantial savings for families who normally need to travel.<sup>7,8</sup> Although we have not costed the potential savings for the health service provider in the present study, a previous economic analysis in telepaediatrics has shown major savings due to

**Table 1** Specialist burns outpatient activity including telepaediatrics and including appointments conducted at the burns centre in Brisbane

Year	Telepaediatric appointments	Face-to-face appointments	Total appointments	Telepaediatric appointments (% total)
2001	64	1104	1168	5
2002	110	1089	1199	9
2003	134	1120	1254	11
2004	167	1220	1387	12
2005	193	1343	1536	13
2006	285	1411	1696	17

reduced patient travel costs.<sup>9</sup> This is important in Queensland, because the health department funds a reimbursement scheme which helps to meet the costs of travel and accommodation required by families travelling from regional centres.<sup>10</sup> The patient travel scheme costs the health department in Queensland more than \$25 million (\$1 = US\$0.84) per year.<sup>11</sup> In the present study, a large proportion of the savings related to activity which took place in a small number of sites.

The telepaediatric burns work done in Queensland has resulted in a major change in the way traditional outpatient services are managed. This change has been made possible by an enthusiastic burns team, a centralized telepaediatric service and a network of dedicated occupational therapists and nurses throughout the state. As the service expands and more patients are being dealt with at a distance, it has been very important to ensure that regional therapists are well supported by the staff of the burns centre and given opportunities to develop their knowledge and skills in this specialist area. To address these needs, we have developed a series of monthly education sessions which are delivered via video-conference to therapists at each of the major regional hospitals. These sessions have been highly valued by regional therapists involved in the programme.<sup>12</sup>

The total distance that would have been travelled if all videoconference patients attended their appointment in Brisbane is substantial. In fact, considering the vast distances between the RCH and the regional centres (i.e. up to 2600 km), the total avoided travel distance could be described as astronomical, without fear of hyperbole – at the point at which the Moon is closest to Earth (perigee), the distance is approximately 360,000 km.<sup>13</sup> For our group of patients, the estimated travel savings were about 1.4 million km in 2006, which is equivalent to a return journey from Earth to the Moon ... twice.

**Acknowledgements:** The telepaediatric service was funded by the Commonwealth Department of Health and Ageing (Medical Specialist Outreach and Assistance Programme). We thank all staff at the SBPBC and at participating regional hospitals for their involvement in delivering telepaediatric services. Support was also provided by the Royal Children's Hospital Foundation. We thank Stuart Bowhay, Royal Children's Hospital, for providing admission and outpatient activity data.



**Table 2** Telepaediatric activity and estimated travel distance saved

Site	Telepaediatric consultations (n)	%	Distance to Brisbane (km)	Distance saved (km)	% total
Arakun	2	0.2	620	2480	0.2
Atherton	12	1.2	1730	41,520	2.9
Ballina	1	0.1	195	390	0.0
Bamaga	4	0.4	2620	20,960	1.5
Barcaldine	13	1.3	1070	27,820	2.0
Bedourie	1	0.1	1840	3680	0.3
Biloela	16	1.6	600	19,200	1.4
Blackwater	8	0.8	820	13,120	0.9
Bundaberg	93	9.3	350	65,100	4.6
Cairns	90	9.0	1700	306,000	21.6
Casino	2	0.2	225	900	0.1
Charleville	9	0.9	750	13,500	1.0
Charters Towers	3	0.3	1650	9900	0.7
Cherbourg	4	0.4	260	2080	0.1
Chinchilla	11	1.1	295	6490	0.5
Clermont	2	0.2	1000	4000	0.3
Cooktown	1	0.1	2030	4060	0.3
Cunnamulla	7	0.7	810	11,340	0.8
Dalby	20	2.0	210	8400	0.6
Dirranbandi	1	0.1	600	1200	0.1
Doomadgee	2	0.2	2210	8840	0.6
Dysart	2	0.2	970	3880	0.3
Emerald	25	2.5	890	44,500	3.1
Gayndah	1	0.1	340	680	0.0
Gladstone	51	5.1	530	54,060	3.8
Glenden	1	0.1	1110	2220	0.2
Gold Coast	1	0.1	90	180	0.0
Goondiwindi	34	3.4	350	23,800	1.7
Grafton	1	0.1	330	660	0.0
Gympie	57	5.7	170	19,380	1.4
Hervey Bay	77	7.7	350	53,900	3.8
Injune	1	0.1	570	1140	0.1
Inverell	1	0.1	435	870	0.1
Jundah	5	0.5	1225	12,250	0.9
Kowanyama	2	0.2	2500	10,000	0.7
Kingaroy	16	1.6	225	7200	0.5
Lismore	14	1.4	210	5880	0.4
Lockhart River	1	0.1	2460	4920	0.3
Longreach	9	0.9	1180	21,240	1.5
Mackay	76	7.6	1000	152,000	10.7
Mareeba	1	0.1	1760	3520	0.2
Maryborough	2	0.2	300	1200	0.1
Melbourne	1	0.1	1685	3370	0.2
Miles	3	0.3	340	2040	0.1
Mitchell	3	0.3	570	3420	0.2
Mt Isa	8	0.8	1830	29,280	2.1
Murwillumbah	4	0.4	135	1080	0.1
Nambour	20	2.0	100	4000	0.3
Proserpine	10	1.0	1100	22,000	1.6
Quilpie	1	0.1	960	1920	0.1
Rockhampton	145	14.5	640	185,600	13.1
Roma	32	3.2	480	30,720	2.2
St George	10	1.0	520	10,400	0.7
Stanthorpe	1	0.1	220	440	0.0
Tara	2	0.2	300	1200	0.1
Taroom	6	0.6	470	5640	0.4
Theodore	2	0.2	575	2300	0.2
Thursday Island	8	0.8	2650	42,400	3.0
Toowoomba	38	3.8	130	9880	0.7
Townsville	1	0.1	1400	2800	0.2
Tweed Heads	3	0.3	110	660	0.0
Wandoan	1	0.1	410	820	0.1
Warwick	8	0.8	160	2560	0.2
Weipa	8	0.8	2510	40,160	2.8
Wujal Wujal	5	0.5	2020	20,200	1.4
<i>Total</i>	<i>1000</i>	<i>100</i>		<i>1,417,350</i>	<i>100</i>

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# ► A cost-minimization analysis of a telepaediatric mental health service for patients in rural and remote Queensland

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## Summary

The e-Child and Youth Mental Health Service (eCYMHS) is delivered by videoconferencing to nine rural and regional sites in Queensland. Between July 2004 and December 2006, a total of 317 videoconference clinics were offered, with 606 patient consultations. A cost-minimization analysis was undertaken to compare the actual costs of videoconference consultations with the potential costs of face-to-face consultations with the same specialists in Brisbane (i.e. patient travel) and the potential costs of face-to-face consultations in the regions (i.e. visiting psychiatrist). The actual cost of providing telepaediatrics during the 30-month period was \$230,753 (\$1 = US\$0.86 or €0.63). The potential cost of patient travel was \$650,389 and the potential cost of a visiting psychiatrist was \$299,913. Videoconferencing was the cheapest method of delivering child psychiatry services when the workload exceeded 131 consultations (compared with patient travel) and 379 consultations for the visiting psychiatrist outreach service. Based on the actual workload observed in the study, the use of videoconferencing resulted in a net saving for the health service of about \$420,000 compared with patient travel and \$70,000 compared with a visiting outreach service.

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## Introduction

Delivering specialist, multidisciplinary mental health services via videoconferencing seems to be a feasible way

## Original article

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# ► Diagnostic accuracy of and patient satisfaction with telemedicine for the follow-up of paediatric burns patients

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### Summary

Videoconferencing has become a routine technique for the post-acute burns care of children in Queensland. We compared the agreement between clinical assessments conducted via videoconference and assessments conducted in the conventional, face-to-face manner (FTF). A total of 35 children with a previous burn injury were studied. Twenty-five children received three consecutive assessments: first FTF by a consultant in the outpatient department, then by a second consultant who reviewed the patient via videoconference, and then by the second consultant in person. The second consultant also reviewed another 10 children twice. At each review, the following variables were measured: scar colour, scar thickening, contractures, range of motion, the patient's level of general activity, any breakdown of the graft site, and adequacy of the consultation. Agreement between the two consultants when seeing patients FTF was moderately high, with an overall concordance of 85%. When videoconferencing was used, the level of agreement was almost the same, at 84%. If one consultant reviewed patients FTF first and then via videoconference, the overall concordance was 98%; if the process was reversed, the overall concordance was 97%. This study confirms that the quality of information collected during a videoconference appointment is comparable to that collected during a traditional, FTF appointment for a follow-up burns consultation.

### Introduction

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Queensland is a large state, spanning nearly 2800 km from north to south and 1500 km from east to west. Most specialist services are located in the south-east of the state, which means that many patients have to travel long distances to access them. For example, there is only one specialist paediatric burns centre in Queensland, which is located at the Royal Children's Hospital (RCH), in Brisbane.

The benefits of telemedicine for paediatric work, or telepaediatrics, are becoming recognized in Queensland<sup>1-3</sup>. For the health service, there are savings

related to patient travel (which is generally reimbursed). For the patient and family, there is improved access to specialist services, without the inconvenience and costs of a trip to a specialist centre<sup>4</sup>.

Telepaediatrics is not likely to be relevant to the acute treatment of a burn, but it can be useful in situations where burns patients travel long distances for follow-up, as is the case in Queensland. Elsewhere in the world there is some experience with telemedicine for burns, but in adults, not in children<sup>5,6</sup>. There seem to be few, if any, reports related to post-acute burns care for children. Furthermore, there seems to be little evidence to support the accuracy of paediatric burns consultations conducted via videoconference. The present study was therefore conducted to assess the accuracy of consultations conducted via videoconference for paediatric burns patients.

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## Methods

We compared the use of videoconferencing for the assessment of burns with conventional, face-to-face (FTF) assessments. Ten experimental clinics were coordinated over a 12-month period. FTF appointments were held in the burns outpatient department at the RCH. Telepaediatric burns sessions were held in the videoconference studios of the Centre for Online Health also located at the RCH. Consultations via videoconference were conducted using ISDN at 128 kbit/s between the two rooms. We used standard videoconferencing equipment (Sony 5100P) in both consulting studios.

Non-acute patients who required review of a pre-existing burn injury and advice regarding scar management were selected for the study. We explained the purpose of the study and sought verbal consent. Permission to conduct the study was obtained from the appropriate committees.

## Comparisons

Three comparisons were carried out.

(1) *Comparison 1: two observers, different modalities.*

Differences in this scenario can be due to differences between the modalities (i.e. FTF and videoconference consultations may give different results) and to differences between the observers (i.e. two observers making a measurement by the same technique in the same patient will not always agree — an example is the measurement of blood pressure by sphygmomanometer).

(2) *Comparison 2: two observers, same modality.*

Differences in this scenario are principally due to differences between the observers. However, there could be an interaction between the observer and the modality used (e.g. observer A always gets a higher result by videoconference).

(3) *Comparison 3: single observer, different modalities.* In this comparison, any discrepancies will be due to differences between the modalities and differences within the observer or subject (the observer making a measurement by the same technique on the same patient will not always obtain the same result — for example, the first of two readings of blood pressure may be higher).

In comparisons 1 and 2, patients were reviewed three times within a period of about 1 h (Table 1). The first appointment was with consultant A (the primary consultant normally responsible for the patient's outpatient care). This appointment was conducted in the conventional manner, FTF in the burns centre

**Table 1** Order of assessments of patients for comparisons 1 and 2

Assessment order	Observer	Mode
1	Consultant A	Face to face
2	Consultant B	Videoconference
3	Consultant B	Face to face

(Fig 1a). The second and third appointments were conducted by consultant B, who saw the patient first via videoconference (Fig 1b) and then FTF (Fig 1c). In comparison 3, patients were reviewed twice within a period of about 1 h.

All in-person (FTF) consultations were conducted in the conventional manner, and involved some contact with the patient to determine the condition of scarring (including scar thickening).

## Outcome measures and user satisfaction

An assessment form was developed for the study, which included the assessment criteria commonly used for the evaluation of a patient receiving post-acute burns care. Six variables were measured:

- (1) *Appearance of scars.* The colour of scars was recorded, as pale, pink or red.
- (2) *Scar thickening.* Consultants were asked whether there were any signs of scar thickening (yes or no; if yes, where).
- (3) *Contractures.* Consultants were asked to record whether there was any evidence of a contracture (yes or no; if yes, where).
- (4) *Range of motion.* Patients showed the range of motion they had in the affected area and stretching abilities for each consultant. When reviewed via videoconference, patients could demonstrate movement by following instructions from the consultant. If patients had difficulty performing an assigned exercise, the consultant recorded the range of motion as restricted, or otherwise unrestricted.
- (5) *Activity level.* In each consultation, the consultant recorded the patient's general level of activity. In addition to general observation of the patient, the consultant also asked the patient (or parents) to describe the level of activity. For example, was the patient involved in any sport or any other form of physical exercise? Activity was also classified as either unrestricted or restricted.
- (6) *Breakdowns.* The assessment of graft sites (particularly areas that had broken down) was an important aspect of the follow-up appointment. In person, the consultant could discuss with the family and closely examine any areas that were of concern. Via videoconference, the consultant



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**Fig 1** Each patient participated in a series of three consecutive appointments. (a) Patients were first reviewed by consultant A in the outpatient department (FTF). (b) Patients were then reviewed by consultant B via videoconference. (c) Patients were then reviewed face to face by consultant B.

viewed close-up live images and sought information from the family. Consultants were asked to decide whether there was any evidence of a breakdown area (yes or no; if yes, where).

A final item on the assessment form asked the consultants to indicate whether the observations made during the session were adequate for diagnosis and clinical decision making.

Patient satisfaction was measured by using a seven-question survey, with responses on a five-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree) (see Table 4). The questions were balanced according to their positive or negative phrasing in relation to videoconferencing. If no answer was made by the subject, the response was classified as 'Don't know'. Each survey was completed immediately after the consultation conducted via videoconference.

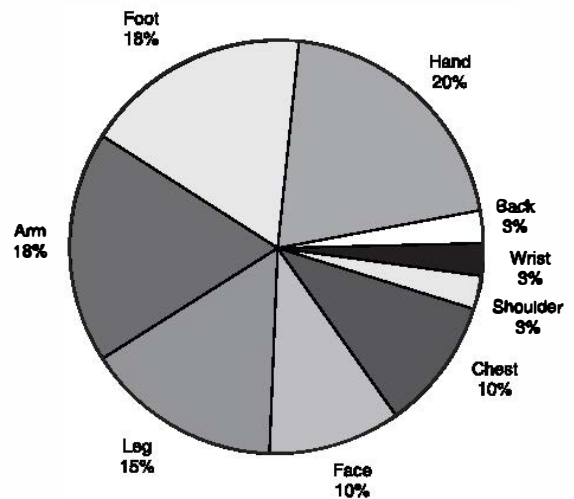
**Results**

Thirty-five patients participated in the study: 25 patients were involved in comparisons 1 and 2, and 10 in comparison 3. All patients required post-acute burns care for injuries located on a range of areas, including the arms, hands, legs, feet, face and chest (Fig 2).

**Comparisons 1 and 2**

Comparisons 1 and 2 allowed the agreement between two observers to be measured for each of the six variables (Table 2):

- (1) *Appearance of scars.* The concordance between the two consultants while reviewing the patient FTF



**Fig 2** Location of burns injuries of subjects involved in the study (n=35).

**Table 2** Comparisons 1 and 2 — agreement between two independent observers who saw the patient face to face (FTF) or via videoconference

Question	Comparison 1: consultant A FTF, consultant B videoconference (n=25)		Comparison 2: consultant A FTF, consultant B FTF (n=25)	
	Complete agreement in each category (%)	Overall concordance (%)	Complete agreement in each category (%)	Overall concordance (%)
Appearance of scars				
Pale	16	60	20	68
Pink	20		28	
Red	24		20	
Scar thickening				
Yes	40	64	40	60
No	24		20	
Contractures				
Yes	12	92	12	92
No	80		80	
Range of motion				
Restricted	88	92	88	92
Unrestricted	4		4	
Activity level				
Restricted	0	100	0	100
Unrestricted	100		100	
Breakdowns				
Yes	12	96	12	96
No	84		84	
Adequate for diagnosis and clinical decision making?				
Yes	100	100	100	100
No	0		0	

was 68% ( $n=25$ ), compared with 60% when videoconferencing was used by one of the consultants.

- (2) *Scar thickening*. The FTF agreement between the two consultants was 60%. When videoconferencing was used by one of the consultants, the concordance increased slightly, to 64%. This represented a minor difference of only a single case in the group of 25 patients.
- (3) *Contractures*. The method of consultation had no effect on concordance when reporting the presence or absence of contractures. In each instance the level of concordance was 92%.
- (4) *Range of motion*. Again, in each instance the level of concordance was 92%.
- (5) *Activity level*. No major restrictions in activity or mobility were reported. Concordance between the two consultants was 100%, regardless of the consultation method.
- (6) *Breakdowns*. Consultation technique had no effect on concordance between the two consultants' assessments of breakdown of the graft site. In each instance the level of concordance was 96%.

In comparison 2, the overall level of agreement between the consultants when both seeing patients FTF was moderately high, at 85%. In comparison 1, when

videoconferencing was used by one of the consultants, the level of overall agreement was almost the same, at 84%.

### Comparison 3

In comparison 3, two examinations were carried out by the same consultant in rapid succession to investigate what effect order of modality had on the level of agreement. There were only trivial differences in the level of agreement according to which order the two modalities had been used in (Table 3). If the consultant reviewed each patient first FTF and then via videoconference the overall concordance was 98%. If the process was reversed and the consultant saw the patient via videoconference first, the overall concordance was 97%.

### Consultant satisfaction

Both consultants were very satisfied with the contact they had with patients, regardless of the technique used. In every case, consultants felt that the appointment was an adequate means of assessing the patient and formulating clinical decisions related to management.

**Table 3** Comparison 3 — order effect, when the same consultant reviewed each patient face to face (FTF) and then via videoconference, and vice versa

Measure	FTF and then videoconference (n=10)		Videoconference and then FTF (n=25)	
	Complete agreement per category (%)	Overall concordance (%)	Complete agreement per category (%)	Overall concordance (%)
Appearance of scars				
Pale	10	90	24	88
Pink	40		36	
Red	40		28	
Scar thickening				
Yes	50	100	72	96
No	50		24	
Contractures				
Yes	20	100	16	100
No	80		84	
Range of motion				
Restricted	100	100	92	100
Unrestricted	0		8	
Activity level				
Restricted	0	100	0	100
Unrestricted	100		100	
Breakdowns				
Yes	30	100	16	100
No	70		84	
Adequate for diagnosis and clinical decision making?				
Yes	100	100	100	100
No	0		0	

**Table 4** Proportion (%) of parents' responses to satisfaction questions regarding consultations conducted via videoconference (n=25)

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't know
I could see the specialist clearly	80	16	4	0	0	0
I had trouble hearing what was said	0	0	0	16	84	0
I was able to say what I wanted	60	36	0	4	0	0
I was worried that others might have been listening	0	8	0	28	64	0
The TV camera made me feel uncomfortable	0	12	12	20	56	0
I was confident that my condition could be sorted out via videoconference	48	52	0	0	0	0
The appointment was not as good as face to face	0	12	24	36	20	8

## Patient satisfaction

Only one of the 25 patients had ever attended a videoconference before. All patients and families involved in the study were very interested in the opportunity to participate in a videoconference. Overall, patient (and parent) feedback was very positive (Table 4).

Patients were very satisfied with the transmission of video and audio during the videoconference: 96% strongly agreed or agreed that they could see the specialist clearly, and all respondents strongly disagreed or disagreed that they had trouble hearing the specialist during the videoconference. Almost all patients (96%) felt that they were able to say everything they wanted during the videoconference.

The majority of patients were comfortable with the technology. Although two families (8%) agreed that they worried that their appointments were not confidential and that others may have been listening, 92% felt that the consultation was private and confidential. Similarly, a few patients (12%) agreed that the video-camera made them feel uncomfortable but most (76%) disagreed or strongly disagreed.

All patients either strongly agreed (48%) or agreed (52%) that their medical condition could be adequately managed via videoconference. Patients were also asked whether they considered the videoconference appointment was not as good as a FTF appointment. Only three families (12%) agreed with this statement, while 56% of families disagreed or strongly disagreed.

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The remaining families maintained a neutral position (24%) or did not know (8%).

## Discussion

Agreement between two observers is conventionally measured using the kappa coefficient<sup>7</sup>. In the present study, we could not calculate kappa values for each assessment category because of the lack of variability in certain variables. For example, all subjects involved in the study had an unrestricted range of motion. Thus the formula for kappa was indeterminate because of division by zero. We therefore calculated the percentage agreement, to give an overall measure of concordance for each of the variables.

The level of agreement obtained by observers using a single technique showed that assessments made via videoconference were no less accurate than assessments made using the conventional method (i.e. conducted in person). Furthermore, the inter-observer agreement in the present study was similar to the agreement which has been shown to exist between independent observers while using scar description tools such as the Vancouver Burns Scale<sup>8</sup>.

In the present study, audio-visual quality during the videoconferences using a single ISDN line at a bandwidth of 128 kbit/s was judged to be reasonable by the consultants. There were no connection difficulties. Overall, audio and visual communication was deemed adequate by both consultants. We chose this transmission speed for two reasons. The first was to replicate the bandwidth most likely to be available in regional and remote hospitals in the state, since in Queensland the majority of videoconference systems are connected by a single ISDN line. The second reason was to ascertain whether a bandwidth of 128 kbit/s was adequate for clinical consultations in this specialist area. The overall agreement between assessments made by videoconference and assessments made FTF indicates that a bandwidth of 128 kbit/s is sufficient, on the whole. However, we suspect that a higher transmission rate may improve the interpretation of range of motion and mobility.

In addition, there are various techniques that could be used to support consultations conducted via videoconference. For instance, parents could be asked to make reports on the patient. A range of questions could be asked for this purpose, such as:

- (1) Can you see any breakdowns? If so, where? Can you describe them?
- (2) Is there any tightening? Where exactly?
- (3) Do you think that the scars have improved since we started using the garments?

- (4) Are the scars raised or flat? If raised, by how much?

Despite the similar levels of agreement, the consultants reported that the colour of a scar was difficult to ascertain by videoconference. In terms of interpreting scar appearance, colour cards may be useful for clinical assessment. The use of specific assessment scales or tactile tests for the measurement of scar thickness might also help to improve overall concordance, but these tools are not conventionally used in the burns unit and therefore were not included in the design of the present study.

The satisfaction of families involved in the videoconferences was very high. Additional comments from parents were that, if given the option of travelling to Brisbane or participating in a videoconference closer to home, they would prefer the latter. Our findings reinforce the concept that families involved in a consultation via videoconference are very satisfied with this method of health service delivery. The present study confirms that the quality of information collected during a videoconference appointment is comparable to that collected during a traditional FTF appointment for a follow-up burns consultation.

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