MACKAY HOSPITAL AND HEALTH SERVICE
Mackay Base Hospital
Dr Michael Williams *MB BS (Hons) FRACP MmedSc*
Paediatric and Adolescent Physician
Private Practice Clinic
Child & Adolescent Unit
E-mail: Michael.Williams3@health.qld.gov.au
Telephone:(07) 4885 7290
Facsimile: (07) 4885 7299
Our Reference: MW:kr
Provider No: 239722A

Queensland Government

Submission

Inquiry into telehealth services in Queensland, Health and Community Services Committee

Michael Williams Director of Child & Adolescent Health
Mackay HHS

Background:

I have been a consultant paediatrician providing services to the Mackay District for more than 30 years. Over that time I have provided outreach clinics to the rural towns in the Mackay district and have established paediatric sub-speciality outreach clinics to Mackay. Around 17 years ago in conjunction with the Royal Children's Hospital we began sub-speciality telehealth consultation to Mackay. This was expanded in conjunction with the Centre for On-Line Health to a wide range of paediatric sub-speciality services delivered to patients through the Mackay Base Hospital. These consultations have largely been scheduled clinics but have also included acute consultations.

In the last twelve years we have provided increasing telehealth consultation to patients at rural sites in the Mackay Health District and some neighbouring sites eg: Emerald. Many consultations are now delivered to patients in their general practitioners rooms.

In conjunction with the Centre for On-Line Heath we have undertaken research with many publications and presentations of our results and experience. Recent presentations have been to the Australian telehealth conference (Melbourne – March 2014) and for the Royal Children's Hospital Brisbane Grand Round (30th April 2014). The grand round presentation was entitled "Delivering paediatric are to regional and rural Queensland", with the theme of providing high standard, safe and cost effective health care using telehealth as a key means of connectivity.

Telehealth Experience:

Our experience has been:

- patient satisfaction – we have had widespread acceptance and satisfaction with Telehealth consultation. This is for a wide range of general and subspecialty paediatric problems. This has included work with indigenous sites in the Mt Isa district, where I have supervised a paediatric Telehealth registrar position.
- acute consultation – we have been providing acute Telehealth consultations for rural sites with patients with an acute problem. This is for advice and to help decide if there is a need to transfer or not. We have found up to a 50% reduction in transfers from the rural hospital where we have a Telehealth consultation compared with providing advice via telephone. Where transfers do occur the Telehealth allows for the receiving unit to better know the patient coming to them (and vice versa for patient), plan accordingly, discuss this with the patient/parent, and plan the appropriate transfer means. I attach a paper we have published on this experience.
- more considered consultation – a Telehealth consultation is a far more considered consultation compared with providing advice via telephone, and hence leads to a better assessment and

Office Child & Adolescent Health Bridge Road Mackay 4740
Postal PO Box 5580 Mackay Mail Centre 4741
Phone 48857290
Fax 48857299

outcome. It needs to be provided without undue delay. It allows for better documentation compared with phone advice.

- inclusivity – Telehealth consultation allows for all parties concerned with the patient to be involved, if necessary via 3 way Telehealth link eg GP with patient in rural site, nurse and general paediatrician in regional site, and subspecialty team at tertiary site.
- patient centric (family centred care) – with the patient the focus of everyone's attention and actively involved with the consultation, all decisions are according to best interests and wishes of the patient
- ease of use – Telehealth can be undertaken with simple devices eg i-pad, laptop with camera and 4G dongle …and so consultants can provide consultation from their office desk, or at home after hours. For example recently we were able to show an echocardiographic study to a consultant paediatric cardiologist at home using his home computer and discuss a case to rule out a critical cardiac problem in a 6 month sick child 2 weeks after cardiac surgery, a great relief for parents and staff.
- range of problems – we have used Telehealth for scheduled consultation for all subspecialties at the RCH including orthopaedics, plastic surgery, burns, neurology. Initial consultation for most problems is beneficial as this allows meeting, establishing the nature of the problem and its history, review of doctor's findings and investigations, and then planning if there is a need for further management which might include face to face review. If there is a need to see face to face the timing of this and organising other assessments can occur to make this visit most efficient.
- support for clinicians – Telehealth consultation does require additional organisation, especially for the administrative officers, making the bookings for both ends, and organising patient and staff accordingly. It is important for someone to ensure all is facilitated for the clinician who can then just concentrate on clinical issues, and avoid wasting clinician time. The extra organisational and consultation time is well compensated with better outcomes including efficiency, avoiding unnecessary appointments at distant sites and better communication between all parties.
- improved health care networks and professional education – meeting via Telehealth creates an improved relationship between health care professionals, which improves communication and care processes. This encourages delegation of care from specialist to generalist. Each consultation allows good discussion of clinical issues around patient management which enables professional development.
- outreach and Telehealth: our experience is that outreach visits can be reduced substantially with Telehealth consultation but should still occur eg 1 – 3 times/ yr according to demand. Outreach is more costly and demanding of time and resources but does allow the clinician to meet others, see patient face to face and know the community and setting. Outreach funding can block Telehealth eg if funded frequently eg monthly or 2nd monthly. Telehealth clinics in between should be a requirement of providing outreach to gain cost and resource efficiency. There should be critical appraisal and revision of all outreach programmes to ensure that maximal Telehealth consultation is provided to these sites.
- Patient Travel Subsidy Scheme (PTSS): stricter requirements for having undertaken Telehealth consultation is required before travel subsidy is provided. We have used PTSS approvals to define high need areas for outreach and Telehealth.
- there has been little incentive or reward for making the effort to move to Telehealth for clinicians or service departments, with executives not adequately supporting it

Recommendations:

- I support the current QHealth initiative to build the role for Telehealth in delivering health care to rural and regional Queensland, through both scheduled and acute consultation;
- the provision of Telehealth should follow established referral pathways eg rural site to regional general specialist. Subspecialty services should be provided through the general specialist site eg paediatric neurology to patients at regional site referred by general paediatrician. Bypassing the regional specialist or rural general practitioner by subspecialists should be avoided, as it will tend to undermine regional and rural practitioners role and experience, and leave them unaware if there is a need for acute local consultation.

Office
Child & Adolescent Health
Bridge Road
Mackay 4740

Postal
PO Box 5580
Mackay Mail Centre 4741

Phone
48857290

Fax
48857299

- the provision of Telehealth advice lines (eg TEMSU, CATCH) should ensure that rural calls are linked to the on call regional specialist (not central) and if unavailable to another specialist experienced in regional and rural practice. The goal of acute Telehealth consultation is to achieve safe care closest to the patients home, and hence reduce the pressure on in- patient beds in regional and tertiary hospitals;
- medical advice is best provided to rural sites via Telehealth by consultants rather than registrars as this ensures the best consideration of keeping the patient at the rural site. Follow-up review can be provided by registrars**.**
- regional and tertiary outpatient clinics should have a process of defining those patients living at more than 100km who should be offered Telehealth consultation at their GPs or local hospital as the default booking;
- on call consultants should have a KPI for providing advice via Telehealth, at least daytime initially;
- specific increasing Telehealth targets for HHS's should be established with mechanisms for funding and other incentives to flow to those clinical departments providing Telehealth**;**
- Telehealth coordinators should provide support to clinicians especially as they begin Telehealth or if only occasionally providing it. The coordinators should aim to build skills in admin officers or clinic nurse to take over coordination role. Co-ordinators should have set targets for delivery of Telehealth services to meet, to ensure delivery of outcomes.

My submission has been limited. I would be very happy to discuss issues to do with my experience with Telehealth with the inquiry.

Dr Michael Williams
DIRECTOR
CHILD & ADOLESCENT HEALTH

5th May 2014

Office
Child & Adolescent Health
Bridge Road
Mackay 4740

Postal
PO Box 5580
Mackay Mail Centre 4741

Phone
48857290

Fax
48857299

RESEARCH/Original article

Teleconsultation from a secondary hospital for paediatric emergencies occurring at rural hospitals in Queensland

Journal of Telemedicine and Telecare
19(7) 405 410

DOI: 10.1177/1357633X13506528
jtt.sagepub.com
SAGE

Sachin Desai[1], Michael L Williams[1] and Anthony C Smith[2,3]

Summary

We reviewed telehealth consultations for acute paediatric patients presenting at rural sites in the Mackay district in 2012. Patient data and outcomes were collected prospectively, and a survey of the referring clinicians was undertaken. Thirty four patient consultations were conducted via telehealth with 14 referring clinicians. Most of the referrals were for respiratory illnesses, including bronchiolitis. We received feedback surveys for 16 consultations (57% response rate). In 47% of the cases, the paediatric team felt that transfer was avoided by using teleconsultation. In 80% of consultations, the referring clinicians felt that video consultation was more effective than telephone alone. In 30% of cases, the referring clinicians felt that the patient would have been transferred to higher facility in the absence of the telehealth facility. Clinicians thought that almost all consultations had educational value and reduced their anxiety in dealing with acute paediatric problems. There were no adverse outcomes or delayed transfers of patients staying at their rural sites. We recommend that telehealth consultation occur for all enquiries about acute paediatric patients at rural sites, especially if transfer of the patient is being considered.

Accepted: 29 August 2013

Introduction

The role of telehealth is well established in managing elective rural paediatric outpatients, where it has proved to be clinically effective and to reduce long distance travelling and costs.[1 3] Rural sites in Queensland often have limited infrastructure and experience in managing paediatric emergencies. These sites are usually staffed by generalist doctors without specialist training in paediatrics.[4] To address this, telehealth consultations have been undertaken for acute patients less than 18 years old at rural sites in the Mackay district.

The Child and Adolescent Health Service (CAHS) at the Mackay Base Hospital serves a large region in northern Queensland, extending more than 300 km to the west and 200 km to the north and south. It supports six rural hospitals in this region (Figure 1). The CAHS has six paediatric consultants (full and part time) and five junior medical staff, including paediatric trainee registrars. The CAHS has an 11-bed ward for children up to 18 years, and an 8-bed special care nursery for managing babies more than 31 weeks gestation.

Since 1998 the CAHS has conducted regular subspecialist telehealth clinics with the Centre for Online Health at the Royal Children's Hospital in Brisbane, the nearest paediatric tertiary centre (1000 km from Mackay). The CAHS has also established a programme of telehealth clinics for rural sites in the Mackay region.[5 9] Neonatal telehealth consultations occur with the nearest Level 3 neonatal unit at the Townsville Hospital, 400 km from Mackay.

Doctors at rural sites ring the CAHS when they have a patient with an acute problem requiring specialist advice or when they think they may need to transfer the patient to the paediatric unit for assessment and management. We have developed a preference for reviewing these patients using telehealth prior to any further management decision, although some transfers are arranged by the state's central retrieval service, Retrieval Services Queensland (RSQ), without CAHS input. Transfer of patients may occur because of parental or health care professional anxiety, rather than there being evidence of serious illness. Transfer is often by air, which is expensive and can be high risk at night.

There are published reports of the use of telehealth by tertiary hospitals to provide trauma, emergency and critical care consultations.[10 16] However, telehealth

[1]Child and Adolescent Health Service, Mackay Base Hospital, Queensland, Australia
[2]Centre for Online Health, University of Queensland, Brisbane, Australia
[3]Queensland Children's Medical Research Institute, Brisbane, Australia

Corresponding author:
Dr Michael Williams, Mackay Base Hospital, Box 5580, Mackay Mail Centre, QLD 4741, Australia.
Email: Michael.williams3@health.qld.gov.au

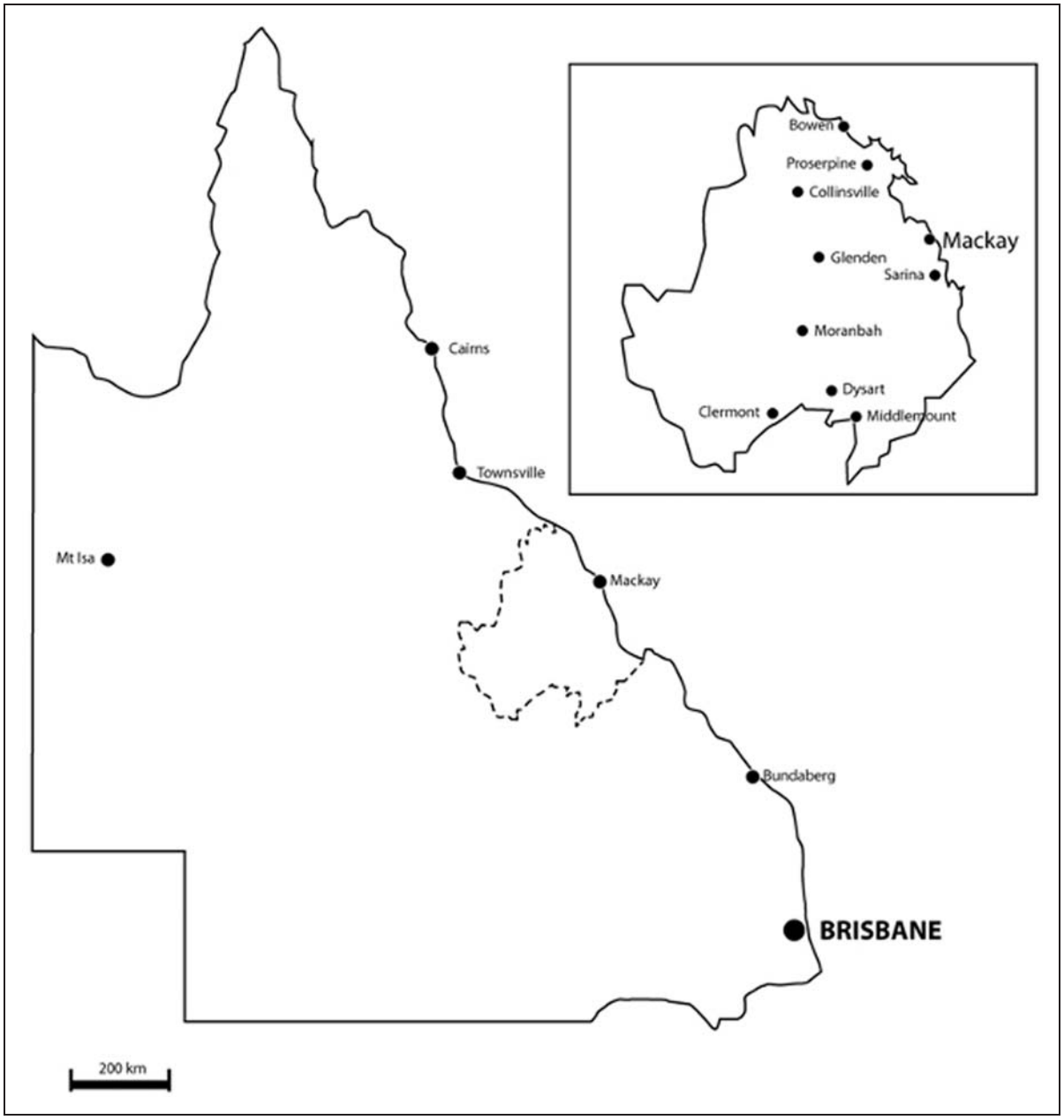

Figure 1. Queensland and the Mackay Health District and hospitals.

consultation by a secondary level paediatric team for acute paediatric problems at rural sites has not previously been reported.

Paediatric emergency teleconsultations

Following a telephone call from a doctor at a rural site about a paediatric patient with an acute problem, a telehealth consultation is arranged when appropriate, with a CAHS consultant paediatrician as quickly as possible.

The CAHS has two dedicated telehealth units and there are telehealth units (Tandberg) in all Queensland Health hospitals, including in all emergency rooms (two wall mounted cameras and a flat screen monitor). Far end camera control enables the receiving consultant to look around the room or obtain close up views of the patient or monitor. Consultations can also be undertaken after-hours from the consultant's home using dedicated software (Movi) on a laptop with a webcam. Annual visits are made to all the rural sites by the CAHS director to review services, infrastructure and build rapport.

During the telehealth consultations, the patients' history, clinical findings and investigations are reviewed. A standardised charting of vital signs, the Childhood Early Warning Tool (Queensland Health) is used at the rural site to identify signs of serious illness. A decision is made either to treat the patient at the rural hospital, or transfer to Mackay, Brisbane or Townsville. The central retrieval service is notified to coordinate transfers. A patient is kept at the rural site only if the clinician,

nursing staff and parent agree. Patients remaining at the rural site are followed up via further telehealth consultations or telephone calls to the referring doctor.

Details of acute telehealth cases were entered into a spreadsheet by the consulting paediatrician including the patient's details (name, age, sex, date of birth, medical record number), clinical problem, referring physician's name and site, outcome (transfer required or avoided) and management suggestions.

We have reviewed our telehealth consultations with the rural health professionals, patients and parents to evaluate outcomes and the need for patient transfers.

Methods

An observational study was undertaken over one year from January to December 2012 inclusive. Ethics approval for the study was not required.

The referring clinician was requested to complete an online survey about each telehealth consultation. The questions included the effectiveness of the consultation compared with telephone consultation, whether they felt supported, whether it reduced their anxiety in managing childhood illness, whether they felt the patient would have been transferred in the absence of telehealth, whether the consultation provided them with an educational opportunity, the audio and video quality, and their suggestions or opinions about the process. Telephone and email reminders were made to improve the response rate.

Results

During the study period there were 34 patient consultations for acute paediatric problems from the six rural sites in the Mackay district. Fourteen rural clinicians referred the patients. Most referrals were from Proserpine, which was the largest and busiest rural site. The average distance between these sites and paediatric services is 200 km (Table 1).

Most of the referrals were for respiratory illnesses, including bronchiolitis (Table 2). One patient had croup with stridor requiring adrenalin inhalation therapy but was not transferred. One patient had an urticarial rash and was transferred the next day with suspected Kawasaki disease. Most of the patients who required transfer had respiratory illness requiring additional support such as high flow oxygen or CPAP. All three patients with prolonged seizures were transferred to Mackay. Preterm twins were retrieved to the Townsville Hospital. Most of the patients referred (90%) were less than five years old. Almost 70% who required transfer were less than one year old (Table 3).

The email survey was sent to the 14 referring clinicians in 28 of the 34 cases. The clinicians' details were not documented for six cases. There were 16 responses, a response rate of 57% (Table 4). In 81% of the consultations, clinicians reported that telehealth consultation was superior to telephone consultation alone. Most (88%) reported that the consultation helped to improve communication between the rural team and the paediatrician. In all cases, they thought the consultation provided them with an educational opportunity in managing childhood illnesses.

Table 1. Referring sites and number of patients.

	Distance from Mackay (km)	Number of teleconsultations	Number of patients transferred to higher centre
Proserpine	126	14	7
Bowen	192	6	3
Dysart	250	2	1
Collinsville	273	2	0
Clermont	274	4	0
Moranbah	200	6	3 (incl twins)
Sarina	37	0	0
Total		*34*	*14*

In most cases (90%), rural clinicians felt that the telehealth consultation had reduced their anxiety in dealing with acute paediatric illness. All felt supported during the consultation and in all cases they agreed that it improved access for the rural patient with acute problems to paediatric services. The majority were happy about the audio and video quality during consultations.

Of the 16 patients with clinician feedback, 3 patients needed transfer. For the remaining 13 cases, the referring clinicians felt that telehealth had reduced the need for transfer in 31% of cases. Six (46%) respondents were not sure whether telehealth prevented the need for transfer (Figure 2). Anecdotal comments from clinicians involved with the telehealth service reinforced the value of the service.

Referral outcomes

Out of 34 consultations by telehealth, 12 transfers occurred to the secondary level hospital and one (of twins) to a tertiary level neonatal unit. The mode, timing and destination for transfer were discussed during the consultation. The remaining 21 patients were managed at the rural sites with subsequent telehealth or telephone review by the Mackay paediatric team. In 16 of the 34 consultations (47%) the paediatrician thought that transfer was probably avoided. There were no adverse events arising from a decision not to transfer the patient, with no patients needing to be transferred subsequently due to deterioration.

Discussion

Providing emergency care is a challenging task for rural sites. Telehealth was able to deliver to the rural site paediatric input as would have occurred at the site where the paediatrician was based. Rural patients may be transferred to a secondary or tertiary hospital for problems

Table 2. Primary diagnosis and cases transferred.

	Number of cases seen by telehealth	Number of cases transferred	Proportion of cases transferred (%)
Preseptal cellulitis	1	0	0
Bronchiolitis	7	5	36
Neonatal jaundice	1	0	0
Fever (unspecified)	3	0	0
Respiratory distress (unspecified)	4	0	0
Croup	1	0	0
Prolonged seizure	3	3	22
Acute faecal retention	2	0	0
Head injury	1	0	0
Rash/urticaria	2	1	7
Thrombocytopenia	1	0	0
Asthma	2	1	7
Meningitis	1	1	7
Staphylococcal scalded skin syndrome	1	0	0
Neonatal respiratory distress syndrome/transient tachypnoea of newborn	1	1	7
Preterm twins	2	2	14
Unknown diagnosis	2	0	0
Total	*35*	*14*	*100*

Table 3. Patient age group.

	No of patients consulted	No of transfers required	Proportion of patients transferred (%)
Newborn (up to 4 weeks)	6	3	21
1–12 months	12	7	50
1–5 years	14	3	22
5–10 years	2	0	0
10–15 years	0	0	0
More than 15 years	1	1	7
Total	*35*	*14*	*100*

potentially manageable at the rural hospital. This may reflect the anxiety or uncertainty of the health care providers (both rural and specialist) or the patient's carer. A telephone call from the rural site to the general paediatric service may provide an unsatisfactory outcome due to an inadequate assessment or inexperienced opinion. There is a tendency when in doubt for the specialty service to ask for transfer of the patient. Telehealth consultation if arranged within minutes of the phone call provides a more considered consultation for all involved, health care professionals, the patient and parents. It requires the opinion of an experienced consultant, but this can be provided at any time, using a laptop or PC after-hours from the paediatrician's home.

The present study is the first in Australia to assess the effectiveness of telehealth from a secondary hospital in managing paediatric emergency cases at rural sites. The study demonstrates that teleconsultations can be provided quickly with good audiovisual quality. Our results show that a substantial reduction in patient transfers can be achieved safely. Appropriate planning and initial management can be provided for those patients requiring transfer, including having another site such as the retrieval service or paediatric intensive care also linked in via telehealth.

The survey showed that health care providers found that the telehealth consultation supported the care of their patients and was useful for professional development. It enables a form of peer review. Even if there is no significant change in management, it allows validation of the local care, which is supportive for both the clinician and parents. When a patient remains at the rural site it is important for the specialist to review the patient with the treating team by telehealth, as would normally occur at the specialist's site, for example four hours later and the following day depending on the problem and level of concern. New staff and changing symptoms can lead to concerns that need to be addressed.

The present study suggests a reduction of retrievals of 30-47% where teleconsultation occurs after rural sites request a paediatric opinion and possible transfer. This enables patients to be managed close to their home with the benefit of better hospital bed utilisation. Reduction in retrievals allows the health service to avoid substantial costs. Helicopter retrieval (our most common means of transfer) from one of our rural sites costs on average $12,000. Thus avoiding 16 retrievals as estimated in our study would produce a saving of $190,000/year. Utilising telehealth to avoid unnecessary transfer also reduces the

Table 4. Referring clinicians' feedback (n 16).

	Responses (n)	Strongly agree (%)	Agree (%)	Not sure (%)	Disagree (%)	Strongly disagree (%)
1. This consultation would have been equally effective by telephone alone	16 (100)	0 (0)	2 (12)	1 (6)	6 (38)	7 (44)
2. This telehealth consultation helped by improving communication between the rural hospital and a paediatrician at the secondary level hospital	16 (100)	6 (38)	8 (50)	1 (6)	0 (0)	1 (6)
3. Do you think this consultation pro vided you with an educational opportunity in terms of managing acute paediatric illness?	16 (100)	6 (38)	9 (56)	1 (6)	0 (0)	0 (0)
4. This telehealth consultation reduced my anxiety while dealing with acute paediatric illness	16 (100)	3 (19)	11 (69)	1 (6)	0 (0)	1 (6)
5. I felt supported during this tele health consultation	16 (100)	6 (38)	10 (63)	0 (0)	0 (0)	0 (0)
6. This telehealth consultation improved accessibility to a paediatri cian's services for a rural population with acute paediatric problems	16 (100)	6 (38)	9 (56)	0 (0)	0 (0)	1 (6)
7. I was satisfied with the audio quality	16 (100)	7 (44)	8 (50)	0 (0)	0 (0)	1 (6)
8. I was satisfied with the video quality	16 (100)	7 (44)	7 (44)	0 (0)	1 (6)	1 (6)

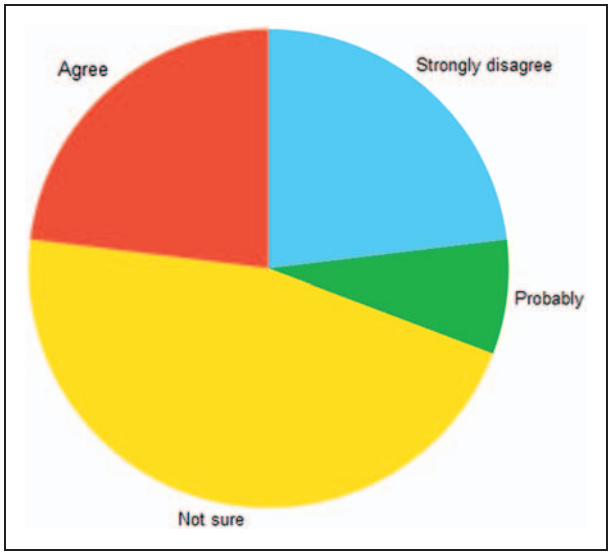

Figure 2. Survey results. Responses to the statement "In the absence of a telehealth service, this patient would have been transferred to higher centre for further management" (n 13).

risks of transfers, such as a helicopter crash en route to an evening retrieval which occurred some years ago in this district.[17,18]

A more considered telehealth consultation prior to transfer allows the opportunity to better plan initial stabilisation and retrieval to the appropriate site by the appropriate means. It enables the correct team to retrieve in a timely manner, with the receiving site having a better understanding of the patient coming to them. In contrast, ill children from island primary care sites have been sent without prior telehealth consultation via the ferry to the local rural hospital and then transferred to the paediatric specialist unit. There are few studies of telehealth use for management of paediatric emergencies, and none based in Australia. These studies have demonstrated that paediatric patients can be correctly assessed via telehealth in an emergency setting, with satisfactory outcomes.[10 16,19] Telehealth consultation by paediatric critical care specialists to children in rural emergency departments and a rural adult intensive care unit provided high quality care, and a high level of parent and provider satisfaction.[12,13]

Our study was a small observational study but does offer evidence for a model that we feel is important. It was limited in the number of responses from referring clinicians. This may be because of staff mobility, high workload and clinicians using one response to cover a number of consultations. Although a patient satisfaction study was not undertaken, other surveys have shown excellent patient support for telehealth consultation.[1 3,5 14,19] We received no complaints about adverse clinical outcomes from this patient group.

There is great potential to use telehealth to support paediatric acute care for patients in isolated sites such as in Queensland. It allows the same access to specialist opinion to that available for patients at the site where the specialist is based. It is facilitated by the specialist being familiar with the geography, the site and those staffing it, through occasional outreach visits to the site.

Conclusion

The use of telehealth by a general paediatrician to support management of paediatric and neonatal emergencies at rural sites appears to provide improved patient consultation and a reduction in the number of transfers of patients to a higher centre, with cost savings and reduced risk. Further evaluation of this model is warranted. It offers support to rural clinicians via better communication with the paediatric team, educational opportunities in managing acute paediatric problems and reduced anxiety. We recommend that telehealth consultation occur for all enquiries about acute paediatric patients at rural sites, especially if transfer of the patient is being considered.

References

1. Karp WB, Grigsby RK, McSwiggan Hardin M, et al. Use of telemedicine for children with special health care needs. *Pediatrics* 2000;**105**:843 7.
2. Smith AC. Telepaediatrics. *J Telemed Telecare* 2007; **13**:163 6.
3. Smith AC. Telepaediatrics in Queensland. pp 25 39 in Wootton R, Batch J, eds. *Telepediatrics: telemedicine and child health*. London: Royal Society of Medicine Press, 2004.
4. Queensland Government. Rural Generalist Pathway. See http://www.health.qld.gov.au/ruralgeneralist/default.asp (last checked 7 August 2013).
5. Smith AC, Williams M, Van der Westhuyzen J, McCrossin R, Isles, Wootton R. A comparison of telepaediatric activity at two regional hospitals in Queensland. *J Telemed Telecare* 2002;**8**(Suppl. 2): 58 62.
6. Williams ML. Telepaediatrics from a secondary level. pp 213 224 in: Wootton R, Batch J, eds. *Telepediatrics: telemedicine and child health*. London: Royal Society of Medicine Press, 2004.
7. Williams ML. Support for the clinician in providing a regio nal telehealth service. *J Telemed Telecare* 2007;**13**:271 3.
8. Smith AC, Williams ML, Justo R. The multidisciplinary man agement of a paediatric cardiac emergency. *J Telemedicine Telecare* 2002;**8**:112 4.
9. Justo R, Smith AC, Williams M, et al. Paediatric telecardiol ogy services in Queensland : a review of three years of experience. *J Telemed Telecare* 2004;**10**(Suppl. 1): 57 60.
10. Rogers FB, Ricci M, Caputo M, et al. The use of telemedi cine for real time video consultation between trauma cen ter and community hospital in a rural setting improves early trauma care: preliminary results. *J Trauma* 2001;**51**:1037 41.
11. Galli R, Keith JC, McKenzie K, Hall GS, Henderson K. TelEmergency: a novel system for delivering emergency care to rural hospitals. *Ann Emerg Med* 2008;**51**:275 84.
12. Heath B, Salerno R, Hopkins A, Hertzig J, Caputo M. Pediatric critical care telemedicine in rural underserved emergency departments. *Pediatr Crit Care Med* 2009;**10**:588 91.
13. Marcin JP, Nesbitt TS, Kallas HJ, Struve SN, Traugott CA, Dimand RJ. Use of telemedicine to provide pediatric critical care inpatient consultations to underserved rural Northern California. *J Pediatr* 2004;**144**:375 80.
14. Marcin JP, Ellis J, Mawis R, Nagrampa E, Nesbitt TS, Dimand RJ. Using telemedicine to provide pediatric subspe cialty care to children with special health care needs in an underserved rural community. *Pediatrics* 2004;**113**:1 6.
15. Kofos D, Pitetti R, Orr R, Thompson A. Telemedicine in pediatric transport: a feasibility study. *Pediatrics* 1998;**102**:e58.
16. Brennan JA, Kealy JA, Gerardi LH, et al. A randomized controlled trial of telemedicine in an emergency department. *J Telemed Telecare* 1998;**4**(Suppl. 1): 18 20.
17. Australian Transport Safety Bureau. Air safety investigation 200304282. Available from http://www.atsb.gov.au/aviation.aspx (last checked 9 August 2013).
18. Queensland Courts. Inquest into the deaths of Craig Liddington, Stewart Eva and Andrew Carpenter. See http://www.courts.qld.gov.au/__data/assets/pdf_file/0005/86594/cif liddington c stewart e carpenter a 20051028.pdf (last checked 9 August 2013).
19. Marcin JP, Schepps DE, Page KA, Struve SN, Nagrampa E, Dimand RJ. The use of telemedicine to provide pediatric critical care consultations to pediatric trauma patients admitted to a remote trauma intensive care unit: a prelim inary report. *Pediatr Crit Care Med* 2004;**5**:251 6.