

The feasibility and cost-effectiveness of a novel telepaediatric service in Queensland

*A THESIS SUBMITTED IN THE SCHOOL OF MEDICINE,
FACULTY OF HEALTH SCIENCES
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY
AT THE UNIVERSITY OF QUEENSLAND
APRIL 2004*

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Statement of originality

The work contained within this thesis has not been previously submitted for a degree or diploma at any other tertiary institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Anthony C. Smith

Signed:

Date:

Acknowledgements

This thesis is the product of several years' work, which has not only been a valuable test of endurance but also an opportunity to discover and confirm my interest in a unique field of medical research. This thesis would not have been possible without the involvement and support of many people, all of whom are the subject of my appreciation.

I am sincerely thankful to Professor Richard Wootton, Director of Research, Centre for Online Health, University of Queensland for exceeding his role as principal advisor. Richard's expertise in online health and strong commitment to quality research has helped guide me through the work described in this thesis. I would also like to thank Professor Peter Yellowlees (University of Queensland) for his helpful advice and interest during the early stages of candidature.

I thank my colleagues at the Centre for Online Health including Karen Youngberry, Jo Cignoli, Kerrie Crew, Dr Peter Whan, Andrew Hockey, Mark Bensink and Janet Hayes for their support and friendship (not forgetting the strong coffee and morning teas we have shared). Thanks to Karen in particular for her contribution towards the operation of the telepaediatric service and for her helpful advice during the final formatting stages.

I have had the pleasure of working with students with a range of backgrounds. I would like to thank Sinead Gormley and Jessica Patterson - Northern Ireland (UK), Alison Gowdy (UK), David Miller, Fiona Christie and Jodi West – Scotland (UK). They have each provided valuable support as research assistants for the telepaediatric project.

I thank Professor Sydney Salmon (Ulster Hospital, Belfast) for her involvement in the independent evaluation of telepaediatric referrals during the first phase of the project. I also thank Professor David Hailey (University of Alberta), Professor Sukhan Jackson (University of Queensland), Dr Jeanine Young (Nursing Director, RCH) and Mr Eric Dillon (WA Health) for their helpful comments and suggestions.

My sincere thanks to Professor Jennifer Batch (University of Queensland) for her kind offer to read a final draft of this thesis and for her constructive comments. Thanks also to Associate Professor Peter O'Rourke (University of Queensland) for his statistical advice. I am grateful to the RCH Ethics Committee for their advice and assistance.

I thank all staff who have been actively involved in the telepaediatric service, including medical staff, nursing staff, allied health staff and administrative personnel. Deserving thanks is owed to Professor Alan Isles (District Manager, RCH), Dr Bob McCrossin (Medical Director, RCH), Dr Michael Williams (Mackay Base Hospital) and Dr Jasper Van der Westhuyzen (Hervey Bay Hospital) who have each demonstrated untiring support and involvement in the coordination of telepaediatric services.

The following funding sources are duly acknowledged:

- Commonwealth Department of Health and Ageing (Medical Specialist Outreach Assistance Programme) for funding and support for this project.
- Royal Children's Hospital Foundation for the travel scholarship which allowed me to visit various leading telehealth research centres in California and Calgary.
- Centre for Online Health, University of Queensland.

I thank the following agencies for permission to reproduce published papers:

- The Royal Society of Medicine, London
- Elsevier Science Limited, Oxford

I am very grateful for my wonderful family. To my wife Sarah, for the innumerable personal sacrifices she has made to compensate for the many hours I've spent away from home. This work would not have been possible without her patience, love and support, for which I am truly thankful. I also thank my miraculous children - Zachary, Jacinta and Alexander for giving me the natural inspiration to complete my study and regain a more regular social life.

I dedicate this work to my family and to the memory of my late brother David Bruce Smith (1974-2003).

Publications

The following publications by the candidate have emanated from the work presented in this thesis. All papers have been published or accepted for publication in peer-reviewed journals. Copies, where available have been included as an appendix of this thesis (Appendix 4).

Smith AC, Williams M, Van der Westhuyzen J, McCrossin R, Isles A, McCrossin R, Youngberry K and Wootton R. A review of telepaediatrics in Queensland. *Journal of Telemedicine and Telecare* 2004, *accepted for publication*

Justo R, **Smith AC**, Williams M, Van der Westhuyzen J, Murray J, Sciuto G and Wootton R. Paediatric telecardiology services in Queensland: a review of three years experience. *Journal of Telemedicine and Telecare* 2004, *in press*

Williams M and **Smith AC**. Paediatric outreach services. *Journal of Paediatrics and Child Health* 2004, 40: 501-503

Smith AC, Kimble R, Bailey D, Mill J, and Wootton R. Diagnostic accuracy of and patient satisfaction with telemedicine for the follow-up of paediatric burns patients. *Journal of Telemedicine and Telecare* 2004, 10(4):193-198

Smith AC, Youngberry K, Julie Mill, Kimble R and Wootton R. A review of three years experience using email and videoconferencing for the delivery of post-acute burns care to children in Queensland. *Burns* 2004, 30(3): 248-52

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Wootton R, **Smith AC**, Gormley S and Patterson J. Logistics of large telemedicine networks. 1. Site Directories, *Journal of Telemedicine and Telecare* 2002; 8 (Suppl. 3): 77-80

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Smith AC, Williams M and Justo R. The multidisciplinary management of a paediatric cardiac emergency, *Journal of Telemedicine and Telecare* 2002; 8(2): 112-114

Smith AC, Isles A, McCrossin R, Van der Westhuyzen J, Williams M, Woollett H and Wootton R. The point of referral barrier - a factor in the success of telehealth, *Journal of Telemedicine and Telecare* 2001; 7 (Suppl.2): 75-78

Conference presentations

The following presentations have been made at local, national and international conferences during the candidature period.

m-Health. Providing excellence in quality of care through wireless, tele and mobile technology integration

30-31 March, 2004

The Sydney Boulevard, Australia

Providing innovative solutions through telehealth technology

Data Communication Systems and Telemedicine Department of Information Systems

15 March, 2004 (lecture presented via videoconference)

Brunel University, Middlesex, UK

The development and evaluation of telepaediatrics in Queensland

The Cardiac Society of Australian and New Zealand 51st Annual Scientific Meeting

10 – 13 October, 2003 (poster)

Adelaide Convention Centre, Australia

Videoconferencing for the management of children with suspected cardiac defects

Asia Pacific Burns Congress

September, 2003

Brisbane Convention and Exhibition Centre, Queensland, Australia

1. Post-acute burns care for children: a virtual outpatient service in Queensland

2. Diagnostic accuracy of telemedicine for the follow-up of paediatric burns patients

3rd Successes and Failures in Telehealth Conference

25th August, 2003

Royal Children's Hospital, Queensland, Australia

Family costs of outpatient appointments via videoconference compared to conventional appointments (face-to-face)

3rd Successes and Failures in Telehealth Conference

25th August, 2003

Royal Children's Hospital, Queensland, Australia

Online techniques to assist with the delivery of specialist diabetes services in Queensland

Nursing in a Technological World, International Nursing Conference

1st July, 2003

Brisbane Convention and Exhibition Centre, Queensland, Australia

Innovative communication techniques for the delivery of specialist nursing services

Royal Australian College of Physicians Annual Conference

26th May, 2003 (poster)

Hobart Function Conference Centre, Tasmania, Australia

The trial and development of a telepaediatric service in Queensland

Queensland Child and Adolescent Diabetes Conference

28th February, 2003

Royal Children's Hospital, Queensland, Australia

Telemedicine and the delivery of health services for children and adolescents with diabetes

Australia New Zealand Burns Association - Conference

21st October, 2002 (poster)

Auckland, New Zealand

Using online communication techniques for the delivery of paediatric burns care in Queensland

APEG Annual Scientific Meeting

22-24 August, 2002 (poster)

Darwin, Northern Territory, Australia

Diabetes and endocrinology: Using innovative techniques to improve the delivery of paediatric health services in Queensland

2nd Successes and Failures in Telehealth Conference

1st August, 2002

Royal Children's Hospital, Queensland, Australia

A comparison of telepaediatric activity at two regional hospitals in Queensland

Camp Diabetes “An Oasis of Learning”

21st June, 2001

Rydgas Oasis Resort, Caloundra, Australia

Rural kids with diabetes – improving the outcomes with telehealth

Royal Australasian College of Physicians & Royal College of Physicians Thailand

6th May, 2002

Brisbane Convention and Exhibition Centre, Queensland, Australia

Isolated health service delivery – telemedicine

Italian Australian Technology Innovation Conference and Exhibition

26th March, 2002

Le Meridien at Rialto & Rialto Towers, Melbourne, Australia

Telemedicine and technological innovation in medicine

Health Telematics Unit – Multipoint Conference

15th August, 2001

University of Calgary, Calgary, Canada

Visiting Scholarship

An overview of telepaediatrics in Queensland

Centre for Health & Technology

10th August, 2001

University of California, Sacramento, California, USA

Visiting Scholarship

An overview of telehealth in Australia

Annual Asia Pacific Medical Student Conference (AMSE)

10th July, 2001

Monash University – Melbourne, Australia

Telehealth - an Australian perspective

Telemedicine Summer Symposium

4th July, 2001 (presented via videoconference)

University of Calgary, Canada

Telehealth Integration in Queensland

Successes & Failures in Telehealth Conference

22nd June, 2001

Royal Children's Hospital & Health Service District

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

Child and Youth Mental Health Conference

24th May, 2001

Royal Children's Hospital, Queensland

Using telehealth for secondary tertiary consultation

Abstract

Telehealth has the potential to improve access to health services for patients living in rural and remote communities. Despite the long distances in Queensland, telehealth has been significantly under-utilised. One possible reason is that it has generally been easier for the referrer to send patients to a specialist than to organise a telehealth consultation. This thesis describes a novel model of telehealth, in which a small scale call centre was accessible by a single telephone number. All calls made to the centre were received by a telepaediatric coordinator. The coordinator was responsible for facilitating the appropriate response.

The principal hypothesis was that by shifting the responsibility for telepaediatrics from the referrer to the provider, the telehealth process could be made equally or more attractive than the conventional alternative. The model was tested and proven to be an effective method for the coordination of telehealth services. During the first three years of operation, about 1400 patient consultations were coordinated by the telepaediatric service. The continued usage of the service has been an encouraging sign of its acceptance amongst clinicians. Telepaediatric activity steadily increased to about 20 h of videoconferencing time per month for clinical consultations. On average 50 patient consultations were conducted per month. Paediatric subspecialties included burns, cardiology, child development, dermatology, diabetes, endocrinology, gastroenterology, nephrology, neurology, oncology, orthopaedics, paediatric surgery and psychiatry.

Activity data at selected regional sites pre and post telepaediatrics showed a marked reduction in the number of children travelling to Brisbane for an outpatient appointment and a substantial increase in the number of children accessing specialist services in their local hospital (via videoconference).

An economic analysis of telepaediatric activity showed savings made to the state health department. The total cost of providing 975 patient consultations through the telepaediatric service was \$740,248. The estimated potential cost of providing an outpatient service to the same number of patients at the Royal Children's Hospital (RCH) in Brisbane was \$1,060,231. Based on the analysis of 975 patient consultations, telepaediatrics was a more cost-effective method for the delivery of outpatient services when the workload exceeded 597 patient consultations and resulted in a net saving of about \$320,000 to the health service provider. A sensitivity analysis showed that the threshold point was most sensitive to changes related to videoconference equipment costs, staff salaries and patient travel costs; other factors (e.g. telecommunication costs) were less important.

The family costs of attending outpatient appointments in person at the RCH and via videoconference at a regional hospital close to home were compared by interviewing 300 families. There were significant differences between the two groups. It cost families more to attend an appointment at the RCH than to attend a videoconference. 95% of families (n=100) in the RCH group reported at least one type of expense (median cost \$18). In contrast, only 10% of families (n=200) who had a local videoconference reported any additional costs (median cost \$0). Families who had their specialist appointment via local videoconference spent less time travelling to and from their appointment and less time off work.

The accuracy of clinical assessments for burns conducted via videoconference was investigated. Agreement between the two consultants when seeing patients face-to-face (FTF) was moderately high, with an overall concordance of 85%. When videoconferencing was used, the level of agreement was almost the same, 84%. This confirms that the quality of information collected during a videoconference appointment is similar to that information collected during a conventional FTF appointment for a follow-up burns consultation.

The routine use of telepaediatrics for the delivery of post-acute burns care meant that families in regional and remote parts of Queensland had more convenient access to specialist services which were normally only available in Brisbane. 293 patient consultations were conducted during the first three years.

A substantial proportion of outpatient care could be delivered using videoconferencing, email and the telephone. Telepaediatric burns services proved valuable in two key areas. The first area involved the delivery of routine specialist clinics via videoconference. The second area related to ad-hoc patient consultations for collaborative management during acute presentations.

Telepaediatrics was used to complement the conventional outreach programme for children with diabetes and endocrine conditions. In three years, 194 patient consultations and 13 education sessions were conducted via videoconference.

Telepaediatric services in endocrinology and diabetes were established at three levels: (1) the coordination of routine specialist clinics via videoconference; (2) ad-hoc patient consultations for collaborative management during acute presentations and at times of urgent clinical need; and (3) the delivery of education to staff and patients throughout the state.

This study provides quantitative evidence to support the feasibility and cost-effectiveness of a novel telehealth service model in Queensland. Telepaediatrics has been successfully introduced as a routine service at the RCH, alongside conventional methods of health service delivery.

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Glossary and abbreviations

Term	Definition
ABS	Australian Bureau of Statistics
ATSP	Association of Telehealth Service Providers (Portland, OR, USA)
Bandwidth	The capacity of an electronic transmission medium to transmit data per unit of time. The higher the bandwidth, the more data can be transmitted. Typically measured in kilobits or megabits per second (Mbit/s). Standard telephones are low bandwidth devices (maximum bandwidth = 33.6 kbit/s). Cable television uses high bandwidth (up to 140 Mbit/s).
CNC	Clinical Nurse Consultant
CODEC	COder/DECoder (also COmpression/DECompression) device. This is hardware and/or software used with interactive video systems that converts an analogue signal to digital, then compresses it so that lower bandwidth telecommunications lines can be used. The signal is decompressed and converted back to analogue output by a compatible CODEC at the receiving end. The compression method (algorithm) may be proprietary or (much preferred) standards-based.
COH	Centre for Online Health (University of Queensland)
Cost-benefit analysis	Determines how much more or less of society's resource should be allocated to achieve a defined goal. Compares input and output in monetary units.
Cost-effectiveness analysis	Determines how a given goal is achieved most efficiently. Relates costs to some measures of outcome.
Cost-minimisation analysis	Determines which of two options with equal benefits has the lowest costs. Compares costs between different options thought to be equally effective.
Cost-utility analysis	Determines the best way of spending a given health care budget. Relates cost to healthy years gained.

Efficacy	The ability to achieve a desired effect under artificial, laboratory conditions.
Efficiency	The allocation of goods to their uses of highest relative value. The ratio of the output to the input of any system.
Effectiveness	The ability to produce a desired health outcome (cure, alleviation of pain, return of functional abilities), under real-life conditions.
ENT	Ear, nose and throat
FTF	Face-to-face; conducted in person
IDDM	Insulin Dependent Diabetes Mellitus
Incidence	The rate of occurrence of some event, i.e. the number of occurrences per unit of time.
IP	Internet protocol
IQR	Inter-quartile range
ISDN	Integrated Services Digital Network
Kbit/s	Measurement of bandwidth (kilobits per second)
LAN	Local Area Network
MSOAP	Medical Specialist Outreach Assistance Programme is a funding programme of the Commonwealth Department of Health and Ageing, Australia. http://www.ruralhealth.gov.au/services/msoap.htm
Multipoint meeting	Videoconference involving more than two sites simultaneously.
NASA	National Aeronautics and Space Administration
NSW	New South Wales
PC	Personal computer
Peripheral devices	Attachments to videoconferencing systems to augment their communications or medical capabilities. Examples include: electronic stethoscopes, ophthalmoscopes, dermoscopes, document cameras and scanners.
Point to point meeting	Videoconference involving two sites.

PIP	Picture in Picture
Prevalence	The number of cases or events in a given population, usually expressed as a ratio.
PTSS	Patient Travel Subsidy Scheme http://www.health.qld.gov.au/services/community/ptss/
QLD	Queensland
QH	Queensland Health http://www.qld.gov.au/
QTN	Queensland Telemedicine Network
RCH	Royal Children's Hospital, Brisbane
RCT	Randomised controlled trial
Real-time	Sends and receives audio / video / data simultaneously, without more than a fraction of a second delay. Applications that are transmitted within a few seconds are sometimes called near real-time. Compare store-and-forward.
RN	Registered Nurse
SD	Standard deviation
SPPBU	Stuart Pegg Paediatric Burns Unit
Store-and-forward	Captured audio clips, video clips, still images, or data that are transmitted or received at a later time (sometimes no more than a minute). Email is a store-and-forward system. Enables asynchronous communication, with the advantage of not needing concurrent participant involvement. Compare to real-time.
Telehealth	General term relating to the delivery of health services over a distance using a communication technique.
Telepaediatrics	The delivery of paediatric and child health services to regional and remote sites using a range of online communication techniques including email, videoconferencing and telephony.
Telstra	Telecommunications provider (Australia)
TV	Television

UQ	University of Queensland http://www.uq.edu.au/
URL	Uniform Resource Locator (World Wide Web address)
US	United States
WA	Western Australia
WHO	World Health Organisation
WWW	World Wide Web