Access to care and benefits for cancer patients in rural and remote locations using telemedicine

Thesis submitted by
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in the College of Medicine and Dentistry
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Statement of the Contribution of Others
Included papers, Structure of the Thesis

The chapters in this thesis are designed to contain information corresponding to the research questions. Since the information in each chapter has already been published as journal articles (see Appendix 1), these journal articles form most of the body of the chapters. To maintain the integrity of the published version of the papers, and to satisfy the word limitations of respective journals, only minor formatting changes were made to the published manuscripts as included in this thesis.

In all the papers, except "Teleoncology: Indigenous perspectives", concept design, writing of the proposal, ethics submission and writing of the majority of the manuscripts were the work of Sabe Sabesan. Sarah Larkins and Rebecca Evans were the supervisors who contributed to the design of the proposal, research questions, and gave advice on methodology. They also provided comments on the draft manuscripts. In the chapter summaries below, information on the contributions of additional co-authors is provided for each paper.

Chapter 1

In chapter one, a brief summary is provided of (i) the access issues faced by rural patients in Australia and particularly North Queensland (where Townsville is the largest regional centre) in relation to specialist cancer services, (ii) the geography of North Queensland, and (iii) the role of telemedicine models as a possible solution to access problems. Subsequently, details of the Townsville Teleoncology Network (TTN) and its model of care (TTN model of care) are summarised. At the time of inception of the TTN in 2007, literature on teleoncology was limited to few aspects of care. Therefore, the literature review is kept brief in this chapter and an updated review is provided in chapter 10.

Chapter 2

This chapter contains background information regarding the research questions and overarching methodological details.

Chapter 3

This chapter deals with the research question "Has the Townsville Teleoncology model improved access to specialist medical oncology services closer to home for rural patients in North Queensland?" Details of the services provided under the TTN are described in the following article:

Sabesan S, Larkins S, Evans R, Varma S, Andrews A, Buettner P, Brennan S, Young M, Telemedicine for cancer care in NQ: bringing cancer care home, ***Aust J Rural Health,*** 2012**,**20:259-264

Contribution by co-authors: The last five authors provided comments on the manuscripts and advice regarding implementation of the TTN.

Chapter 4

While it is a continuation of chapter 3, the aim of this chapter is to discuss the impact on timeliness of the services provided through the TTN model. The following article fulfils that aim.

Sabesan S, Aitken P, Roberts L, Larkins S, Timely access to specialist medical oncology services closer to home for rural patients: Experience from the Townsville Teleoncology Model, ***Aust J Rural Health***, 2014;22:156-159.

Contribution by co-authors: P. Aitken and L. Roberts provided comments on the manuscripts.

Chapter 5

Chapters 5 and 6 answer the research question "Are patients and rural health workers satisfied with the Townsville teleoncology model?". The perspectives of Indigenous patients and health workers are discussed in this chapter in the following article.

Mooi J, Whop L, Valery P, **Sabesan S**, Teleoncology for Indigenous patients: the responses of patients and health workers, ***Aust J Rural Health,*** 2012, 20:265-269

Contribution by co-authors: J. Mooi collected the data and wrote the first draft while an oncology trainee. L. Whop and P. Valery contributed to analysis. S. Sabesan provided advice on design, methodology, analysis, and comments on the draft and overall supervision and guidance to J. Mooi.

Chapter 6

The routine face-to-face model of care was mostly replaced by the teleoncology model of care for rural patients in 2009. This chapter explores patients' perspectives regarding the new model of care through the article below.

Sabesan S, Kelly J, Evans R, Larkins S, A teleoncology model replacing face to face specialist cancer care: perspectives of patients in North Queensland. ***J Telemed Telecare***. 2014;20(4):207-211.

Contribution by co-authors: J. Kelly conducted the patient interviews and contributed to analysis and writing of the results section.

Chapter 7

In this chapter, the research question "What is the cost comparison between the face-to-face model and the Townsville teleoncology model in relation to health systems?" is explored. The article listed below reports on the costs involved in setting up the TTN and the savings resulting from the TTN model of care.

Thaker D, Monypenny R, Olver I, **Sabesan S**, Cost savings from a telemedicine model of care in northern Queensland, Australia, ***Med J Aust*** 2013;199(6):414-417

Contribution by co-authors: D. Thaker conducted data collection, R. Monypenny and I. Olver contributed to the economic analysis and S. Sabesan also provided mentoring and supervision to D. Thaker.

Chapter 8

In this chapter, the research question "Is it safe to remotely supervise chemotherapy administration in rural towns via telehealth models of care?" is explored. The following manuscript forms the main body of this chapter, which is currently under revision for the Medical Journal of Australia.

Chan B, Watt K, Evans R, Larkins S, **Sabesan S**, Is it safe to remotely supervise chemotherapy administration in rural towns via telehealth models of care? (currently under revision for Medical Journal of Australia).

Contribution by co-authors: B. Chan collected the data and wrote the methods section and K. Watt conducted the statistical analysis.

Chapter 9

This chapter discusses the research question "To what degree has the teleoncology model of care improved the capacity of rural hospitals to provide specialist cancer services?" The article below summarises the history of the TTN and demonstrates the improvement in service capabilities in rural towns.

Sabesan S, Allen DT, Caldwell P, Loh PK, Mozer R, Komesaroff PA, Talman P, Williams M, Shaheen N, Grabisnki O**,** Practical aspects of telehealth: establishing telehealth in an institution, ***Internal Medicine Journal;*** 2014;44:(202-205)

Contribution by co-authors: All the co-authors provided comments to improve the manuscript.

Chapter 10

From 2007 to the present, quality improvement studies of the TTN have contributed to further new knowledge documented in the literature. Therefore, a summary of the current literature incorporating the studies included in this thesis are summarised in the following article.

Sabesan S, Medical models of teleoncology: Current status and future directions, ***Asia Pacific Journal of Clinical Oncology***, (invited paper), published ahead of print 17/6/2014. DOI:10.1111/ajco.12225.

Chapter 11

This chapter discusses the conclusions, strengths and limitations of the current studies, and details the researcher's view of future directions.

Conference and invited presentations arising from the studies included in this thesis

2014 Medical models of teleoncology; Symposium, World Cancer Congress, Melbourne, Australia

2014 Doctor patient communication in Telehealth; Consultant proffered session, Medical oncology group of Australia, annual scientific meeting, Sydney, Australia

2014 Rural chemotherapy project; Australian Telehealth Conference, Melbourne, Australia

2013 Teleoncology models of care; Key note speech, Innovations in cancer care and treatment conference, Cancer Institute of New South Wales, Sydney, Australia

2013 Rural chemotherapy project in Queensland; Statewide rural and remote clinical network forum, Mackay, Queensland, Australia

2013 Telehealth series-Practical aspects of telehealth; Workshop, Royal Australasian College of Physicians Congress, Perth, Australia

2013 Teleoncology for Indigenous patients; National round table on indigenous cancer and Centre of Research Excellence launch, Brisbane, Australia

2013 Barwan Health Integrated Cancer Centre annual forum: Teleoncology models of care, Geelong, Victoria, Australia.

2012 Let your broadband do the walking: long distance cancer care; Inspire 2012 - Health Workforce Australia conference, Melbourne, Australia

Declaration on Ethics

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council (NHMRC) National statement on ethical conduct in human research, 2007. The proposed study received ethics approval from the human research ethics committees of the Townsville Health and Hospital Services (HREC/12/QTHS/29) and the James Cook University (H4602).

May 30 2015

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Signature Date

Sabe Sabesan

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Name

Acknowledgements

When the Townsville Teleoncology Network (TTN) was set up nearly seven years ago, my main focus was purely to improve the quality of the processes and the service we provided to rural patients. As a busy medical oncologist and a clinical teacher, who at times had to work as a solo practitioner, I never thought I would be able to complete a PhD. I am indebted to my supervisors A/Prof Sarah Larkins and Dr Rebecca Evans for showing me that it was possible to accomplish this, and also for providing me with supervision and mentoring. I feel that the rigor of the quality improvement process was much stronger because of the training I had as part of the PhD journey. Despite their busy schedules, A/Prof Kerrianne Watt and A/Prof Petra Buettner were always there for me when I needed help with quantitative research methods. Advice and input from Dr Jenny Kelly and Dr Robin Ray were invaluable in relation to qualitative research methods.

My fellow medical oncologists Dr Varma, Dr Otty and Dr Joshi gave me support in terms of sharing the clinical work so that I could focus on departmental quality improvement activities. Administrative support officers of the department of medical oncology Ms Michelle Toombes, Ms Patricia Grady, Ms Kellie Poole, Ms Cathy Baker and Ms Annie Ciavarella were there for us when we needed help with organising the medical charts. Without them, smooth operation of the TTN would not have been possible. Our operational director Ms Liza Tomlinson deserves special mention, since she translated our dream of telehealth into reality.

There were many academic friends who shaped my PhD and the TTN through advice and encouragement over 4-5 years. A/Prof Lynden Roberts, Prof Tarun Sen Gupta, Prof Nat Ketheesan, Dr Melissa Crowe, Dr Jenni Judd and A/Prof Jacob are especially deserving of mention. From the clinical sector, A/Prof Andrew Johnson, Mr Ken Whelan and Ms Aniko Cooper are a few of the colleagues who assisted me.

Our trainees Dr Darshit Thaker, Dr Jennifer Mooi and Dr Bryan Chan not only did their projects on teleoncology, but also contributed to improving the service. My co-authors Prof Ian Olver and A/Prof Richard Monypenny gave me the insight into economic evaluation and lobbying at government level .

TTN and our quality improvement activities would not have been possible without the enormous dedication and contribution of our rural health professionals. These health professionals include Dr Uma Lakhsman, Dr Tina Andrews, Ms Sonya Bisson, Ms Jessica Casey, Ms Nicole Johnston and nurses and doctors from other rural centres.

Our patients and their families put so much trust in us when we embarked on the telehealth model. We are indebted to them for their feedback and suggestions to improve the model of care despite their daunting cancer journey.

Finally I salute my wife Vanaa and my children Anoj and Ashna, who gave me the opportunity to juggle my time and embark on a project like this to help the people of disadvantaged communities.

Abstract

Introduction

Access to specialist cancer services is a significant issue faced by residents of rural, remote, Indigenous and some regional communities in Australia. Telemedicine using videoconferencing technology has been used in many fields of the healthcare sector to address the issue of poor access. In order to provide most of the specialist cancer services closer to home for patients in Mt Isa and other rural towns in North Queensland, Australia, the medical oncology department at the Townsville Cancer Centre (TCC) embarked on establishing a teleoncology model of care (telemedicine for cancer care) in 2007. An initial hybrid teleoncology/face-to-face model was shown to be acceptable to non-Indigenous patients.[1]

The overall purpose of this study was to examine the benefits and disadvantages of teleoncology models for rural patients, health professionals and hospitals. In addition, the study sought to evaluate the model in relation to acceptance by patients and health workers. A cost comparison with face-to-face models was conducted, while the safety of remotely supervised chemotherapy and the overall impact of this model on rural service capability was also evaluated.

Our evaluation was guided by the following research questions

1. To what degree has the Townsville Teleoncology model of care improved?
    a. Can the model provide access to specialist medical oncology services closer to home for rural patients in North Queensland?
    b. What is the capacity of rural hospitals to provide medical oncology services to rural patients?
2. Are patients and rural health workers satisfied with the Townsville teleoncology model?

3. Is it safe to supervise chemotherapy administration in rural towns via the Townsville teleoncology model?

4. What is the cost comparison between the face-to-face model and the Townsville teleoncology model in relation to health systems?

Methods

The project was embedded in a Continuous Quality Improvement (CQI) framework. Data for the questions relating to feasibility, safety and cost analysis were collected retrospectively from medical charts and from the oncology information management system of the TCC . Using appropriate statistical tests for comparisons, a safety analysis was performed. This was done by comparing dose intensities and toxicity profiles between rural patients and TCC patients. A cost analysis was performed by comparing the cost of establishing the service against the costs prevented by the service. A one-way sensitivity analysis was performed to study the impact of cost on savings. Patients' and health professionals' perspectives were examined by means of questionnaires and semi-structured interviews. These were analysed using iterative thematic analysis. Rural doctors and nurses were surveyed before and after the teleoncology service was implemented in order to map the service's capability in rural towns.

Results

Feasibility of services

Between May 2007 and May 2011, 158 patients from 18 rural towns received a total of 745 consultations. Ten of these patients were consulted urgently and treatment plans initiated locally, avoiding inter-hospital transfers. Eighteen Indigenous patients who were accompanied by more than four family members received consultative services. Eighty-three patients received a range of intravenous and oral chemotherapy regimens in Mt Isa. Oral agents were supplied in other towns through remote supervision by medical oncologists from Townsville.

Timely access to care

From 2007-2009, 60 new patients from Mt Isa travelled to TCC for their first consultation and their first dose of chemotherapy. Six of these patients required inter-hospital transfers and eight required urgent flights to attend outpatient clinics. Only 50% of these rural patients (n=30) were reviewed within one week of their referral, compared with 90% of the Townsville patients. In 2009, the Townsville teleoncology model mostly replaced face-to-face care in Mt Isa. Between 2009 and 2011, TCC provided cancer care to 70 new patients from Mt Isa. Of these new patients, 93% (65/70) were seen within one week of referral. All 17 patients requiring urgent reviews were seen within 24 hours of referral and were managed locally, thus eliminating the need for inpatient inter-hospital transfers.

Perspectives of Indigenous patients and health professionals

Eighteen patients and health professionals who participated in this study gave high ratings (more than 4) on a five point Likert scale for quality of teleoncology consultation, establishing rapport, patient preference and satisfaction with care. Health workers welcomed this model for many reasons, including educational benefits, expanding scope of practice and the ability to readily connect with specialists.

Teleoncology model replacing face-to-face care

Thirty-five patients participated in a qualitative study. The study identified five major themes: (i) quality of the consultation, (ii) communication and relationships, (iii) familiarity with technology and initial fears, (iv) local services and support and (v) co-ordination of services. Responses for the first four themes were largely positive. Coordination between service providers needed further improvement to facilitate the model's smooth operation.

Cost-savings

Six hundred and five consultations were performed for 147 patients over 56 months, at a total cost of AUD$442,276. The total cost for project establishment, equipment/maintenance and

staff was AUD$36,000, AUD$143,271 and AUD$261,520, respectively. The estimated travel expense avoided was AUD$762,394, including: travel cost for patients and escorts AUD$658,760, aeromedical retrievals AUD$52,400, and specialist travel AUD$47,634. This resulted in a net saving of AUD$320,118. The cost would need to increase by 72% to negate the savings.

Safety of Townsville teleoncology model

Over five years, 89 patients received a total of 626 cycles of various chemotherapy regimens in Mt Isa. During the same time period, 117 patients who received a total of 799 cycles of chemotherapy at TCC were eligible to be considered in the comparison group. For most of the demographic characteristics there were no statistically significant differences between Mt Isa and TCC: mean number of cycles (5.38 vs 5.07), dose intensities, proportion of side effects (4.4% vs 9.5%) and hospital admissions (27.8% vs 35.3%) [$p>0.05$]. There were no toxic deaths in either group.

Improvement in rural service capability

The level of services provided at Mt Isa Hospital has lifted to a higher service capability level as a result of the teleoncology model of care . The number of oncology-specific medical, nursing and allied health staff has also increased.

Conclusion

We were able to demonstrate the following in relation to the Townsville teleoncology model of care

- It is feasible to provide comprehensive services close to home,
- Patients and health professionals welcome this model,
- It is safe to remotely supervise chemotherapy, and
- Health systems acquire savings as a result.

Other major benefits were achieved by providing timely and equitable access and improvements in service capabilities at the Mt Isa Hospital. Over five to seven years, Mt Isa has become a stand-alone rural medical oncology unit. This was due to the gradual shifting of all services from Townsville to Mt Isa, and successful lobbying for resources to adequately fund the workforce and infrastructure to sustain these services. The end result was that patients from Mt Isa could get most of their services closer to home without the need for costly long distance travel. This adds to the growing body of evidence about the feasibility and efficacy of telemedicine models of care. Since our evaluation is on a single network encompassing a large geographic area, our findings may not be applicable to networks that serve patients facing short travel distances.

Impact of the findings of this thesis on service quality provided through TTN

The aggregated results of the above studies have produced an improvement in the processes and resources of the TTN and continual improvement in the quality of care provided.

Future directions

These results should lead to development of new models of care to benefit patients from smaller rural towns. One such model is the Queensland Remote Chemotherapy Supervision (QReCS) model, which aims to provide chemotherapy services in small rural towns across the

state. The concept of the model and its governance were informed by the results of the studies included in this thesis, and it is now being implemented and evaluated with funding of AUD$2.5 million from Queensland Health Innovation Fund.

Table of Contents

List of Figures

List of Tables

Glossary

Chemotherapy	Medications used to treat cancers; could be given orally or intravenously.
Cycles	Number of chemotherapy doses
Dose intensity	Ratio of actual dose given/planned dose; expressed as a percentage.
Medical oncology	A sub-speciality in internal medicine that deals with medical therapies of cancers.
OIMS	Oncology Information Management System; the database of the Townsville Cancer Centre. Mosaiq is the OIMS at the Townsville Cancer Centre.
Rural and remote	Definition is based on the ASGC-RA (Australian Standard Geographical Classification – Remoteness Areas) system.
Service Capability Framework of Queensland Health for medical oncology	A document prepared by Queensland Health in consultation with key clinicians to determine the capability of hospitals to provide medical oncology services.
Townsville Cancer Centre (TCC)	A tertiary referral cancer centre in North Queensland, Australia.
Telemedicine	Provision of medical and other health services through technology including videoconferencing, store and forward methods, home monitoring and telemonitoring (In this thesis, main focus was on direct patient care using videoconferencing).
Teleoncology	Provision of cancer care using telemedicine technologies.
Toxic death	Death occurring due to side effects of cancer treatment.

Chapter 1 Rural Access Issues and Telemedicine Models as Solutions

1.1 Limited access to specialist cancer services in rural towns in Australia

Access to specialist cancer care services is a significant issue faced by residents of rural, remote, Indigenous and some regional communities in Australia.[2] Lack of access to specialist services is partly due to a lack of specialist visits or the lack of availability of specialists locally, a narrow scope of practice for rural health professionals and overall rural workforce shortages. These three factors seem to create a vicious circle (Figure 1.1) with the end result being lack of specialist services close to home and the need for often costly long distance travel.

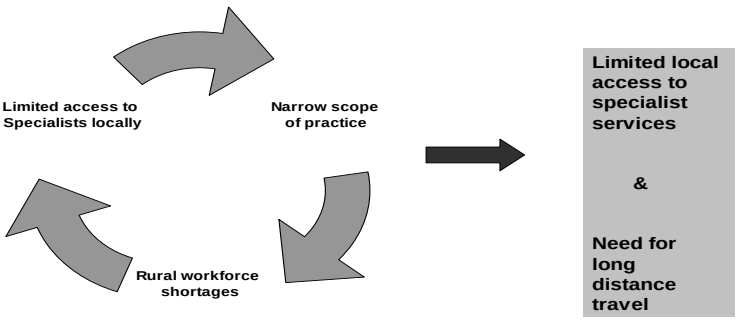

Figure 1.1 Limited rural access to specialist services and the need for travel

Limited access to health promotion and screening services can mean that people experience the impact of poor health service access even before the onset of disease. Once the disease has occurred, access issues are encountered in various aspects of the patient journey including accessing general practitioners, specialist services, diagnostic services, treatment, nursing and allied health services and follow up care.[3] Poor access to healthcare services could be one of the

contributors to the disparity in survival and disease related outcomes that exist between metropolitan and non-metropolitan patients.[4-7]

Face-to-face outreach specialist services from metropolitan centres attempt to address some of these access issues, with results varying in quality and intensity.[2] Most of the current models do not provide care on a daily basis, and leave rural health clinicians to make stressful decisions without direct supervision by more experienced specialists. In addition, patients from many smaller rural towns continue to travel to larger centres for their care and patients from larger rural centres may need to be transferred to larger urban centres when they are sick.[2]

1.2 Distance issues in North Queensland

Clinicians and patients in North Queensland, Australia face similar issues related to the vast geography and long travel distances. The northern area occupies about 750,000 square kilometres with a population of more than 600,000 people.[8] Just over half of the population in this zone lives in one of three coastal cities and their hinterlands, with the rest of the population spread over 98% of the zone. Consequently, the average population density is 0.77 persons per square kilometre. The medical oncology department at the Townsville Cancer Centre (TCC) is responsible for half of that area. The TCC is the tertiary cancer centre for North Queensland, Australia. Rural towns in this area covered by the department of medical oncology include Mt Isa, Palm Island, Charters Towers, Ingham, Ayr, Bowen, Collinsville, Proserpine, Hughenden, Winton, Julia Creek, Cloncurry, Richmond, Karumba, Normanton, Mornington Island, Doomadgee, Camooweal and Burketown (Figure 1.2).

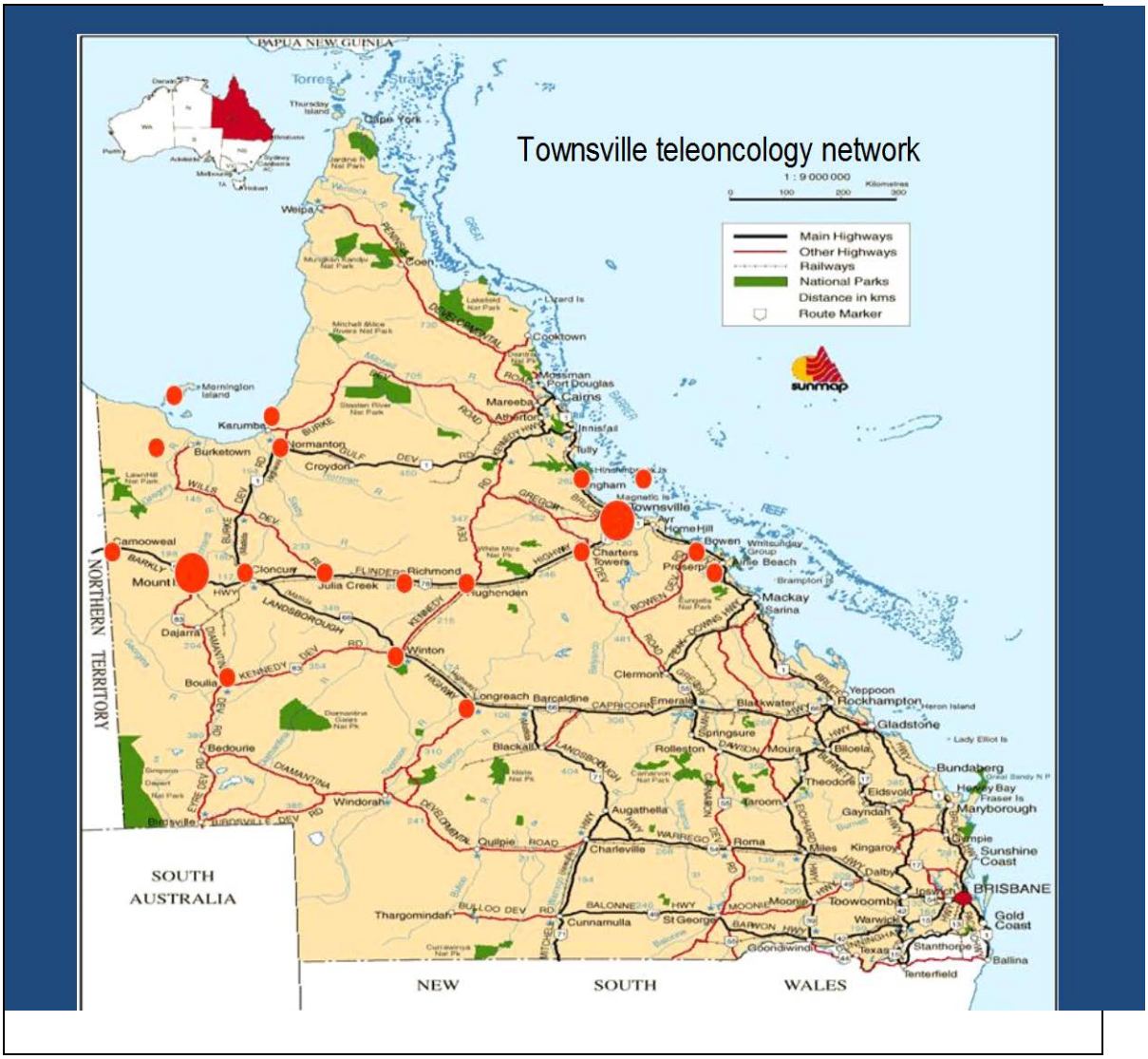

Figure 1.2 Rural sites served by the Townsville Cancer Centre

Source: Queensland road and rail maps

1.3 Telemedicine models to provide care closer to home

Telemedicine or telehealth using videoconferencing technology has the potential to satisfy many of the specialist healthcare needs of rural populations in most fields of the healthcare industry. It is potentially able to provide specialist cover on demand.[9-11] The aspects of medical care potentially covered by telemedicine include:

- Case discussions between health professionals,
- Outpatient clinic reviews,

- Supervision of treatment,
- Urgent ward consultations and ward rounds for admitted patients and management of diagnostic services such as teleradiology,
- Remotely directed teleultrasonography, and
- Robotic telepathology, among others.[10]

Systematic reviews suggest that patients and health providers were satisfied with these models, although the quality of the studies was limited because of their small sample sizes.[49]

1.4 Current use of telemedicine models

Examples of large telehealth networks include the USA Veteran Affairs Telehealth Services (http://www.telehealth.va.gov), the University of Kansas Center for Telemedicine & Telehealth (USA) (http://www.kumc.edu.community-engagement/ku-centre-for-telemedicine-and-telehealth.html), the Ontario Telemedicine Network (Canada) (https://otn.ca/en), Queensland Health Statewide Telehealth Services (Australia) (http://www.health.qld.gov.au/telehealth/), and TEMPiS, Germany's telestroke network.[12], Queensland health services and the Department of Veterans Affairs in the USA are part of the larger health departments who fund and manage Telehealth services. Both models evolved in response to service access issues in geographically dispersed populations. .

Telehealth models focus on a range of specialties and use can use telehealth for different purposes.[11] For example, telehealth mental health services in South Australia focus on providing services from tertiary hospitals in Adelaide to country hospitals and health centres. The burns unit at the Princess Margaret Hospital in Western Australia provides an integrated multidisciplinary assessment and review service for rural and remote burns patients. This facility uses videoconferencing and 'store and forward' digital photography. The Centre for Online Health of the University of Queensland has been coordinating the Queensland

telepaediatric service between Brisbane and many rural and remote towns in Queensland to provide access to various paediatric sub specialty services closer to home.

1.4.1 Telehealth in internal medicine sub-specialities

Internal medicine sub-specialities in Australia include neurology, endocrinology, infectious diseases, nephrology and medical oncology along with seven other fields of internal medicine. A summary of the types of telehealth services provided by selected internal medicine sub-specialties is provided in Table 1.1. Most of the studies on these sub-specialities focussed on describing the feasibility of models and involved outpatient consultations. . A systematic review performed by our centre under the researcher's supervision on the use of telemedicine in supervising administration of intravenous therapies is included in the Appendix. Briefly, this review found that the telestroke and tele home haemodialysis achieved similar outcomes compared with face-to-face care in relation to survival, functional outcomes and the toxicity of interventions. As with most of the telemedicine studies, the quality of studies included in this review was limited by low patient numbers and the retrospective nature of data collection.

Table 1.1
Summary of published work in telehealth use in selected internal medicine sub-specialities

Specialty	Setting	Type of services
Neurology[12]	Rural/remote Community hospitals	● Consultation ● Supervision of thrombolysis
Medical Oncology[13-15]	Rural/remote	● New, routine and urgent consultations ● Supervision of chemotherapy
Endocrinology[16]	Home, rural/remote and community	● Consultations ● Monitoring of diabetes control
Nephrology[17]	Home, rural/remote and community	● Consultations ● Monitoring of dialysis
Geriatrics[18]	Nursing homes, rural/remote, community	● New and review consultations

1.5 Telemedicine models in cancer care (Medical oncology)

The focus of this thesis is limited to the field of medical oncology only. In medical oncology (an internal medicine sub-speciality that deals with pharmacological management of cancers as opposed to radiation management), many centres around the world provide their services to rural patients through telemedicine. Examples of these centres include Kansas cancer centre in USA, many centres in Canada (specifically in British Columbia and Ontario), and the Tamworth and Townsville Cancer Centres in Australia.[13,19-21]

The TCC embarked on providing cancer care to rural towns through telemedicine in 2007 under the Townsville Teleoncology Network (TTN), in order to better service the large geographical area it covers. Since most Queensland Health hospitals were fitted with videoconferencing equipment under the state government's rural program, coordination and mobilisation of human resources was the next step in establishing telemedicine in North Queensland.

1.6 Model of teleoncology in Townsville Teleoncology Network

Prior to the introduction of the TTN in 2007, all patients from Townsville and Mt Isa health service districts had to attend clinics in person in Townsville. Mt Isa patients requiring chemotherapy received their first dose of chemotherapy in Townsville, and if uncomplicated, received their subsequent courses in Mt Isa.Patients returned to Townsville on a regular basis for assessment of cancer response. Patients from other surrounding rural towns were required to visit Townsville for clinical assessments and the entire chemotherapy course. Between 2007 and 2009, Mt Isa patients needed to travel to Townsville only for their first consultation and the first dose of chemotherapy and were subsequently managed via videoconferencing. In 2009, the current Townsville teleoncology model replaced face-to-face care.

Essentially, the Townsville Teleoncology model involves medical oncologists from Townsville providing their services to rural sites using traditional videoconferencing technology. In the TTN, the equipment used included Tandberg 990 codecs and Sony Bravia 32-inch LCD monitors. In Mt Isa, rurally based doctors, chemotherapy competent nurses and allied health workers accompany patients during consultations. At other rural sites, either a doctor or a nurse accompanies patients since the consultations are for post-treatment reviews or follow-up visits.

When a patient is assessed as fit for chemotherapy, medical oncologists write the care plan and send the prescriptions to Mt Isa where chemotherapy competent nurses give chemotherapy. For oral chemotherapy, medical oncologists send authority scripts to patients or the local pharmacy after appropriate training by medical oncologists, nurses or pharmacists.

Prior to the clinic, informed consent for participation in the teleoncology clinic is obtained from patients. Should patients decline to participate, they may travel to Townsville for face-to-face consultations. All participants at both ends of the videoconferencing session are introduced to the patients.

If videoconferencing equipment is in a conference room, the doors are closed before commencing the consultation. Scans and blood results are shown and explained to patients using duo video systems. Details are documented in case notes in Mt Isa and TCC and summary reports are sent to general practitioners at the end of consultations. .

Videoconference consultations are conducted on a weekly basis and patients are booked via the medical oncology clinics in Townsville as part of routine clinic procedures. The duration of each session varies between 10 and 40 minutes. Consultations with new patients and review patients as well as urgent ward consultations and ward rounds are part of the current model.

In relation to training, each case is used as case-based discussions for doctors and nurses where specific details of management are spelt out. Rural doctors also have access to the TCC Medical oncology handbook. . Nurses from Mt Isa travel to TCC annually for up-skilling and refresher courses. TCC pharmacists support the Mt Isa pharmacist via tele-pharmacy models. Credentialing of staff is done by respective hospitals according to their usual practices.

An overview of the Townsville Teleoncology model is described in the Youtube video "RACP Introduction to telehealth" which can be accessed via

https://www.youtube.com/watch?v=N5l7UexKcTU

1.6.1 Comparing models of care between centres

The basic requirements of teleoncology clinics are similar at all the cancer centres, with the exception of staffing levels at the rural clinics, rules for the types of consultations provided and the nature of coordination between sites. While many centres require a medical officer at the rural facility, the Kansas model allows nurses as proxy for physical examinations.[13] Most centres have internal mechanisms to coordinate the clinics between urban and rural centres,[13-15,22,23] while most centres in Ontario, Canada rely on Ontario Telehealth Network (an entity external to the Ontario Health Department), for coordination and booking of sessions.[21] While the literature on teleoncology for medical oncology is limited, most reported studies lack details

on the nature of cancers cared for, types of consultation services provided and details of chemotherapy administered through these models. In addition, while many other centres require the patients to be seen face-to-face for their initial visits, at a large rural centre within the TTN (as described in chapter 5), teleoncology has replaced the face-to-face medical care.

Chapter 2 Improving the Teleoncology Service Through Research

In order to identify and fix emerging problems, to continually improve the model and to prove their place in health systems, the implementation of new models of care requires simultaneous evaluation of several aspects of the models..

2.1 Purpose of the study

The overall purpose of this study is to examine the benefits and disadvantages of teleoncology models for rural patients, health professionals and hospitals. In addition, the study seeks to evaluate the model in relation to acceptance by patients and health workers, cost comparison with face-to-face models and safety of remotely supervised chemotherapy.

2.2 Research questions

1. To what degree has the Townsville Teleoncology model of care improved

    a. access to specialist medical oncology services closer to home for rural patients in North Queensland?

    b. the capacity of rural hospitals to provide medical oncology services to rural patients?

2. Are patients and rural health workers satisfied with the Townsville teleoncology model?

3. Is it safe to supervise chemotherapy administration in rural towns via the Townsville teleoncology model?

4. What is the cost comparison between the face-to-face model and the Townsville teleoncology model in relation to health systems?

2.3 Continuous quality improvement framework

We adopted a continuous quality improvement framework in the conduct of our research. Continuous Quality Improvement (CQI) is an approach to quality management that builds upon traditional quality assurance methods by emphasising the organisation and systems. "It focuses on "process" rather than the individual, recognises both internal and external "customers", and promotes the need for objective data to analyse and improve processes". [24] "It is simply a philosophy that encourages all healthcare teams to continuously ask: "How are we doing?" and "Can we do better?"[25] Setting up the CQI framework involves seven steps: forming the team, setting aims, establishing measures, selecting changes, testing changes, implementing changes and spreading changes".[25] Since the main aim of establishing the TTN was to address the disparity in access to care faced by rural and remote patients in North Queensland (step three of CQI framework: establish measures), the CQI methodology was chosen as the framework for evaluation and improvement of the network.

The specific aspects requiring evaluation in the new teleoncology model included:

- Acceptance by patients and health workers,
- Cost-effectiveness to patients and hospitals, and
- Safety of remotely supervising chemotherapy administration.

Another important question was whether the implementation of teleoncology has contributed to overall improvement in quality of services accessed by rural patients. Identifying challenges in establishing a teleoncology network is important so that others can learn from these experiences.

2.4 Overview of methodology

Overall this study was set up as a multicomponent project evaluation using a CQI framework influenced by action research. The methodologies specific to the individual studies are described in the journal articles within the respective chapters. As appropriate for each study,

retrospective and/or prospective approaches were used for data collection. Data for describing the types of services, cost comparison and safety aspects were retrieved retrospectively the Oncology Information Management Systems (OIMS) and from medical charts. The majority of the data in OIMS and medical charts were recorded prospectively during patient management. Information and data for patient and health professional perspectives and mapping of services were collected prospectively using both questionnaires and semi-structured interviews. Relevant and appropriate qualitative methods and quantitative methods were used for analysis and interpretation of the data.

Features and various outcomes of the TTN were described using descriptive univariate and bivariate statistics. Depending on the distribution of the variables, comparisons between variables were conducted using parametric and non-parametric tests. Chapters 3 to 9 each present a research paper addressing an aspect of the research questions.

2.5 Researcher background and reflexivity

Currently, the researcher is working at the Townsville Cancer Centre as a senior medical oncologist, providing services to Townsville and Mt Isa health service districts. As the key clinical champion and the director of the department, the researcher has pioneered the use of teleoncology model in North Queensland over the last seven years, and has established the Townsville Teleoncology Network across the North Queensland region. An internship in Alice Springs and working in various rural rotations as a junior medical officer have made the researcher appreciate the issues associated with the long travel distances endured by the rural patients. Issues faced by the author in this research included the possibility of coercion in recruitment of patients for research studies, the effect of power imbalances with patients during interviews, and potential for bias in interpreting the data. These issues were mitigated by using research officers to obtain informed consent and conduct interviews and by using supervisors and another qualitative researcher to assist with establishing themes by consensus.

As a medical oncologist who was passionate about providing services closer to home, the researcher was obviously looking for positive themes from interview transcripts. Since the focus of the project was to improve the quality of the services further, patients and health professionals who held negative views were purposefully sought to improve the rigor of the interview process.

Chapter 3 Types of Services Feasible Under the Teleoncology Model

3.1 Chapter overview

This chapter deals with the research question; "Has the Townsville teleoncology model improved access to specialist medical oncology services closer to home for rural patients in North Queensland?" Details about the types of services made available through the Townsville teleoncology model to rural cancer patients at participating hospitals and health services in North Queensland are reported in a journal article in section 3.2, "Telemedicine for rural cancer care in North Queensland: bringing cancer care closer to home", as published in ***Aust J Rural Health*** **2012,**20:259-264.

NB: At the inception of the TTN, videoconferencing equipment was already installed by the Queensland Department of Health at most rural towns in North Queensland. Currently TTN has 21 participating sites. Additional equipment was purchased for six satellite sites because of poor location of equipment at those sites. Since the papers in this thesis were not published chronologically, the number of participating sites reported by various papers differs depending on number sites at the time of publication. To keep Table 3.3 short, some towns are grouped under regions.

3.2 Telemedicine for rural cancer care in North Queensland: bringing cancer care closer to home.

3.2.1 Abstract

Objective

To describe the use of telemedicine in cancer care (teleoncology model of care) for rural patients in North Queensland.

Design

This is a descriptive study. Data on demographic and clinical factors were retrieved from the teleoncology database of the Townsville Hospital and by a review of medical records for the period between May 2007 and May 2011.

Setting and participants

The medical oncologists at the Townsville Cancer Centre, a regional cancer centre in North Queensland, have been providing their services to rural hospitals in Townsville and Mt Isa districts via videoconferencing since 2007.

Intervention

Cancer care delivery to rural sites via Townsville teleoncology model.

Main outcome measures

The ability of the teleoncology model to provide the following services to rural towns

- Specialist consultations,
- Urgent specialist medical care,
- Care for Indigenous patients, and
- Remote supervision of chemotherapy administration.

Results

Between May 2007 and May 2011, 158 patients from 18 rural towns received a total of 745 consultations. Ten of these patients were consulted urgently and treatment plans initiated locally, avoiding inter-hospital transfers. Eighteen Indigenous patients, accompanied by more than four family members, received consultative services. Eighty-three patients received a

range of intravenous and oral chemotherapy regimens in Mt Isa. Oral agents were supplied in other towns through remote supervision by medical oncologists from Townsville.

Conclusion

The teleoncology model of care allows rural and Indigenous cancer patients to receive specialist consultations and chemotherapy treatments closer to home, thus minimising the access difficulties faced by the rural sector.

Key words

Access, Indigenous health, models of rural services, oncology, rural health, teleoncology

3.2.2 Introduction

The limited access to cancer care services is a significant issue faced by residents of rural, remote, Indigenous and some regional communities in Australia and other countries with widely dispersed rural populations.[2,13,19] Limited access to health promotion and screening services can mean that people experience the impact of poor health service access even before the onset of disease.[7]

Rural cancer patients and their families travel long distances to major centres for diagnosis, treatment and follow up. As a result, they incur out of pocket expenses for travel and accommodation[26] and face disruption to their daily routine.[3] Lack of access to healthcare services may be one of the contributors to the disparity in survival and disease-related outcomes that exist between metropolitan and non-metropolitan patients.[4,6,27]

Face-to-face outreach specialist services from metropolitan cancer centres attempt to address some of the access issues, with results of varying quality.[1,2] Under the current models, oncologists travel to larger rural centres, with the frequency of visits ranging from weekly to three monthly. In between visits, patients are managed by local medical officers with phone advice from the treating specialists or transferred to major centres for further management.

Patients from smaller rural centres travel to major centres for all aspects of their cancer management.[2]

Therefore, new models of care are required to improve the access of rural patients to specialist services locally and reduce the need for travel to major centres. One such example is telemedicine model of care. As defined by the American Telemedicine Association, Telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve patients' health status.[28] The telemedicine model is efficient because it can provide services to different towns in the one session, allowing greater geographical access than that allowed by attending a limited number of prescribed peripheral clinics.

Telemedicine using videoconferencing technology has been taken up by many sub-specialities in internal medicine for outpatient consultations and multidisciplinary meetings and by a very few centres for remote supervision of treatment.[12,18,29] The management of oral anticoagulation therapy in cardiology and thrombolytic therapy in neurology [12,30] are examples of the remote supervision of treatment.

In the field of medical oncology, a sub-speciality in internal medicine dealing with the medical management of cancer patients, telemedicine (here onwards referred to as teleoncology) is utilised by many centres for outpatient consultations and case discussions between health professionals.[13,15,20] Doolittle et al in BC Canada, and Taylor et al in Kansas, US demonstrated that medical oncology services can be provided to rural sites under a teleoncology model of care and that this is acceptable to patients and physicians.[13,15] However, the nature and the types of remotely supervised chemotherapy delivery are not reported by these studies.

To provide most of the medical care of rural cancer patients closer to home, the Department of Medical Oncology at the Townsville Cancer Centre established its teleoncology project in 2007. It operates between the regional tertiary centre of Townsville and rural towns in the Townsville and Mt Isa health service districts. The distance between Townsville and rural sites

ranges between 100 km to 1200 km, and approximately 365,000 people live in these two health service districts.[8]

Prior to the introduction of the project, all oncology patients had to attend clinics in person in Townsville. Mt Isa patients requiring chemotherapy received their first dose of chemotherapy in Townsville, and if uncomplicated, received subsequent courses in Mt Isa. For assessment of cancer response, patients returned to Townsville on a regular basis. Patients from other towns were required to visit Townsville both for clinical assessments and chemotherapy.

3.2.3 Clinic model

Description of the teleoncology clinic model has been published previously.[31] A questionnaire-based survey of this model has already reported high levels of satisfaction among patients and health workers.[1]

The aim of this manuscript is to describe the medical oncology services extended to rural cancer patients in North Queensland by the Townsville Cancer Centre, using the Townsville teleoncology model of care.

3.2.4 Methods

3.2.4.1 Data collection and entry

As part of a prospective evaluation of the implementation of the service, all occasions of teleoncology service were captured and entered into the Oncology Information Management System (OIMS) of the Townsville Cancer Centre. Demographic parameters including age, gender, ethnicity, histology and stage of malignancy were recorded. Details of the consultations were documented in medical records of The Townsville Hospital and Mt Isa Hospital and summary letters pertaining to the consultations outlining the management plans were sent to the relevant hospital medical records and patients' general practitioners. Data for this manuscript was obtained for the period between May 2007 and May 2011.

3.2.4.2 Analysis

Descriptive statistics were used to report on the demographic details of the patients and the types of medical oncology services provided remotely.

3.2.5 Ethical Approval

This study was approved by the Human Research Ethics Committees of the Townsville and Mt Isa Hospitals.

3.2.6 Results

Services provided to the patients through the teleoncology model of care are described below.

1. **Provision of specialist consultations to patients at their home towns**

Between 2007 and 2009, patients were required to attend at least one face-to-face clinic. In 2009, once the providing specialists and rural based health professionals involved in the teleoncology model of care became familiar with the concept of remote specialist supervision, it was decided that there was no need for a face-to-face attendance unless requested by the patients or the treating medical oncologists. Since there were no private facilities in rural sites, both private and public patients attended the teleoncology clinics at Queensland Health sites. Between May 2007 and May 2011, 158 patients were consulted via videoconferencing, resulting in 745 consultations. One patient declined to participate in this model of care and travelled to a tertiary centre for care. Demographic details of patients are described in Tables 3.1, 3.2 and 3.3.

Table 3.1
Demographic details of patients attending teleoncology clinics.

Median age	**67y, (19-87y)**
Gender -Male	77(48%)
-Female	81(52%)
Ethnicity- Indigenous	18(11%)
- Non indigenous	140(89%)
Seen via videoconference only	85(54%)
Seen face-to-face prior to videoconference	73(46%)

Table 3.2
Cancer types of patients attending teleoncology clinics.

Cancer types	**Number of patients**	**Curative intent**	**Palliative intent**
Breast	55	28 (51%)	27(49%)
Colorectal	31	10 (32%)	21(68%)
Lung	37	0	33(100%)
Upper GI Malignancy (stomach, esophagus, & pancreas)	14	2(14%)	12(86%)
Genitourinary malignancy (testis, prostate, bladder & kidney)	10	3(30%)	7(70%)
Melanoma	6	3(50%)	3(50%)
Ovarian cancer	3	3(100%)	0
Invasive mole	1	1100%)	0
Mesothelioma	1	0	1(100%)
Total	158	50(31%)	108(69%)

Table 3.3
Number of patients and consultations according to rural sites

Teleoncology Centres (distance from Townsville)	**Number of Patients**	**Number of Consultations**
Mt Isa(900 km)	130	600
Proserpine/Bowen(275 km)	17	73
Hughenden(385 km)	02	21
Winton(599 km)	04	23
Doomadgee(1200 km)	01	03
Palm Island(off shore 160km)	01	01
Gulf of Carpentaria(740-1200km)	05	18
Total	158	745

Eighty-five patients were seen via videoconferencing for initial and subsequent consultations and the rest were seen at least once in person, when they travelled to Townsville for other medical or social reasons (e.g. visiting family or friends or other specialists). Except for those requiring urgent reviews, all patients were seen within seven days of referral to the medical oncologists. On average each new consultation lasted about 30 minutes, and reviews lasted 10-15 minutes.

2. Provision of urgent specialist medical care

Ten patients from Mt Isa required urgent consultation during the study period. All were seen via videoconferencing within 24 hours. Table 3.4 describes the cancer types of these patients.

Table 3.4
Cancer types and treatment of patients consulted urgently

Cancer type	**No of Patients**	**Median age (range)**	**Chemotherapy**	**Palliation**
Extensive stage small cell	3	68y(60-82y)	2	1
Non small cell lung	2	67y	2	0
Metastatic head and neck	1	76y	0	1
Metastatic colon cancer	3	58y(19-72y)	3	0
Invasive mole	1	49y	1	0
Total	10		8	2

Prior to the initiation of the teleoncology service, these patients would have required transfer to Townsville Hospital for assessment. After discussion with the patient and family, , two of these 10 patients required transfer to palliative care units in Mt Isa. Treatment was initiated for the remainder within 48 hours. Since the project began no urgent inter-hospital transfers were required between Townsville and Mt Isa. By way of contrast, very sick patients from other rural hospitals, which lacked the capacity to care for them, had to be transferred to Townsville during this period.

3. Care of Indigenous cancer patients

Eighteen Indigenous patients were consulted and treated under this model of care. No one declined to participate. Twelve patients, accompanied by four or more extended family members for cultural and family needs, attended consultations and treatments . Four patients were accompanied by their spouses, while one patient was accompanied by a traditional healer. Table 3.5 describes the nature of cancer and the treatment received by these Indigenous patients.

Table 3.5
Cancer types and treatments of Indigenous patients (n=18).

Type of cancer	No of Patients	Median age (range)	Active treatment (no of patients)	Palliation
Breast cancer	3	60y(52-66y)	Chemotherapy (2) Hormonal agent(1)	0
Small cell lung cancer	3	68y(60-82y)	Chemotherapy(2)	1
Non small cell lung cancer	5	70y(60-83y)	Chemotherapy (2) Targeted agent(1)	2
Oesophageal cancer	2	56y	Chemotherapy(1)	1
Metastatic head& neck cancer	1	63y	0	1
Rectal cancer	1	19y	Chemotherapy	0
Metastatic colon cancer	1	58y	Chemotherapy	0
Ovarian cancer	1	61y	3 lines of chemotherapy	0
Bladder cancer	1	36y	Intravesical BCG	0

4. Provision of cancer treatments closer to home

As part of establishing the teleoncology model of care, Mt Isa was set up to provide all the types of solid tumour chemotherapy regimens that are available in Townsville. In Proserpine, single agent regimens like Herceptin, Gemcitabine and 5 Fluorouracil could be administered. In Proserpine, three patients received Gemcitabine (a single agent) for an average of eight weeks. In Mt Isa, 83 patients received intravenous and oral chemotherapy, supervised remotely by medical oncologists from Townsville via videoconferencing. Table 3.6 shows various chemotherapy regimens and number of cycles administered.

Since the project began, no patients from Mt Isa had travelled to Townsville for chemotherapy. Eight patients from other towns were supervised via videoconferencing for their oral anti-cancer medications including Capecitabine, Erlotinib and Sunitinib.

Table 3.6
Chemotherapy regimens supervised via teleoncology in Mt Isa.

Regimens	Number of patients	Median number of cycles (range)
Breast cancer		
TAC	6	6 (2-6)
TC	3	4 (4)
AC	2	4 (4)
Taxol/gemcitabine	3	8 (6-8)
FEC100-Taxotere	3	6 (6)
Colorectal cancer		
XELOX	8	6 (1-13)
FOLFOX	2	10 (10-12)
Fluorouracil	3	24 (24)
Capecitabine	3	8 (1-8)
Lung cancer		
Carboplatin /Taxol	6	6 (3-6)
Carboplatin/Vinorelbine	4	4 (2-4)
Carboplatin/Gemcitabine	10	4 (3-6)
Carboplatin/etoposide	5	6 (2-8)
Ovarian cancer		
Carboplatin/Taxol	3	6 (6)
Germ cell tumour		
BEP	1	4 (4)
Invasive mole		
Methotrexate infusion	1	2 (2)
Others	21	-
Total	83	

T = docetaxel, A = Adriamycin, C = Cyclophosphamide, E-Epirubicin, BEP=Bleomycin/etoposide/platinum, XELOX/FOLFOX=Oxaliplatin based regimens.

3.2.7 Discussion

The Townsville teleoncology model is one of the few examples of specialist medical oncology care provided to rural sites via telemedicine. Under this model of care, rural patients were able

to receive inpatient and outpatient consultations, urgent ward reviews and chemotherapy administration without the need for long travel to major centres.

Unlike the current face-to-face model, the teleoncology model of the Townsville Cancer Centre facilitates immediate access to specialist medical oncology services and allows medical consultations on an urgent basis within 24 hours. Treatment can be commenced locally, without the need for costly and disruptive inter-hospital transfers and the inherent delays associated with transfer.

Eighteen Indigenous patients and their families from rural and remote communities were seen in teleoncology clinics. By allowing patients to remain located within their immediate communities while accessing specialist advice and management, Special attention to cultural needs and community participation in patient care is facilitated. Attendance of local traditional healers and family members with patients at their consultation offers the opportunity of education and acknowledgement of cultural values.

The ability to treat patients with chemotherapy closer to their homes is a major benefit of this project. Mt Isa routinely provides all solid tumour chemotherapies, both oral and intravenous, while patients from smaller towns can be safely supervised for oral agents. Since the project began, no patients from Mt Isa had to travel the 900 km to Townsville for chemotherapy. A further advantage is that patients may be reviewed by medical oncologists immediately for complications and appropriate advice discussed with the physician responsible at the remote centre.

The benefits this project offered to rural patients has encouraged clinicians from other departments within The Townsville Cancer Centre (including Radiation Oncology, Haematology and Palliative Care) to introduce this teleoncology model for selected rural patients. The model has the potential for wide applicability within cancer care, including in the area of telenursing.

This manuscript has not focussed on the safety aspects of remote supervision of chemotherapy delivery. Audits are underway to address this concern. Another question not addressed by this study is whether enhancing rural access to specialist cancer services via the teleoncology model of care improves patients' cancer related clinical outcomes compared to face-to-face models. In conclusion, teleoncology via videoconferencing is an alternative and complementary technology which enhances rural patients' access to services. Not only can teleoncology provide specialist oncology services, but also support all fields of medicine, and should become part of daily business for all departments involved in the care of rural patients. This would be one an important step in closing the gap between rural and urban health outcomes, as well as Indigenous and non-Indigenous health outcomes. Teleoncology could provide benefits not only in Australia, but also in many other developed and developing countries with significant rural populations.

3.2.8 Acknowledgements

We thank our administration support officers, chemotherapy nurses in Mt Isa, Sonia Bison, Nicole Johnston and Jessica Casey, other rural nurses, doctors and allied health professionals in Townsville and Mt Isa health districts who made this model of care a success.

3.3 Impact on service delivery

Results of and experiences gained from this study helped the Townsville Cancer Centre to extend its services to admitted-in patients in Mt Isa and to many other rural towns in North Queensland, and other Australian states including Victoria and New South Wales. Following publication of this article, many cancer centres from other states adopted this model of care to provide care closer to home for their rural patients (personal communication Dr Ashley, Geelong, A/Prof George, Tamworth).

Chapter 4 Timely Access to Specialist Cancer Services Closer to Home

4.1 Chapter overview

While the previous chapter demonstrated that comprehensive services could be provided to rural patients through the Townsville Teleoncology model, it is important to ensure that there are no disparities in timeliness of access to services. The article described under section 4.2 "Timely access to specialist medical oncology services closer to home for rural patients: Experience from the Townsville Teleoncology Model" has been published in the ***Aust J Rural Health***, 2014;22:156-159 and demonstrates that, by overcoming some access barriers, specialist cancer services can be provided in rural areas in a timely manner.

4.2 Timely access to specialist medical oncology services closer to home for rural patients: Experience from the Townsville Teleoncology Model

What is known about this subject

- Teleoncology models can facilitate the provision of specialist consultations and cancer chemotherapy closer to home for rural cancer patients,
- Previous studies report high satisfaction rates with teleoncology clinics,
- Teleoncology models provide economic savings to the health system,
- (Cost benefit paper was published before this paper and included in chapter 7), and
- Literature on the feasibility of providing acute cancer care through teleoncology models of care is limited.

What this paper adds

- Provision of acute cancer care closer to home for rural patients is possible through teleoncology models of care in a timely and equitable manner, and

- To increase the acuity and complexity of care locally in rural towns, more resources need to be allocated to rural hospitals.

4.2.1 Abstract

Problem

Prior to 2009, the teleoncology model of the Townsville Cancer Centre (TCC) did not achieve its aims of equal waiting times for rural and urban patients and the provision of reliable, local acute cancer care. From 2007-2009, 60 new patients from Mt Isa travelled to TCC for their first consultation and their first dose of chemotherapy. Six of these patients required inter-hospital transfers and eight required urgent flights to attend outpatient clinics. Only 50% of these rural patients (n=30) were reviewed within one week of their referral, compared with 90% of Townsville patients.

Design

A descriptive study before and after the implementation of the model.

Setting

TCC provides teleoncology services to 21 rural towns; the largest being Mt Isa, Qld.

Key measures for improvement

Specialist review of 90% of urgent cases within 24 hours, and 90% of non-urgent cases within one week of referral via videoconferencing.

A 50% reduction in inpatient inter-hospital transfers from Mt Isa to Townsville.

Strategies for change

Increased human resources: a half-time medical officer and a half-time cancer care coordinator and implementation of new policies.

Effects of change

Between 2009 and 2011, TCC provided cancer care to 70 new patients from Mt Isa. Of these new patients, 93% (65/70) were seen within one week of referral. All 17 patients requiring urgent reviews were seen within 24 hours of referral and were managed locally, thus eliminating the need for inpatient inter-hospital transfers.

Lessons learnt

Provision of timely acute rural cancer care closer to home requires an increase in the complexity of cases managed in rural health facilities and human resources.

4.2.2 Description of the context

Townsville Cancer Centre (TCC) in North Queensland, Australia has provided comprehensive medical oncology services (medical consultations, supervision of chemotherapy and follow-up) since 2007 to Mt Isa, a mining town of 20,000 people, 900 km west of Townsville. During this time, videoconferencing technology has also enabled TCC to conduct specialist consultation and follow-up services (without administering intravenous chemotherapy agents) to twenty other rural hospitals in its large catchment area.[8,32]

4.2.2.1 How the TCC model works

The TCC teleoncology clinic model has been described previously.[2] In this model, medical oncologists from Townsville provide their services to rural sites through videoconferencing. They are supported by locally based doctors, nurses and allied health professionals.

When the patient is assessed to be fit for chemotherapy, medical oncologists then write the care plan and send the prescriptions electronically to Mt Isa. Chemotherapy is given by chemotherapy competent nurses in Mt Isa. For oral chemotherapy, authority prescriptions are sent via post by medical oncologists to patients or the pharmacy. Treatment is administered after appropriate training by medical oncologists, nurses and/or pharmacists. This model was

acceptable to patients and welcomed by the rurally based health professionals[1] and it appears safe to supervise chemotherapy remotely using this model.[33] A recent cost comparison analysis of this model revealed net savings to the health system by reducing patient travel.[34]

4.2.3 Problems

Two main problems were identified with this service. These problems were the need for inpatient inter-hospital transfers from Mt Isa to Townsville and the disparity between rural and Townsville patients in time from date of referral to clinic reviews. Prior to 2007, all patients were required to travel from Mt Isa and surrounding towns to Townsville for medical reviews. Since the introduction of the teleoncology model in May 2007, patients needed to travel only for their first consultations. Between 2007 and 2009, 60 patients were managed using videoconferencing subsequent to the first face-to-face consultation. The nature of new patients' reviews is illustrated in Table 4.1.

Table 4.1
Nature of reviews of new patients: 2007-2009

Patient group	**Number**
Requiring in-patient inter hospital transfers from Mt Isa to Townsville	6
Requiring flights within one week for outpatient clinic review in Townsville	8
Deemed unfit for flying and referred to palliative care in Mt Isa	3
Requiring reviews through routine clinic process	43
Total	60

Patients admitted to hospital in Mt Isa and other rural hospitals received their in-patient cancer care locally, with telephone advice from Townsville-based medical oncologists. Forty-three patients requiring non-urgent review were seen face-to-face first in Townsville at various times between referral date and their face-to-face review. The median waiting time from the date of referral to review was 17 days (range 7-28 days). Overall, 50% of the new patients were seen within one week of referral compared with 90% of Townsville patients (total of 673 patients).

4.2.4 Key measures for improvement

As the aim of this project was to provide cancer care closer to home in a timely and equitable manner for rural patients, the following constituted key measures for improvement (KMI):

1. **Specialist review of 90% of urgent patients within 24 hours and specialist review of 90% of non-urgent patients within one week of referral closer to home via videoconferencing.**

Urgent patients from Townsville, referred by the Townsville Hospital doctors or general practitioners from the community are now seen within 24 hours of referral and all routine referrals are now attended to in outpatient clinics within one week of referral. Rural patients must also be seen within the above timeframe in order to achieve equity of access for all patients closer to home.

2. **Fifty percent reduction in inpatient inter-hospital transfers from Mt Isa to Townsville.**

If patients are seen urgently and managed locally (with specialist support through videoconferencing), this model of cancer care will reduce the number of inter-hospital transfers and provide savings to the health system.

4.2.5 Process of gathering information

As baseline measurements, data was retrieved from the Oncology Information Management System (OIMS) for the four-year period between May 2007 and May 2011. The following information was collected: number of patients and the waiting time from referral to review, number of inter-hospital transfers, demographic details including age, gender, type of cancer, prognosis, treatment pathway (whether transferred or managed locally) and type of treatment offered.

Ethics approval was received from the Human Research Ethics Committee of both the Townsville District Health Service and Mt Isa District Health Service (HREC/12/QTHS/29) and the James Cook University (H4602).

4.2.6 Strategy for change

To achieve the new key measures for improvement in a safe manner, an increase in the number of medical, nursing and allied health staff in Mt Isa was needed. Similarly, policy and governance structures required change. Funding was obtained to employ a half time senior medical officer and a full time cancer care coordinator.

After two years of experience and familiarity with the teleoncology model of care, new policies were collaboratively developed in an attempt to expand the scope of practice in Mt Isa. These policies were:

- All new patients were seen initially via videoconferencing to ensure that future care was coordinated if and when patients travelled to Townsville,
- Patients from Mt Isa were not required to travel to Townsville unless requested by the patients or the treating teams,
- All solid tumour chemotherapy regimens were administered in Mt Isa, and
- All inpatient admissions to Mt Isa hospital were notified to the Townsville medical oncologists to enable regular specialist patient assessment during their hospital stay via videoconferencing.

4.2.7 Effect of change

Between May 2009 and May 2011, 70 patients were treated via the teleoncology model in Mt Isa. Of these, 44 were managed exclusively by the teleoncology model, without ever travelling to Townsville. Twenty-six patients were seen in Townsville when they presented for radiation and/or surgery. The nature of new patients referred to the service is summarised in Table 4.2.

Table 4.2
Nature of new patients in relation to urgency of reviews: 2009-2011

Nature of referral of new patients	Number	Number of patients seen within one week of referral	Examples of cancers
Urgent reviews	11	11/11 (All within 24 hours)	Metastatic SCLC,NSCLC,H&N, Colon and GTD
Routine clinic referral process	59	54/59	Most types
Total	70	65/70(93%)	

SCLC-Small cell lung cancer, NSCLC-Non small cell lung cancer, H&N-Head and neck cancer, GTD-Gestational trophoblastic disease

Ninety-three percent of the new patients were reviewed within one week of referral. In addition to the 11 new patients requiring urgent reviews listed in Table 4.2, a further six patients were reviewed within 24 hours for treatment related complications. All 17 patients who required urgent reviews by medical oncologists via videoconferencing were managed in Mt Isa with the support of local doctors and nurses without requiring inpatient inter-hospital transfers to Townsville.

4.2.8 Lessons learnt and future plans

We have demonstrated that it is feasible through telemedicine for specialists from tertiary centres to assess and care for acute oncology patients with cancer-related and treatment-related complications in rural hospitals in a timely manner. All 17 urgent patients between 2009 and 2011 received timely specialist care without leaving Mt Isa. Prior to the introduction of the

teleoncology service, these patients would have required transfer to The Townsville Hospital for opinion, assessment and care. In addition, we provided consultations within one of week of referral to more than 90% of the rural patients close to home. This time frame is similar to patients living in Townsville.

Several requirements are needed for safe assessment and management of acutely ill patients under this model of care. Although specialists make decisions from tertiary centres via videoconferencing, the model relies on the availability of a telemedicine infrastructure and the capabilities of local, rural health professionals.

Issues to consider include the levels of support available for the technological infrastructure and operation and the availability of senior medical officers, chemotherapy and oncology competent nurses. The model requires a high dependency or intensive care facility, pharmacy, imaging facility, palliative care, and quick pathology turnaround times for essential blood tests and allied health support.[35] Implementation of this model depends upon the availability of these requirements and the capacity to provide training, support and workforce stability. The provision of a teleoncology model of service is much more than the installation of telemedicine equipment.

In conclusion, it is feasible for medical oncologists from tertiary centres to assess acute cancer patients and initiate cancer care in a timely and safe fashion at rural hospitals through the use of telemedicine, if the infrastructure and human resources are adequate at the rural sites. The ability to care for patients locally and avoidance of inter-hospital transfers provides many benefits for patients, their families and the health system. When a decision is made (following an urgent teleoncology consultation) that the patient requires travel to the tertiary centre for care, effective communication between the tertiary and rural health professionals may facilitate care at the tertiary centre in a coordinated manner. In the future, this model of care will be expanded to as many small towns as possible by improving the service system capabilities. We believe this approach is sustainable for three reasons;

- This model is acceptable to patients and health professionals,
- The savings acquired by reducing inter-hospital transfers and patient travel can be redirected to improving the capabilities of rural hospitals to provide care locally, and
- It is feasible to manage complications of chemotherapy closer to home in a timely and safe manner.

4.3 Impact on service delivery

As a result of the findings of this study, that cancer services can be provided to Mt Isa in a timely manner thorough teleoncology model, a policy change was implemented whereby all new cases from rural towns were initially required to have a teleoncology consultation locally at rural centres. This was mainly to make sure the future care was delivered in a coordinated manner when patients travelled to the tertiary centre.

Chapter 5 Patient and Health Professional Satisfaction-Indigenous Perspective

5.1 Chapter overview

It was encouraging and satisfying to see that oncology services could be provided to rural patients closer to home through teleoncology models. However, quality improvement activities need to include patients' and health professionals' perspectives so that services can be delivered at acceptable standards. A systematic review of studies on satisfaction with various telehealth models revealed high rates of acceptance by patients and health providers.[49] Similar to the findings of teleoncology studies from Kansas USA and Kelowna, BC,[15,50] a study from our own centre reported high levels of satisfaction amongst 50 patients and 18 health workers who participated in the Townsville teleoncology service.[36] This study reported high levels of satisfaction and acceptance by patients and health professionals. None of the health professionals raised concerns regarding medicolegal issues, and all welcomed the model for its many healthcare and professional development benefits. Since there were no Indigenous patients included in the study, given the importance of Indigenous health in Australian social and political context, a separate study described in section 5.2 was conducted to examine the perspectives of Indigenous patients and their health professionals. This study was published under the title "Patient and health professional satisfaction with teleoncology-Indigenous perspective" in the ***Aust J Rural Health,*** 2012, 20:265-269. The research question "Are patients and rural health workers satisfied with the Townsville teleoncology model?" is considered in this chapter focussing on Indigenous perspectives and the Chapter 6.

5.2 Tele-oncology for Indigenous patients: the responses of patients and health workers

5.2.1 Abstract

Problem

Townsville Cancer Centre provides video-consultation (VC) services to patients in rural/ remote regions of North Queensland in order to improve access to specialist cancer care. Previously, the experience and responses of Indigenous patients utilising this service had not been studied. Our objective is to assess the level of satisfaction and the responses of Indigenous patients, their families and health workers to VC and such teleoncology service.

Design

A descriptive study; using semi-structured interviews.

Setting

Tertiary referral centre (Townsville Cancer Centre); and various rural and remote towns in Queensland.

Key measures for improvement

Satisfaction levels of Indigenous patients, their family members and Indigenous health workers with various aspects of the teleoncology service.

Lessons learnt

Our evaluation suggests that teleoncology is an acceptable model of care for Indigenous patients, with high levels of satisfaction expressed from patients, families and health workers. Health professionals involved with providing this service need to be adaptive to the needs of individual patients and local communities in order to provide culturally appropriate care. Formal skills training for staff, effective communication between specialist and local HWs, and informed consent procedures are essential to maintain safety of practices.

Strategies for change

- Mandatory informed consent procedure for all patients offered VC.
- Formalised competency training for staff in skills essential to maintain safe practices in teleoncology.
- Clear clinical documentation to facilitate improved communication in patient management between medical staff at main centre and distant sites.
- Further efforts in promotion, education and support for staff to participate in telemedicine.

Keywords

Indigenous health, telehealth/telemedicine, health services access, rural/remote services, cancer care.

5.2.2 Context

In Australia, poorer survival outcomes for Aboriginal and Torres Strait Islander (hereafter referred to as Indigenous) people with cancer compared to their non-Indigenous counterparts have been well documented.[37-39] Indigenous people with cancer are likely to have less cancer treatment, more delays to surgery, and have interrupted treatment patterns.[40] They have lower survival rates and greater rate of co-morbidities[40], even after adjustment for cancer stage at diagnosis.

Indigenous cancer patients' reduced access to and utilisation of medical services , have been implicated as some of the reasons for their poorer survival.[42-44] This situation is exacerbated by the fact that poorer cancer survival has also been linked to rural and remote areas of Queensland.[41]

The telemedicine model could be used to overcome these issues. This model has the potential to enhance access to specialist medical care by overcoming geographical barriers, as well as the potential to possibly improve clinic attendance rates and treatment adherence.

In order to improve access for these areas to specialist cancer care, [31,32]the Townsville Cancer Centre provides video-consultation (VC) services to patients in rural and remote regions of North Queensland and the Gulf of Carpentaria. In addition, chemotherapy can be administered to patients at rural hospitals that have appropriate staff and facilities, under distant supervision of the medical oncologist at the main Townsville centre. Family members, Indigenous health worker, nurse or local medical officer are usually able to accompany the patient at the remote site during VC. VCs may be for new referrals, reviews, monitoring of treatment or routine follow-up.

Previous studies have established the benefits and satisfaction from patients and health workers (HWs) of utilising such models of teleoncology.[1,14,45,46] One study from our own centre reported high levels of satisfaction amongst 50 patients and 18 HWs who participated in VCs with the oncology service.[1] Another study from Canada compared patient satisfaction with VC versus face-to-face (F2F) consultation and found no difference.[14] However, no Indigenous patients were included in these studies and responses or experiences of Indigenous patients using VC models have so far not been described. Since cultural factors are known to influence the way in which Indigenous patients utilise mainstream health services,[47] acceptance of the teleoncology model by non-Indigenous populations cannot be extrapolated to Indigenous groups.

5.2.3 Outline of the problem

We set out to assess the satisfaction level and perspectives of Indigenous patients, their families and HWs working with Indigenous patients, on VC and the teleoncology service.

Key measures for improvement

The following factors are seen to be essential in maximising satisfaction of patients and HWs utilising a teleoncology service[35]

- Efficient coordination of clinics,
- Smooth functioning videoconferencing equipment and connectivity, and
- Adequate nursing, medical and psychosocial support for patients at distant sites.

Accordingly we sought to assess levels of satisfaction and feedback, via an interview and questionnaire process, from Indigenous patients, their family members and HWs on these aspects of our teleoncology service.

5.2.4 Processes of gathering information

Indigenous patients who had participated in VC with a medical oncologist between January 2007 and July 2011 were identified via Townsville Cancer Centre's Oncology Information Management Database. These patients, their nominated family member/s and HWs who had accompanied them during VCs were invited to take part in semi-structured interviews using a mix of open-ended and graded-response questions. Interviews were conducted face-to-face, via telephone or via videoconference according to feasibility and interviewee preference. A single interviewer conducted all interviews, in order to ensure uniformity of questioning. Patients and family members were asked to record responses to statements relating to four themes: quality of VC (Theme 1), rapport with specialist (Theme 2), benefits of VC over face-to-face consultation (Theme 3), and satisfaction with overall care received via teleoncology model (Theme 4). The responses were tabulated on a 5-point scale of agreement. Interviewees were also given the opportunity to provide open-responses to each theme.

Responses from patients and family members were analysed and presented together due to small numbers. Types of response (strongly agree, agree, etc.) for all questions within a theme were totalled to calculate an overall percentage of agreement for each theme.

Interviews with HWs consisted of seven open-ended questions. Responses from HWs were analysed separately by two investigators. They each performed thematic analysis, and then combined to develop an overall interpretation of the data.[48]

5.2.4.1 Analysis

Twenty-three Indigenous patients participated in VC between 2007 and 2011. At the time of the evaluation, 13 were deceased, nine were interviewed and one could not be contacted. Only two family members were interviewed as the majority declined or could not be contacted. All six HWs who were identified were interviewed. They consisted of one doctor, one clinical nurse consultant, two registered nurses, one Indigenous liaison officer and one senior support officer.

5.2.4.2 Responses from patients and family members

The responses of patients and family members to questions within the four themes are presented in Figure 5.1. The percentage of responses rating agreement (strongly agree or agree) to themes 1, 2, 3 and 4 were 96%, 97%, 97% and 87% respectively.

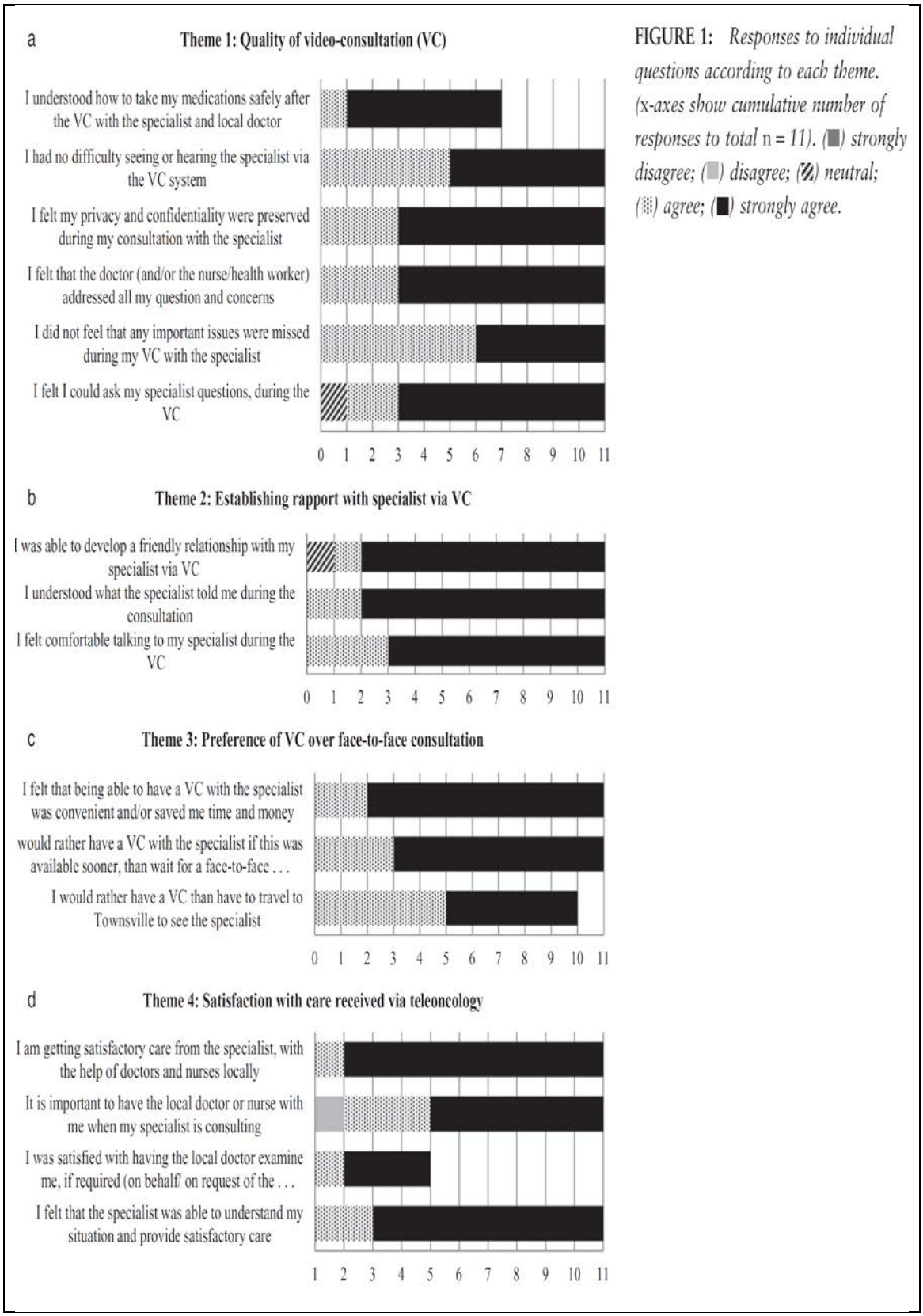

FIGURE 1: *Responses to individual questions according to each theme. (x-axes show cumulative number of responses to total* n = *11). (■) strongly disagree; (■) disagree; (▨) neutral; (▩) agree; (■) strongly agree.*

Figure 5.1 Responses to individual questions according to each theme.

One family member reported dissatisfaction with the care provided by the medical staff at the local site. Two patients reported that it was not important to have a local doctor/nurse sit in with them at their local site during the VC.

In response to an open-ended question regarding receiving or discussing bad news in relation to their cancer, all interviewees indicated that they had no preference whether this occurred via VC or face-to-face consultation. All interviewees indicated that they were satisfied with VC overall and would be happy to have it again.

5.2.4.3 Responses from health workers

Summary of responses from HWs are recorded in Table 5.1.

Table 5.1
Responses of health-workers (HWs) involved with video-consultation (VC) for Indigenous patients.

Questions	Summated points from health-workers' (HW) responses
How do you feel about safety of chemotherapy delivery at a distant site, in the Teleoncology model of care?	• Most felt that administering chemotherapy at their local site was safe • Regular and effective communication (via written correspondence, email, phone calls) ensured HWs felt well-supported by the specialist at main site • Skills and competency training for nurses in administering chemotherapy was very important
How do you feel about VC compared to F2F consultation? What are the benefits for patients in the Tele-oncology model of care?	• All felt VC was a very valuable service as it saved time and costs of travel for the patient, their family, and the health system • Another advantage is enabling local family to be involved in the VC with the specialist • Further advantage in enabling patients to receive treatment close to home, without being removed from their community and family supports • Most reported good rapport established between the patient and the specialist despite initial patient "shyness" at first VC episode. (*Responses from two questions combined due to overlap and similarities in responses*)
What are the benefits for local HWs in the Tele-oncology model of care?	• Educational benefits and opportunity for HWs to acquire new skills • HWs felt actively involved in the patient's care • Fostered a closer working relationship between HWs and specialist enabling a collaborative approach in caring for the patient
What are the problems faced/potential problems you perceive with this model of care?	• Most report no problems (1 centre had initial IT operational problems which were soon rectified) • Some commented that other HWs' (who have not experienced using VC) attitudes of "resistance to new technology and a novel way to care for patients" may limit the adoption of this model of care
Do you feel there are any medico-legal concerns with this model of care?	• Most reported no concerns • Comments that obtaining informed consent from patient and clear guidelines for when to transfer patient to main centre, are important
Should this model of care continue to be provided for Indigenous cancer patients?	• All responded "yes" • All agree it is an appropriate model that is well received by Indigenous patients

HWs described benefits of VC and teleoncology not only for patients and their families, but also in adding educational value for themselves and in fostering closer working relationships with the specialist team.

5.2.4.4 Overall responses

All groups interviewed indicated an overall preference for VC over face-to-face consultation, with reasons quoted including reduced waiting time, cost, burden of travel and removal from local support.

5.2.5 Interpretation / Lessons learnt

Whilst acknowledging the limitation of our evaluation's small sample size not being entirely representative, it is the first to report responses of Indigenous patients, their families and their HWs to VC and a teleoncology service. Furthermore it is the first to describe VC combined with chemotherapy treatment for patients at a distant site within a comprehensive teleoncology model of care.

Similarly to the findings of other studies examining VC in non-Indigenous cohorts,[1,14] our evaluation has found high levels of satisfaction with VC in oncology. Our results indicate that teleoncology can be an effective tool to reach Indigenous communities that have traditionally been distanced from specialist medical services due to geographical or cultural barriers.

Not all patients felt it was important to have a doctor/nurse sit in with them at the local site during video-consultation with the specialist. One patient specifically requested not to have a local health-worker sit in during the VC in order to preserve privacy. On the other hand, all HWs interviewed felt their role in the VC helped the patient's understanding of the discussion with the specialist. This highlights the issues surrounding informed consent and patient confidentiality in the practice of telemedicine. Furthermore the differential responses from patients and HWs on this issue serve as a reminder to healthcare professionals to avoid succumbing to assumptions and biases associated with treating Indigenous patients.

Enhancing partnerships between local HWs and specialist teams was another benefit of the teleoncology model demonstrated by our evaluation.. The promotion of this shared-care model optimally delivered quality care to Indigenous cancer patients "at their door-step". Formal skills training and effective communication between specialist and local HWs are essential to maintain safety of practices.

In relation to medicolegal concerns, though none of the health professionals (albeit smaller numbers) identified this as an issue, adherence to good clinical practice, accurate and timely documentation and results of regular audits are necessary to minimise the risk.

5.2.6 Strategy for change/Next steps

This small evaluation suggests that our model of teleoncology is acceptable to Indigenous patients, with high levels of satisfaction expressed from patients, families and HWs. To further improve the acceptability and satisfaction with this service, we propose the following in the future:

- All patients offered VC should give prior consent to the process of VC, the presence of any third parties during the VC, the recording of images or audio content (if needed) and the option to request a face-to-face consultation at any stage.
- All physicians and health staff participating in VC and the teleoncology service should undergo formal training in communication skills, basic operational skills for VC equipment and cultural awareness skills.
- There should be a dedicated staff member (telehealth coordinator) to ensure efficient operation of teleoncology clinics and coordination between main centre and distant sites.
- Clinical documentation needs to be recorded after each VC episode and kept at both distant and main sites, including a summary of assessment and the management plan.

- Further efforts in promotion, education and support for physicians are needed to overcome physician barriers to participating in telemedicine.

5.3 Impact on service delivery

The results of this study and the study in next chapter contributed to the development of the Practical Aspects of Telehealth series in the Internal Medicine Journal on behalf of the Royal Australasian College of Physicians Telehealth working group. At the local level, results of this study helped in the drafting of training modules for junior and senior doctors to improve teleoncology communication skills.

Chapter 6 Teleoncology Model Replacing Face-to-Face Cancer Care

6.1 Chapter overview

Studies in the previous chapter evaluated patient satisfaction with a model that required that the patient be seen face-to-face for their first consultation. With clinicians' increasing confidence in the teleoncology model of care, the model evolved to a point where most Mt Isa patients were managed solely through teleoncology. Since this approach (face-to-face care in Mt Isa being replaced by this teleoncology model) is novel and not described in the literature, the perspectives of patients (who have not seen their medical oncologists face-to-face at any time during their journey) were explored using qualitative methods in a study published online in the ***J Telemed Telecare***. 2014;20(4):207-211.

, under the title "A teleoncology model replacing face-to-face specialist cancer care: perspectives of patients in North Queensland". This chapter continues exploration of the research question "Are patients and health professionals satisfied with the Townsville Teleoncology model?"

6.2 A teleoncology model replacing face-to-face specialist cancer care: perspectives of patients in North Queensland

6.2.1 Summary

We explored the experiences of patients using the Townsville Teleoncology clinic in which most patients are no longer seen face-to-face. We utilised a qualitative study design and conducted semi-structured interviews with 29 oncology patients who participated in teleoncology between September and December 2012. The study identified five major themes: quality of the consultation; communication and relationships; familiarity with technology and initial fears; local services and support; and lack of co-ordination of services from the local

rural hospital to the major regional hospital. Incorporating feedback from patients, the users of the service, is essential to improve and expand new models of care.

6.2.2 Introduction

Teleoncology is used in cancer care to provide services to rural, remote and underserved populations.[13-15] Previous questionnaire-based surveys and qualitative studies have reported high satisfaction rates.[1,9,49-51] The reasons for these high satisfaction rates include the ability to receive specialist services closer to home, reduction in travel time and its economic consequences and positive technical aspects of teleoncology, such as clarity of audio and video.[49] In these studies, most patients have been seen face-to-face at some time during their cancer care, where providers had the opportunity to establish a rapport and orient them to teleoncology in person.

As providers have become more familiar with teleoncology, more complex management has been provided in some rural towns within TTN.[32] However, a shortage of supportive care networks may limit the ability of many rural centres to provide complex services closer to homes.[2,4]

Face-to-face care has been replaced by teleoncology in the Townsville Teleoncology Network (TTN) of the Townsville Cancer Centre (TCC) in North Queensland.[32] In this model, many patients have never seen the specialist face-to-face. New, routine and urgent reviews are performed via videoconference with support from local doctors, nurses and allied health professionals. Patients who are fit for chemotherapy receive most solid tumour regimens locally with the help of suitably trained nurses. Earlier evaluation studies found positive patient satisfaction with telemedicine.[1] However, these studies were limited to patients who were initially seen face-to-face.

To provide truly patient-centred care, it is important to seek patients' views, by exploring their experiences. Therefore, the aim of the present study was to examine the patient perspective of

the Townsville Teleoncology clinic where the majority of the patients are no longer seen face-to-face.

6.2.3 Methods

We conducted an exploratory, descriptive, qualitative study.[52] All 35 medical oncology patients who were seen for their initial consultations by their medical oncologists in 2012 via videoconferencing were invited to participate in an interview. None refused. Semi-structured interviewing was conducted using a flexible interview guide. The interview guide was pilot tested with five participants and then refined. Interviews took 30-45 min. An experienced nurse researcher conducted all of the interviews. With the participants' permission the interviews were all audio-recorded, later transcribed in full and analysed for common themes.[53] Two researchers independently coded the data and themes were agreed by consensus. The appropriate ethics committees approved the study.

6.2.4 Results

Thirty two patients were interviewed by telephone and three via videoconference at their local health service facility. Six interviews were not included in the final analysis due to recording failures. Demographic details of the participants are summarised in Table 6.1.

Table 6.1
Demographic details of patients (n=29)

Median age, years	**58**
Age range, years	**25-83**
Gender	
Men (%)	12 (41)
Women (%)	17 (59)
Ethnicity	
Indigenous (%)	3 (10)
Non-indigenous (%)	26 (90)
Seen via videoconference only (%)	20 (69)
Seen face-to-face after initial videoconference (%)	9 (31)
Cancer type	
Breast	12
Carcinoid	1
Colon	6
Lung	6
Head and neck	1
Ovarian	1
Testicular	2

Data analysis identified five major themes, and each major theme included a number of subthemes. The major themes were:

1. Quality of the consultation,
2. Communication and relationships,
3. Familiarity with technology and initial fears,
4. Local services and support, and
5. Co-ordination of care.

The results are summarised in Table 6.2 using the participant's own words. Pseudonyms have been used to protect the patient's anonymity.

1. Quality of the consultation.

The majority of patients interviewed (69%) had not seen the oncology specialist face-to-face. Despite not having received the conventional model of care, 17 of these patients (85%) found the video-consultation to be of high quality and were extremely satisfied with the interaction. When participants were asked about the quality of the consultation with the specialist on the video link, they commented on the broader aspects of the interaction rather than merely the technical components. One patient who had received initial face-to-face consultations at the regional hospital and was now receiving follow up consultations via videoconference found the teleoncology helpful.

Another patient, who lives approximately 600 km from the regional hospital and had seen the specialist face-to-face previously, was extremely enthusiastic about teleoncology. For six patients interviewed, their initial fears appeared to subside once they were greeted warmly by the specialist via the videolink. Three patients who had not been seen face-to-face were surprised by the quality and ease of communication via videoconference.

2. Communication and relationships.

Four patients interviewed spoke of the ways in which the specialist made them feel 'like a person, not just a patient.' Six of the participants interviewed who had been seen face-to-face and then received treatment via videolink, regarded the first face-to-face visit with the specialist as advantageous. However, they also reported that even without this first visit, the videoconference would still have been acceptable and comfortable for them. Two other patients expressed a pragmatic approach to the use of videolink. Barry, a 53-year-old patient who had been treated for more than 12 years by the specialist, preferred face-to-face consultations. However, he acknowledged the benefits of videoconferencing for people who live in rural and remote areas. For this patient, a long-standing relationship with his treating specialist

influenced his reaction to the use of video consultations. The other patients interviewed did not have such a long-standing relationship with the specialist.

Other problems occurred during the teleoncology consultations. Hearing loss, experienced by an 84-year-old patient, posed an additional challenge to his experience of teleoncology. He had been seen face-to-face at the regional hospital 200 km away from his home, and was now having reviews via videolink.

This patient expressed that, initially, he did not find it easy to ask questions. However, although he found it difficult to hear, he was satisfied with this mode of oncology. Sue, a 53-year-old patient who had not been seen face-to-face, acknowledged that having other health professionals present in the room helped. Larry, who had not seen the specialist face-to-face, explained that the teleoncology enabled a relationship to develop.

3. Familiarity with technology and initial fears.

The patients interviewed had varied experiences with technology and their comfort level with consultations reflected these experiences. Despite at least five people not having used videoconferencing previously, once they became familiar with it their initial apprehension appeared to lessen. One of the patients, Sally, explained how she was able to assist another patient overcome her fear of the unfamiliar technology. Sally invited this new patient and her partner to attend one of her teleconsultations as a way of alleviating her fears.

4. Local services and support.

Overall, patients were pleased with the teleoncology and the follow up treatment and support provided by their local, rural hospital. Thirteen participants in this study highlighted the advantages of having local doctors and nurses in the consultation. For nine patients, the active participation of their local health professionals in the consultation with the specialist gave them extra reassurance and was a source of comfort to them. One participant mentioned how the local medical staff acted as interpreters and explained test results to them. Participants who had

confidence with the skills and abilities of the local health service staff were more likely to be in favour of teleoncology model of care than those who did not trust the local service. Two of the patients interviewed explained that they did not trust their local health service and as a result they would prefer to travel long distances to the regional hospital for their treatment, even though the treatment could be provided locally.

5. Coordination of care.

Whilst the majority (93%) of patients interviewed spoke positively of the advantages of teleoncology, some of the patients (15%) were critical of the lack of a coordinated approach to their cancer care and treatment. Not having blood tests and/or scan results available locally at the time of the consultation created further stress for them. The time needed to chase up results was a source of frustration for many participants interviewed in this study. Sally explained how her cancer care could be improved by improving the communication link between the specialist and the local treating doctor. Similarly, Susan, spoke of the problems associated with not having her chemotherapy drugs available when it was time to begin her next round of chemotherapy. These points are illustrated in Table 6.2.

Table 6.2
Responses of participants

Theme	Quotations
Quality of consultation	'I thought it was a very good thing because of the travel, particularly with people who aren't well and I was willing to give it a try and see how it went' (John, Lung cancer).
	'I found it fantastic because of having a doctor in the same room – it's absolutely fantastic!' (Mary, breast cancer)
	'It's just like sitting in the doctor's surgery only you couldn't shake hands with him.' (Sam, colon cancer)
	I thought it was pretty good, surprising actually. The conversation I had I thought was pretty good.' (Mike, testicular cancer)
Communication and relationships	'He was quite friendly and had things to say to me as a person, not just as a patient so that sort of gives you a bit of a relationship with the person as well, because they are a person as well and not just your doctor.' (Bert, colon cancer)
	'I prefer face-to-face, but obviously the telelink is there because there is 900 kilometres between Mt Isa and Townsville – not everyone can be in Townsville.' (Barry, colon cancer)
	'I'm better off with the doctor talking in front of me because of my hearing. I can't hear that well. It's hard to talk to a TV.' (Bert, colon cancer)
	'The first one [telelink consult] was difficult to understand my doctor because he does have an accent but there is always someone else there like a nurse or another doctor that understands him.'(Sue, breast cancer)
	'I haven't met him [the specialist] in person… It is a relationship, basically it's not an intimate relationship like I have with my partner but it's a different relationship.' (Larry, testicular cancer)

Theme	Quotations
Familiarity with technology	'It was strange the first time but last time it was alright because I was used to it by then. I know there is an old couple that got cancer not long after myself and they have no experience with computers and they were quite frightened about it. They came to see me and I was able to put their fears to rest, then they sat in on one of my sessions and then they were fine.' (Sally, colon cancer)
Local services and support	'I felt that the way the doctor had a nurse assigned to us was a plus. Her being in the room made me feel more comfortable. I knew that I could ask her anything afterwards if you had sort of skipped over something that the doctor brought up. It just made you feel more comfortable to know that someone in your town, when you are so far away from the specialist, knows your history right through because at first you are scared about any little thing and having someone in your local area that knows your history makes you feel a lot more comfortable.' (Pippa, colon cancer) 'It is very convenient [with telelink being treated locally]. I feel happy and the staff are very good. They look after me here and it is all on a personal basis you know. I walk in and it's 'hello [name] how's it going? It's not like a number in bigger places.' (Bill, colon cancer) 'As far as the treatment at the hospital here and the two girls in the Oncology section, I don't think I would have got better treatment if I'd gone to Townsville or Brisbane.'(Mary, breast cancer) 'The team here fill that [distance] gap for you, because if anything is a problem, they encourage you to ring them or come down to see them. Nothing is too much of a bother for them. If you are in Townsville you wouldn't be able to just ring the specialist at the drop of a hat, you would have to go through his surgery or office to be in touch with him anyway to make an appointment to see him.' (Andrew, lung cancer) 'I don't mind going to Townsville, because it is a major thing [cancer treatment] and you want to get the best care and you want to understand what is happening to yourself, than do it by a TV script. Well in [local town] I am not confident with the doctors here.' (Helene, breast cancer)

Theme	Quotations
	‘If you are in Townsville you can make one phone call and get those results straight away. Whereas it’s not easy when you are in a remote hospital and they haven’t got all the gear ready.’ (Barry, colon cancer)
Co-ordination of care	‘About two weeks later I would go to the local doctor as Dr [the specialist] would ask me to and get him to do a total once over [thorough examination]. I don’t think the local doctor took it seriously enough and more or less said, ‘you’ll be right.’ A letter needs to be sent to the doctors explaining the situation.’ (Sally, colon cancer)
	‘I have to wait for the chemo to arrive and last time, because they don’t realise that we have limited services out here [600 kilometres away] it took five days to get here.’ (Susan, breast cancer)

6.2.5 Discussion

Our study explored the perspectives of cancer patients from rural North Queensland who received most of their medical oncology treatment close to home in their rural towns. The majority of participants (69%) were receiving specialist consultations through videoconferencing, without seeing their specialist medical oncologists in person. Previous studies of older models of teleoncology from our centre[1] and other centres, reported high rates of acceptance of teleoncology by patients who were seen by their specialist in person sometime during their cancer journey.[14,50] The benefits of the present model were the same as those previously reported, including convenience and reduction of travel. With the exception of two patients, all participants interviewed in our study were satisfied with, and welcomed the teleoncology model of care.

Our study identified five major themes concerning teleoncology. While these themes are similar to those reported in previous teleoncology studies,[14,15,36,54] and are generic for other non-oncology telehealth models,[46,49,80]our study highlighted additional aspects important in continuous improvement of teleoncology services. These are understanding doctors with accents and level of trust and confidence with the local hospital staff.

Most patients (93%) felt that the quality of the consultations was as good as face-to-face consultations and similar to having the specialist present with them in the room. For three patients, other matters such as privacy, hearing loss and doctors with accents were initial barriers to successful consultation. Having rural health professionals with them in the consulting room to fill in the gaps, however, mitigated these matters.

Previous evaluations have reported high ratings by patients for closeness of relationship with specialists.[49,50] Similarly, the results of the present study reveal that many patients are able to relate to the specialists as people rather than images on a TV screen and therefore establish effective relationships with them. Some patients were apprehensive about the new model of

care before meeting the specialists for the first time through videoconferencing. However, most patients became comfortable after few minutes. Since the doctor-patient relationship is an important aspect of medicine, specialists need to spend time to establish a rapport, rather than discussing medical matters with the patient immediately.

Many telehealth guidelines, including the Royal Australasian College of physicians' guidelines in Australia,[55] emphasise the need for rural health professionals to be present during consultations. According to the participants in the present study, the benefits of consulting local health professionals extended beyond their ability to conduct physical examination when required and to implement the care plans devised by specialists. Other benefits included (1) the ability to fill in the gaps of communication between specialists and patients, (2) the ability to troubleshoot technical issues and (3) acting as the local contact person for day-to-day concerns and reassurance.

The acceptance of teleoncology appeared to be linked to the level of trust and confidence patients had in their local health system and staff. The three patients who did not have trust in their local health system were less satisfied with the model, even though they received the same care as other patients from rural towns and patients in Townsville. In all three cases, these patients had negative experiences with the hospitals prior to their oncology treatment and had unrealistic expectations that teleoncology would overcome these limitations. These three patients expected that teleoncology would result in better overall experiences with the local hospital. Patients should be informed of the benefits of teleoncology, the credentials of their local, rural health professionals and their roles and limitations.

One of the important lessons we learned from the study was about coordination of care at rural sites. We had not previously considered the consequences of high staff turnover and rural health workforce shortages on the coordination of care. It is important to have a comprehensive knowledge of the availability of medical, nursing and allied health services in rural towns so

that providing sites can accept a major coordination role if there are workforce problems in rural areas.

6.2.6 Limitations of the study

A limitation of the study was that the study participants were from a single mining and farming region of rural Queensland. The fact that socioeconomic status and education status of participants were not obtained was another limitation. For these reasons, our findings may not be generalizable to urban and other settings.

6.2.7 Conclusion

The teleoncology model that replaced face-to-face care seems to be accepted and welcomed by patients. Effective communication and a satisfactory doctor-patient relationship are possible through this model of care. There are many benefits to the patients related to support from local health professionals during and after consultations. The informed consent process needs to include explanations about the model and reassurances that the services provided through teleoncology are secure and of the same standard as regional services. However, as published evidence is limited to date, any reassurances on services can only be given based on the results of audits. Information on the credentials of the health professionals involved should be provided in order to foster patients' trust in teleoncology and the local system. Providing centres may need to take up major care role coordination where there are workforce shortages in rural areas.

6.3 Impact on service delivery

The results of this study were used to change the contents of the departmental orientation and training manuals. These changes included emphasizing the need for better coordination of care, consideration of privacy and the need for allocating enough time to establish doctor patient relationships during consultations.

Chapter 7 Cost Savings From the Teleoncology Model

7.1 Chapter overview

The main reason for embarking on teleoncology models is to provide care close to home for rural patients in an acceptable manner, as described in the previous chapters. There would be a justifiable assumption that travel by patients and their relatives are significantly reduced under teleoncology models. Since travel is currently subsidised by Queensland Health patient travel subsidy scheme (PTSS), teleoncology models would be expected to provide net savings to the health system. A cost comparison analysis was conducted of the TTN in conjunction with the School of Business of the James Cook University and Cancer Council of Australia. Details of this study found in section 7.2 were published in ***Med J Aust*** 2013;199(6):414-417, under the title "Cost savings from a telemedicine model of care in northern Queensland, Australia".

(NB: for this analysis, patients from travel distances of 100km or less from Mt Isa or Townsville were excluded. Training costs were not factored in since salaried staff provided such training during the course of their duties).

7.2 Cost savings from a telemedicine model of care in northern Queensland, Australia

7.2.1 Abstract

Objective

To conduct a cost comparison analysis of a telemedicine model for cancer care (teleoncology) in North Queensland, Australia, from the perspective of the Queensland Health.

Design, setting and participants

Cost comparison analysis involved the teleoncology services at the Townsville Cancer Centre (TCC) and its six rural satellite centres in North Queensland, Australia. Under this model of care, there is no specialist oncologist or patient travel, with most medical oncology services provided by teleoncology at selected rural centres.

Costs incurred for setting-up and staffing to manage the service. Benefits included the avoidance of specialist oncologist and patient travel and accommodation.

Data was collected from the information system of the TCC between March 2007 and November 2011. A one-way sensitivity analysis was performed to test the robustness of findings in net savings.

Results

Six hundred and five consultations were performed for 147 patients over 56 months, at a total cost of AUD$442,276. Cost for project establishment, equipment/maintenance and staff was AUD$36,000, AUD$143,271 and AUD$261,520, respectively. The estimated travel expense avoided was AUD$762,394, including travel cost for patients and escorts AUD$658,760, aeromedical retrievals AUD$52,400, and specialist travel AUD$47,634. This resulted in a net saving of AUD$320,118. Cost has to increase by 72% to negate the savings.

Conclusion

The teleoncology model of the TCC saves money to the Queensland Health. These net savings are mainly due to the negation of high travel costs. This model is applicable to geographically distant areas requiring lengthy travel.

Keywords

telemedicine, rural, cancer care, cost

7.2.2 Introduction

Cancer patients from rural and remote areas of Australia and other countries with large rural populations travel long distances to major cities or regional centres to receive specialist consultations.[2,13] A proportion of these patients require overnight accommodation for themselves and their escorts. All the states and territories of Australia usually pay some or all of the travel costs and part of the accommodation.[56] Telemedicine has the potential to provide

specialist consultations to patients in their hometowns and minimize the need for long-distance travel.

Evidence for the cost benefit of telemedicine is mixed.[57-60] A study by De la Torre et al[58] evaluating various telemedicine services at eight rural centres in Arizona, USA, did not show a cost benefit to telemedicine because of under-utilisation of networks. However, Doolittle et al in Kansas, USA,[59] and Smith et al in Queensland,[60] Australia, showed that the cost of telemedicine services in cancer care and paediatrics were less than face-to-face care, because of larger travel distances and numbers of patients.

Townsville Cancer Centre (TCC) provides tertiary cancer care to North Queensland, Australia. Given that the travel distances by a specialist oncologist and patients can be up to 1,400 kms from Townsville, in 2007 TCC's Medical Oncology Department embarked on providing comprehensive medical oncology services to its rural satellite sites using a teleoncology (telemedicine for cancer care) model of care.[1] According to questionnaire-based satisfaction surveys, [36]this model was acceptable to patients and health professionals.

7.2.3 Townsville teleoncology model[61]

A teleoncology coordinator at TCC coordinates all the referrals to the teleoncology service. Medical oncologists from TCC, supported by rurally based health professionals, consult with patients. The level of complexity of the cases determines the need for the presence of health professionals. . Since the majority of patients from Mt Isa, a satellite centre 900 km from Townsville with a population of 20,000, are managed locally without the need for travel to a tertiary centre for chemotherapy and inpatient admissions, local doctors, nurses and allied health professionals attend the local teleoncology sessions. In the other five satellite centres, nurses accompany patients during the sessions. Consultations range from review of new cases, follow-up cases, and urgent reviews for acutely-ill patients, usually within 24 hours of request. New cases usually take up to 30 to 40 minutes and reviews take about 10 to 20 minutes.

The aim of this study is to conduct a cost comparison analysis of the teleoncology model of care at the TCC and its six rural satellite centres in North Queensland. This analysis was performed from the perspective of Queensland Health.

7.2.3.1 Patients and Methods

Demographic details of patients managed via teleoncology between March 2007 and November 2011 were collected from the Oncology database of TCC. Data collected included date, time, site and type of consultation, whether it was urgent or routine, ethnicity and gender of the patient, diagnosis and type of treatment (curative or palliative). The project was approved by Townsville Hospital Ethics Committee (HREC/12/QTHS/29).

7.2.3.2 Costs

We considered project establishment and equipment costs as one-off costs, while maintenance, communication and staff costs to manage the service are considered running costs.[62,63] Calculation of costs for the study period is summarized in Table 7.1. Since the costs for the satellites are borne by the Queensland Health (QH), average cost per satellite is mentioned wherever possible.

Table 7.1
Cost analysis of Townsville teleoncology model

Type of cost	Cost per centre (AUD$)	Cost for 6 centres (AUD$)	Total (AUD$)
Project establishment	6,000	6,000 x 6	36,000
Equipment	20,376	20,376 x 6	122,256
Maintenance	750 per year	750 x 6 x 4.6	21,015
Communication	0	0	0
Teleoncology coordinator for TCC*	48,000 per year	48,000 x 4.6	224,160
Nurse in Mt Isa(0.1FTE)	8,000 per year	8,000 x 4.6	37,360
Total cost for the study period			**442,276**

***TCC, Townsville Cancer Centre; Study period was 4.6 years.**

1. Cost of installation of equipment

As each satellite is different, installation costs vary depending upon the location and complexity of the project; they include travel costs of service provider, AUD$3,000, and installation of power and data cabling ranging from AUD$1,000 to AUD$4,000, depending upon the area[64]. The average satellite installation cost is AUD$6,000 per centre.

2. Equipment cost[64]

Total equipment cost is AUD$23,676 per centre, which includes Tandberg C20 camera (Polycom, California, USA) AUD$16,700; Sony 32" LCD monitor (Sony, Tokyo, Japan) AUD$1,200; cart AUD$1,020; wall mount brackets AUD$300; shelf for holding the Tandberg AUD$156; miscellaneous costs, such as consumables AUD$100, freight AUD$1,000, one-off Tandberg license cost AUD$250, installation AUD$2,350, assembly, testing & go live AUD$600.

3. Maintenance

Maintenance costs include the salary of technical experts, travel and accommodation to each site for system monitoring and annual check ups. Since technical experts are employed regardless of telehealth, no extra cost was added to our model. Average annual travel and accommodation to each site by one technical expert was AUD$750.

4. Communication cost

Video connectivity within the QH network uses the same link as all other data sources and does not necessarily generate a cost to establish telehealth networks.

5. Staffing cost

This included the annual salary and overheads of employing the teleoncology coordinator for three days a week; that was, AUD$48,000 per year. The role of the coordinator was to receive referrals from doctors, coordinate appointments at rural and tertiary ends and send copies of management plans to general practitioners and referring doctors. Cost of taking a nurse from the chemotherapy unit to sit in with patients during sessions one morning a week in Mt Isa was AUD$8,000.

7.2.3.3 Benefits

1. Prevention of travel by patients and escorts to tertiary centre

Avoiding travel of patients and an escort per patient to the tertiary centre in Townsville from satellite sites prevented travel expenses. Normally, these expenses are fully reimbursed by Queensland Health.[56] Prior to the introduction of the teleoncology model, a a family member or a friend accompanied all the patients as escort.

Benefit (savings) is calculated by multiplying return travel cost for two persons (patient and one escort) for each consultation at every satellite site as described in Table 7.2. Proserpine is not

included in calculations as it generally involves a road trip in a personal car. Overnight accommodation cost is calculated as required for 10% of total number of consultations.

Table 7.2
Townsville Hospital guide to patient travel/accommodation and aeromedical retrieval expenses[56]

Location	Aeromedical retrieval cost (AUD$)	Commercial travel (AUD$)	
		Patient/escort travel (one way) (AUD$)	PTSS subsidy amount (AUD$)
Doomadgee	14,200	A: 515	Full subsidy
Hughenden	6,600	A:130	Full subsidy
Mt Isa	13,100	A:250-300	Full subsidy
Proserpine	5,500	B:70	Full subsidy
Winton	10,400	A:160	Full subsidy
Karumba/Normanton /Mornington Island (Gulf of Carpentaria)	14,200	A:515	Full subsidy

PTSS-Patient Travel Subsidy Scheme; A by air and B by bus.
Accommodation cost is AUD$80-100 per person. PTSS subsidy is AUD$30 each for patient and escort. Quoted commercial prices are based on average cost and urgent booking can be more expensive.

2. Prevention of overnight accommodation in Townville

On an average 10% of patients needed to stay overnight post-treatment. Normally, Queensland Health reimburses 30% of the accommodation cost And the patient pays the rest. By teleconsultation, this cost is avoided.

3. Prevention of aeromedical retrievals

Seeing patients urgently on videolink, and advising the necessary management plan to local medical services, avoided aeromedical retrieval of patients from satellite sites to the tertiary centre and saved money to the Queensland Health.

4. Prevention of travel by specialist oncologists

Regular visits (three weekly) of a specialist oncologist to satellite sites became unnecessary. Cost calculation for specialist travel and accommodation was based on the figures for patient travel and accommodation.

7.2.3.4 Assumptions

The following assumptions underpin the calculations of costs and benefits:

- The social cost of disruption to patient work routine, family routine and loss of income were not included.
- The indirect benefits, such as prevention of loss of wages by patients and relatives and reduction in workload at the home site were not included.
- Loss of time incurred by specialists during travel to the satellites was not included. On average, a specialist would spend six hours for a return trip between Townsville and Mt Isa, including time spent at the airport and on the plane.
- The cost of staff at the tertiary centre and in the six satellite sites, excluding the new teleoncology coordinator position and a nurse, was not included. They were employed regardless of the teleoncology service model.

A one-way sensitivity analysis was performed to test the strength of the findings in net savings. The cost benefit analysis is based on a number of assumptions about contributing variables. The strength of the findings and the ability to generalize the findings are explored by varying the values given to the variables in a one-way sensitivity analysis.

7.2.4 Results

A total of 605 consultations were performed for 147 patients between March 2007 and Nov 2011 from TCC to six satellite centres. Remoteness of the centres, and distribution of patients/consultations per centre, is shown in Table 7.3.

Table 7.3
Remoteness of the centres and distribution of patients/consultations per centre

Teleoncology Centres	Distance from Townsville (kms)	Number of patients	Number of consultations
Mt Isa	900	122 (82%)	516 (85%)
Proserpine	200	14 (10%)	40 (7%)
Hughenden	400	2	11
Winton	600	4	21
Doomadgee	1,200	1	3
Gulf of Carpentaria (Normanton, Mornington Island, Karumba)	1,400	4	14
Total		147	605

Ninety percent of all consultations were done in the two satellite centres of Mt Isa and Proserpine. Patients were equally distributed by gender. Sixteen percent of patients were from Indigenous communities, and the Indigenous communities were largely in the Gulf of Carpentaria. All cancer types were seen, breast cancer being the most common (31%), and followed by lung cancer (18%). Patient demographics and cancer type distribution is shown in Table 7.4.

Table 7.4
Patient demographics

	Number of patients
Gender	
Male	69 (47%)
Female	78 (53%)
Ethnicity	
Indigenous	24 (16%)
Non indigenous	123 (84%)
Cancer types	
Breast	47 (31%)
Colorectal	23 (16%)
Lung	26 (18%)
Upper gastrointestinal malignancy (stomach, oesophagus & pancreas)	12 (8%)
Genitourinary malignancy (Testis, prostate, bladder & kidney)	10 (7%)
Melanoma	6 (4%)
Others	23 (16%)

In the first year of the project (2007/8), 54 consultations were conducted. Numbers increased to 129 in 2008/9, 136 in 2009/10, and 286 in 2010/11. In regards to enrolment of new patients, numbers increased each year (2007/8: 25, 2008/9: 31, 2009/10: 37 and 2010/11: 54).

Four patients from Mt Isa were consulted urgently on the day of referral or within 24 hours. These cases would have required transfer to TCC before the teleoncology clinics were started. No inter-hospital transfers from Mt Isa have occurred since the teleoncology clinics began. Details of benefit calculation are provided in Table 7.5.

Table 7.5
Analysis of savings of Townsville teleoncology model

Description of expenses prevented	**Calculation of cost**	**Total (AUD$)**
Return travel cost for patient and one escort to Townsville.	Mt Isa: 516 x 2 x 600 = 619,200 Hughenden: 11 x 2 x 260 = 5,720 Winton: 21 x 2 x 320 = 13,440 Doomadgee: 3 x 2 x 1150 = 6,900 Normanton: 8 x 2 x 480 = 7,680 MorningtonIsland: 4 x 2 x 580 = 4,640 Palm Island: 1 x 2 x 110 = 220 Karumba: 1 x 2 x 480 = 960	658,760
Overnight accommodation at Townsville (10% of total consultations)	120 x 30	3,600
Urgent aeromedical retrieval of four patients from Mt Isa	13,100 x 4	52,400
Specialist/registrar travel once every three weeks for 4.6 years	17x600 x 4.6	47,634
Total savings for the study period (4.6y)		762,394

Travel calculation: Number of consultations x 2 (patient and escort) x return travel cost Accommodation calculation: 10% of total consultations x 2 (patient and escort) x the subsidy amount. Specialist travel: number of visits per year x return travel cost

The analysis showed that total cost in the first year was AUD$115,825, while benefit was AUD$59,195. In the second year of the project, only running costs were incurred which was

AUD$45,457 (due to the increased number of consultations, the benefit was AUD$157,929). In the third year (2009), as four new centres were started, the total cost of establishment and running of the centres was AUD$221,302, while the benefit was AUD$164,795. In 2010, as the number of consultations increased significantly, the benefit was AUD$380,475 while the cost of running the existing centres was AUD$59,692. Overall in four and a half years, the total cost was AUD$442,276, while the estimated expenses prevented was AUD$762,394, and resulting in a net saving of AUD$320,118.

7.2.4.1 Break-even point

Break-even point (the point at which gains equal loss) would vary depending on distance, patient numbers and complexity of cases managed. For example in Mt Isa, the cost of establishment and running cost in the first 12 months was AUD$75,926. At a travel cost of AUD$1,000 for both patient and their escort excluding overnight accommodation, savings were generated after 76 consultations. This means smaller towns and towns closer to the major centres with low patient numbers will take longer to generate savings or may not generate savings at all. But overall, under the Townsville teleoncology model, initial cost was negated after 105 consultations to Mt Isa.

7.2.4.2 Sensitivity Analysis

Net savings

The net savings were AUD$320,118. The main costs are set-up costs and staff cost to manage the service, while the key benefits are avoidance of specialist oncologist and patient travel costs. The costs would have to increase from AUD$442,276 to AUD$762,394, that is by 72%, for the net savings to decrease to zero.

We did not proceed with a sophisticated sensitivity analysis for the following reasons:

- The number of factors included in the calculations was few, as above.
- Since the net savings were large, small increases in cost variables would not negate the net savings.

Equipment usage

In terms of project establishment and equipment, though initially installed for oncology, they now are used more than 50% of the time by other services. Therefore, in our analysis, the cost was an overestimation.

Travel with escort

All the patients were assumed to travel with escorts. If we assume that only 50% of the patients have escorts from Mt Isa, cost of travel for one escort decreases by AUD$154,800, leaving a net saving of AUD$165,360.

Air travel cost

The lowest price available was used in our calculation. However, a proportion of the specialist oncologist and patient travel is booked only a few days before travel, costing two to three times the lowest price.

7.2.5 Discussion

The Townsville teleoncology model of cancer care is one example of telemedicine models to facilitate the provision of specialist cancer services to rural patients closer to their homes. It reduces patients' and doctors' travel, reduces unnecessary inter-hospital transfers and also provides access to ongoing medical education for staff working in remote areas.[65] At the same time the drawbacks are possible legal implications, depersonalization, overdependence on technology and clinical risk.[66]

Evidence for cost-effectiveness of telemedicine services compared to conventional face-to-face consultations is mixed. A systematic review by Mistry[57] concluded that there was no further conclusive evidence that telemedicine and telecare interventions were cost-effective compared to conventional healthcare over 20 years. However, the studies in this systematic review varied in methodology of cost analysis, patient travel distances, number of patients served, types of specialities involved and extent of services provided, making it difficult to arrive at firm conclusions. Studies by Doolittle et al from Kansas, USA,[59,67] reported that the telemedicine cost for cancer care was lower than face-to-face clinic cost and that the cost of telemedicine clinics had declined over the years due to the increase in patient numbers.

Similarly, Smith et al[60] from Queensland, Australia, reported savings from telemedicine clinics in paediatrics. In contrast, De la Torre et al[58] reported no cost benefit for their model which provided various speciality services to eight rural centres. They attributed low patient numbers as the reason.[58]

Our study reveals significant savings to the health system, similar to the studies by Doolittle et al and Smith et al.[59,68] In our study small changes in cost were unlikely to affect the net savings due to net large savings. Therefore, a simple one-way sensitive analysis was adequate for the purposes of this study. The major contributor to the savings was avoidance of travel by patients and specialists. Unlike other studies, models in these three studies, including ours, served patients from very long distances and in larger numbers.

In our model, where all the medical oncology services were provided locally in Mt Isa, avoiding inter-hospital transfers further enhanced the benefit. Therefore, our findings may not be generalized to models that serve patients from smaller travel distances and in lower numbers. Since July 2011, more than 80% of our consultations have been eligible for Medicare rebate by the Australian government. This would further increase the savings.

At TCC, the number of consultations increased every year. Mt Isa and Proserpine had a large increase in consultations as these centres also provided increasingly complex chemotherapy

treatment over time. Other centres did not have large growth and may not generate savings due to smaller patient numbers. For these centres, decision would be based on policy decisions relating to equity of access and social justice; not on economic grounds. At smaller rural centres, sharing of the system by more than one speciality will probably improve the savings further.

While this paper focuses on cost savings to the QH, we cannot ignore the savings to the patients and the societal benefits provided by telemedicine models in terms of equity of access to tertiary services by underserved populations. For the specialists, travel time saved could be used for other matters including work life balance and professional development.

In conclusion, the Townsville teleoncology model saves money to the QH and to patients, while providing efficient cancer care to rural North Queensland. The main driver of net savings is avoidance of travel costs for patients and escorts. Ideally, net savings should be redirected to further improving rural infrastructure and capabilities.

7.3 Impact on service delivery

Following the results of this study, a significant portion of the savings was used to create a medical registrar position in Mt Isa to cover medical oncology. This position now allows trainees from Cairns and Townsville to rotate to Mt Isa to gain significant exposure in rural health. Hopefully, through positive work experiences and exposure, some trainees may return to Mt Isa as specialists in the future.

Chapter 8 Safety of Remote Supervision of Chemotherapy

8.1 Chapter overview

Previous chapters discussed patient experiences of teleoncology models of care and cost benefits to the health systems resulting from these models. In this chapter, the research question "Is it safe to remotely supervise chemotherapy administration in rural towns via telehealth models of care?" is explored. In this chapter, safety is related to rates of side effects, hospitalisations and mortality. The manuscript in section 8.2 forms the main body of this chapter, which is currently under revision for Medical Journal of Australia.

8.2 Is it safe to remotely supervise chemotherapy administration in rural towns via telehealth models of care?

8.2.1 Abstract

Introduction

Townsville Cancer Centre (TCC) in Queensland, Australia has been facilitating the administration of chemotherapy in rural towns in North Queensland via a teleoncology model of care since 2007. The aim of this study is to compare the dose intensity and toxicity profiles observed in patients treated at the TCC with patients who received their chemotherapy in Mt Isa (a large rural town) in North Queensland) supervised by medical oncologists from TCC via teleoncology.

Methods

Demographic characteristics, details of chemotherapy doses and toxicity profile (severe toxicity) were extracted from the database of TCC for the period of May 2007 to May 2012 after ethics approval was granted. A comparative analysis was conducted using appropriate tests including Chi-squared, t-tests and Mann Whitney U tests. A p-value of <0.05 indicated significant differences between groups.

Results

Over five years, 89 patients received a total of 626 cycles of various chemotherapy regimens in Mt Isa. During the same time period, 117 patients who received a total of 799 cycles of chemotherapy at TCC were eligible to be in the comparison group. There were no significant differences between Mt Isa and TCC in most of the demographic characteristics, mean number of cycles (5.38 vs 5.07), dose intensities, proportion of side effects (4.4% vs 9.5%) and hospital admissions (27.8% vs 35.3%) [p>0.05)]. There were no toxic deaths in either group.

Conclusion

It seems safe to administer chemotherapy in rural towns under the supervision of medical oncologists from larger centres via teleoncology, provided that rural resources are adequate and governance arrangements are strict.

Keywords

rural chemotherapy, teleoncology, remote supervision

8.2.2 Introduction

Even in developed nations, patients from rural regions often have inferior cancer survival rates compared to their urban counterparts.[4,5,69] In Australia, poorer rural cancer outcomes are compounded by poorer outcomes among Indigenous patients compared with non-Indigenous patients.[70] One of the reasons proposed for this disparity includes the differential access to various cancer screening and treatment programs[2] between rural and urban patients. Achieving timely and equitable access to cancer care services for all patients remains a significant challenge, especially in large countries with geographically dispersed populations, such as Australia.

When compared with their urban counterparts, rural patients in the state of New South Wales (Australia), were found to have received differential rates of prostatectomy and orchidectomy

for prostate cancer,[71] underwent less breast conserving surgery for breast cancer[72] and had a lower probability of completing radiotherapy for rectal cancer.[73] With regard to chemotherapy, several studies have reported that the uptake of treatment may be lower for patients from rural areas. For example, in Scotland, patients with colorectal cancer from deprived areas were less likely to be treated with chemotherapy.[74] A Canadian study from the British Columbia Cancer Agency also reported that patients from rural areas were less likely to receive adjuvant chemotherapy for rectal cancer compared to those from larger urban centres.[75]

There are many possible explanations for the differing rates of chemotherapy usage between rural and urban populations. Some of these include the limited access to chemotherapy closer to home[2] and clinician concerns regarding potential chemotherapy toxicity. To explore the latter concern, the Townsville Cancer Centre (TCC) conducted a study amongst breast and colon cancer patients in North Queensland (Australia).[76] Results of this study suggested that rural patients with breast and colon cancers could be treated safely with same doses and dose intensity as their urban counterparts. In addition, patients could have their complications managed at rural centres with supervision and partnership between rural and urban clinicians.[76]

A possible solution to provide timely access to chemotherapy closer to home and improve the uptake of chemotherapy by rural and remote patients is to administer chemotherapy in rural centres with medical oncology support and supervision via teleoncology (telehealth for cancer care) models. Similarly to practitioners in Kansas and Kelowna,[13,14] medical oncologists from our centre (TCC) supervise the delivery of most chemotherapy agents in Mount Isa (a large rural town, 900 km from Townsville) using the Townsville Teleoncology model.[32,61] Under the Townsville Teleoncology model, patients undergoing chemotherapy at rural centres are assessed for chemotherapy fitness by TCC-based medical oncologists via videoconferencing. This assessment is supported and assisted by rurally based doctors and nurses during telehealth consultations. Chemotherapy proficient nurses administer chemotherapy agents that are prescribed by the TCC-based medical oncologists.

Although this model has been proven to be acceptable to patients and health professionals,[1] it was not known whether the safety and quality of treatment received by Mt Isa patients (as measured by dose intensity and toxicity profile) are comparable to that for Townsville patients.

Therefore, the aim of this study was to compare the quality and safety of chemotherapy (as indicated by dose intensities and rates of serious adverse effects) received by patients treated in person by medical oncologists at the TCC, and those who were treated at the Mount Isa Hospital by the same oncologists via teleoncology.

8.2.3 Methods

8.2.3.1 Data collection

Retrospective chart audits were conducted at both Mt Isa and Townsville Hospitals for patients who received chemotherapy at these sites. Data collected included the following:

- Demographic details including age, gender, and cancer type,
- Types of chemotherapy regimens, dose intensity (actual dose/ planned dose) and number of cycles administered,
- Intent of treatment: Curative (chemotherapy is given as a primary therapy or as an adjunct to surgery to cure cancer) and palliative (chemotherapy is given to prolong survival and improve or maintain quality of life (QOL), and
- Rates of severe side effects (Grade 3 and 4 toxicities according to National Cancer Institute Common Toxicity Criteria (NCI CTC Version 4)[77] and admission rates to inpatient facilities due to side effects.

8.2.3.2 Patient selection

For Mount Isa, the audit was conducted for all chemotherapy administered from the inception of the Townsville teleoncology model of care in May 2007 through to May 2012. At the TCC, the audit was conducted for two separate 3-month periods, from March to May 2009 and June

to August 2010. These two unrelated periods were chosen for two important reasons. Firstly the TCC, as a tertiary centre, had many patients on clinical trials after 2010 and those trials were not available to patients at Mount Isa, which would make comparing the data difficult. Secondly, referral patterns at the TCC fluctuate depending on surgical theatre availability during major holiday seasons. The end-of-year holiday period was avoided due to the unusual patient profile at the TCC during this time of year. Hence, these two separate time periods for data collection attempt to avoid tumour selection bias in the study population. An attempt was also made to match the sample population for patient co-morbidities. However, data was incomplete for minor co-morbidities. Therefore, it was assumed that both patient populations were fit for chemotherapy based on usual practice where patients with severe co-morbidities and poor performance status were not offered chemotherapy.

8.2.3.3 Analysis

Chi-square tests were used to analyse between group differences for categorical variables. Where expected cell count was less than 5, Fisher's exact test was used. T-tests were used to analyse between group differences for numerical variables. Where data were not normally distributed and sample size for each group was less than 30, Mann-Whitney U tests were used. The statistical software SPSS (IBM SPSS Inc, Chicago, Illinois) was used for analysis. A p value of <0.05 indicated significant differences between groups. Our study had 90% power to detect a group difference of 0.4 for mean number of side effects and 0.5 for mean number of hospital admissions with a significance level of 0.05.

8.2.4 Results

Between May 2007 and May 2012, a total of 89 patients were treated with chemotherapy in Mt Isa under the supervision of medical oncologists from TCC through the teleoncology model. During the same time period, 117 patients from Townsville were eligible to be in the comparison group. Demographic details of patients are summarized in Table 8.1. There were no significant differences in demographic characteristics of patients at each site with respect to

gender, age, cancer types or treatment intent ($p > 0.05$). However, there were significantly more Indigenous patients at Townsville Hospital than Mt Isa ($\chi^2 = 11.66$; df=1; $p<0.001$) and among patients for whom treatment intent was palliative, there were significantly more Indigenous patients being treated at Townsville Hospital than Mt Isa ($\chi^2=12.62$; $p<0.001$).

Table 8.1
Demographic details of patients from Mt Isa and Townsville

	Mt Isa (n=89)	**Townsville (n=117)**
Gender		
Male	43 (48.3%)	60 (51.3%)
Female	46 (51.7%)	57 (48.7%)
Ethnicity		
Indigenous	20 (22.5%)	7 (6.0%)
Non-Indigenous	69 (77.5%)	109 (94.0%)
Age	57.82yrs (SEM± 1.15)	59.32yrs (SEM±1.09)
Intent		
Curative/Adjuvant	34 (38.2%)	56 (47.9%)
Palliative	55 (61.8%)	61 (52.1%)
Cancer Type		
Breast	24 (27.0%)	33 (28.2%)
Colon	10 (11.2%)	12 (10.3%)
Lung	21 (23.6%)	22 (18.8%)
Prostate	1 (1.1%)	2 (1.7%)
Rectal	7 (7.9%)	2 (1.7%)
Oesophagus/Gastric	4 (4.5%)	2 (1.7%)
Neuroendocrine/GIST	1 (1.1%)	1 (0.9%)
Head/Neck	0 (0%)	2 (1.7%)
Other	21 (23.6%)	41 (35.0%)

Except for ethnicity, p value was >0.05 between groups, SEM-standard error of the mean

8.2.4.1 Chemotherapy doses and side effects

A total of 626 and 799 cycles were administered in Mt Isa and Townsville respectively between May 2007 and May 2012. A summary of chemotherapy cycles and toxicity rates are shown in Tables 8.2 and 8.3. Side effect profile is summarized in Table 8.4.

Table 8.2
Doses and toxicity details by site

	Mt Isa (number of patients=89)	**Townsville (number of patients=117)**
Mean cycles per Line	5.38 (SEM±0.41)	5.07 (SEM±0.44)
Total No of Cycles	626	799
Mean no of Lines	1.30 (SEM±0.07)	1.36 (SEM±0.06)
Side Effects (per patient)	4.4%	9.5%
Hospital Admission		
Total Number	30	50
Per patient	27.8%	35.3%

p>0.05 between groups, SEM-Standard error of the mean

Table 8.3
Summary of the chemotherapy doses and rate of side effects; stratified by intent and site.

	Palliative (n=116)		**Curative/Adjuvant (n=90)**	
	Mt Isa (n=55)	*Townsville (n=61)*	*Mt Isa (n=34)*	*Townsville (n=56)*
Mean cycles per line	4.37 (SEM±0.33)	4.47 (SEM±0.67)	7.0 (SEM±0.86)	5.70 (SEM±0.57)
Mean number of lines	1.44 (SEM±0.10)	1.45 (SEM±0.10)	1.08 (SEM±0.05)	1.27 (SEM±0.07)
Total Number of cycles	367	388	259	411
Side Effects				
Per patient	5.4%	15.0%	2.9%	3.6%
Hospital Admission				
Total Number	24	33	6	17
Per patient	35.7%	43.3%	14.7%	26.8%
Dose Intensity (%)				
	97.38 (SEM±3.27)	98.21 (SEM±2.10)	84.38 (SEM±4.44)	88.09 (SEM±3.46)

p>0.05 between groups

Table 8.4
Summary of the G3/4 side effect profile of patients in Mt Isa and Townsville

	Overall (N=206)		**Palliative (n=116)**		**Curative (n=90)**	
	Mt Isa	**Townsville**	**Mt Isa**	**Townsville**	**Mt Isa**	**Townsville**
Neutropenia*	28.9	18	20.6	23.1	33.9	13.3
Nausea &Vomiting	0.0	1.7	0	0	0	3.3
Diarrhoea	1.1	6.9	0	12.5	1.8	1.7
Neuropathy	3.3	1.7	8.8	0	0	3.3
Fatigue	0.0	4.3	0	1.8	0	6.7
Other	15.6	25.9	8.8	21.4	16	30

Figures are expressed in percentages. *Overall more neutropenia occurred in Mt Isa that did not result in more hospital admissions.

No site differences were observed in relation to number of cycles, number of cycles per line, number of lines per patient, number of side effects or number of hospital admissions ($p>0.05$). Though, overall there were more neutropenia in Mt Isa, it did not result in more hospital admissions or dose delays. There were no deaths due to toxicity in either group. In addition, there were no differences in dose intensities between sites regardless of treatment intent ($p>0.05$).

8.2.5 Discussion

Many types of chemotherapy can be provided closer to home for rural patients with close supervision by medical oncologists from urban centres through teleoncology models.[32] This type of remote chemotherapy supervision model has been shown to: (i) reduce the need for rural patients to travel long distances; (ii) be acceptable to patients and health professionals; and (iii) save money for healthcare systems.[13,34] However, it is also imperative to ensure that safety is not compromised and that the quality of care provided through these models is at least the same standard as experienced by patients receiving their care in person by oncologists.

This study has shown that in comparable populations, there was no statistical difference in safety measures between an urban, traditional model of care and a rural teleoncology model. Similarity in number of cycles, lines and dose intensity indicates that the therapy was similar in both rural and urban patient groups. Though the Townsville group had greater number of Indigenous patients, it would not have affected our results since chemotherapy treatment decisions are based on medical co-morbidities and not on ethnic background.

Our study is the first in the literature to demonstrate that many types of chemotherapy agents can be administered in rural centres via teleoncology models of care with the same dose intensity and toxicity profiles as observed in urban centres. These results, along with the results of a previous study comparing the safety of chemotherapy between rural and urban breast and colon cancer patients,[76] can reassure many urban clinicians that high quality cancer care can be provided at rural centres via teleoncology models of care. It is important to note though, that these teleoncology models require appropriate governance and adequate healthcare system resources directed to rural centres.

At the TCC, the quality of care provided via teleoncology is closely related to the adequacy of the surrounding rural workforce and strict governance around chemotherapy management.[61] In the Townsville teleoncology network,[32] medical oncologists from TCC provide their outpatient services on demand and routinely via videoconferencing and are also able to review and make decisions for admitted inpatients. Doctors, nurses, allied health professionals and pharmacists at the rural centres support TCC-based oncologists. In this network and during this study, the Mt Isa hospital was adequately resourced to provide services locally via a teleoncology model of care.[61] As the scope of practice widened and complexity of cases increased over time, clinicians successfully lobbied for increased resources at Mt Isa to expand rural service capabilities. Therefore, the results of this study may not be applicable, or should be applied with caution, to centres with limited resources.

The fact that this study had adequate power to detect differences in toxicity profiles and dose intensities was one of its strengths. Though it was powered for calculations regarding dose intensities between sites, comparisons for individual tumour types were not meaningful because of smaller patient numbers for each tumour type. While selecting a matched sample at the TCC was considered, it was difficult to detail a complete history of patient co-morbidities given the retrospective nature of the audit and incomplete chart data. However, in reality, patients with severe co-morbidities would not have received chemotherapy and lack of matching is likely to have minimal impact on results in this study.

As this data was not prospectively collected, it is possible that some adverse effects and other data including QOL information were not recorded at that time and hence not captured within the audit. However, serious adverse effects (NCI CTC grade 3 and 4) usually result in admission to hospital, which would be captured using admission records. In addition, any omission or delays in chemotherapy are likely to be documented in patient charts.

In conclusion, the current study along with our previous study on chemotherapy for rural breast and colon cancer patients[76] provide reassurance that high quality and safe cancer care can be provided to rural patients closer to their home through teleoncology models. By building rural healthcare systems through teleoncology models, rural patients may have similar access to, and uptake of, chemotherapy as urban patients. Centres embarking on these rural chemotherapy models need to make sure that rural resources are adequate and governance arrangements are strict to ensure a high level of safety and quality.

8.3 Impact on service delivery

Results of unpublished departmental audits and the current study provided comfort and confidence for us to make the decision to supervise all types of chemotherapy through teleoncology. It was mainly because of this decision and change in practice that we were able to replace most of the face-to-face care in Mt Isa with teleoncology.

Chapter 9 Impact of Teleoncology on Rural Service Capabilities

9.1 Chapter overview

As demonstrated in the previous chapters, it is feasible to provide comprehensive medical oncology services to rural patients through teleoncology models of care in a safe, cost-effective and satisfactory manner. For these models to be sustainable and meaningful, ultimately the rural health system needs to be adequately resourced to be capable of providing these services locally. Keeping rural resources in mind, expansion of services were paralleled by gains in resources through business cases and lobbying by both Mt Isa administration and Townsville clinicians as described in the article "Practical aspects of telehealth: establishing telehealth in an institution" published in the ***Internal Medicine Journal*;** 2014;44:(202-205) on behalf of the Royal Australasian College of Physicians telehealth working group.

9.2 Practical aspects of telehealth: establishing telehealth in an institution

9.2.1 Abstract

Telehealth models can facilitate the provision of specialist services to rural and remote patients closer to home. Some of the barriers to successful implementation of these models relate to workforce, funding and infrastructure at rural sites, as well as the traditional mindset of healthcare professionals. Therefore, the rural sector needs to be adequately resourced for telehealth models to be substantive and successful. This paper describes the development of a large teleoncology network over a vast geographical area in North Queensland. Adequate resourcing for the rural sites and undertaking quality improvement activities has continually refined the model over a five to six year period. The benefits of this model of care are twofold: (1) patients received their care closer to home and (2) the workforce, service capabilities and infrastructure for the hospital in Mt Isa, (a rural town 900km away from its tertiary centre) has improved.

9.2.2 Introduction

The provision of specialist medical services in many rural and remote towns is hampered by workforce shortages, narrow scope of practice and limited service capabilities.[2,78] Telehealth models in cancer care (hereafter referred to as teleoncology) can facilitate the provision of specialist cancer services closer to home. In many countries, centres providing specialised care to rural and remote communities have adopted teleoncology.[13,32]

A successful telehealth model relies on motivated providers, an adequate workforce and sufficiently resourced remote facilities. Consequently, to build a telehealth network it is important to ensure the growth of capacity at remote sites in parallel with the providing sites.[79] In the literature, many factors have been identified as barriers to the uptake of telehealth.[80] These include: lack of funding, extra time commitment for rural doctors and the resultant impact on workload, insufficient infrastructure, equipment, technology and skills, and a preference for a more traditional approach.

The Department of Medical Oncology of the Townsville Cancer Centre (TCC), the tertiary cancer centre for Northern Queensland (Australia) services a geographical area of more than 300,000 sq kms. The largest rural town in its catchment is Mt Isa, with a population of 20,000, which is located 900 km west of Townsville. In 2007, TCC embarked on establishing a network to provide cancer care to rural towns through telehealth. Since most rural Queensland Health hospitals were already fitted with videoconferencing technology at this time, the coordination and mobilisation of human resources were the next steps in establishing this Townsville Teleoncology Network (TTN).

Objective

In this paper we attempt to show that service capability and scope of practice in rural hospitals can be enhanced by providing specialist services in rural towns through telehealth schemes modelled on the Townsville-Mt Isa experience.

9.2.3 Case study: Development of the TTN model

To illustrate the gradual and reflective development of the Townville-Mt Isa model within the TTN, we have summarised the sequence of events leading to the current operational structure as:

1. Service capability of Mt Isa Hospital prior to teleoncology network,
2. Selection of levels of services to be provided,
3. Establishment of the TTN model of care, and
4. Expansion and refinement of the model.

1. Service capability of Mt Isa pre-teleoncology model of care

Prior to the introduction of teleoncology, the Emergency Department at Mt Isa Hospital managed cancer patients on a goodwill basis. There were two nurses who had some competency in administering chemotherapy.

Mt Isa Hospital had an internal medicine physician who could be called upon for help, a radiology facility with computer tomography (CT) and biopsy capability, an intensive care unit for less complex cases, and pathology had a turnaround time of less than 60 minutes for simple blood tests.

In terms of cancer care services, there were three chemotherapy chairs occupied for two days a week. All patients had to travel to TCC for their first consultation and for reviews. All the first

doses were given in TCC. Moderately toxic regimens were given subsequently in Mt Isa. Highly toxic regimens were given in TCC.

2. Selection of level of activities

The selection of sites for chemotherapy was based on the service capability of each site as per the Queensland Health Service Capability Framework (SCF).[81] In the SCF, hospitals are assigned levels from 3-6. A Level 3 service provides low-risk ambulatory care, whereas a Level 6 service provides comprehensive cancer care including bone marrow transplant and high-risk chemotherapy protocols. Mt Isa was selected for providing more comprehensive medical oncology services, given its already existing level 3 chemotherapy facility.

3. Establishment of TTN

Period of 2007-2009

The network between Townsville and the rural sites was established in May 2007 by informal arrangements between the Department of Medical Oncology of the TCC and health professionals at rural sites. Videoconferencing equipment was installed in meeting rooms at rural sites. At the tertiary centre, they were installed in meeting rooms and offices. Patients were booked via medical oncology clinics in Townsville and were consulted using the videoconferencing. Prior to consultations, patients were asked to sign an informed consent form for participation in this model of care. Patients declining consent were offered the option of travelling to Townsville, as was the usual practice prior to 2007.

Mt Isa staffing and professional development

Extra training was provided at TCC for two nurses to gain competency in administering complex regimens in Mt Isa. Senior medical officers from the emergency department were formally rostered to facilitate the videoconference sessions. The medical oncology handbook used for junior doctors at the TCC was shared with the Mt Isa doctors for reference purposes[82].

Each case discussion via videolink also served as an occasion for continuing medical education for rural doctors.

Service capabilities

Between 2007 and 2009, patients travelled to Townsville for the first consultation with medical oncologists. Mt Isa patients were subsequently managed through videoconferencing. For chemotherapy treatment, patients travelled to Townsville for their first treatment and were able to receive subsequent doses in Mt Isa, with the exception of toxic regimens like BEP (Bleomycin, Etoposide and Platinum), Ifosfamide and methotrexate infusions. Hence, the assigned level was SCF level 3.

4. Expansion and refinement of TTN model

Period of 2009-2012

Given the increased activity in Mt Isa, TCC was successful in securing additional funds from Queensland Health to build capacity for the TTN in Mt Isa. Once all involved parties became comfortable with this model of care, and increased work force, the following decisions were made: (a) all new patients could be seen first via videoconferencing to make sure their future care was coordinated if and when patients travelled to Townsville, (b) patients from Mt Isa did not need to travel to Townsville unless requested by the patients or the treating teams, (c) all solid tumour chemotherapy regimens could be administered in Mt Isa and (d) all admitted inpatients were to be seen by medical oncologists in ward rounds via videoconferencing.

Clinic model

Details of the clinic model has been published previously.[32] Chemotherapy competent nurses, senior and junior medical officers and allied health practitioners, joined patients and their families during consultations. At other sites either a doctor or a nurse sat in with patients if required. Details of the consultations were documented in medical charts and summary letters sent to general practitioners and referring doctors.

Quality Assurance

As part of refining the model, several quality assurance activities were undertaken:

- Patient satisfaction surveys (these revealed more than 96% overall satisfaction rates by the patients),[1]
- Indigenous and non-indigenous health professional perspectives (there was overwhelming support from both for this model),[1,51]
- Audits of safety of remote supervision of chemotherapy (study ongoing), and
- Mortality and morbidity meetings.

Outcomes on workforce and service capabilities

As the result of the teleoncology model of care, the level of services provided at Mt Isa Hospital has escalated to SCF level 4 (Table 9.1). The numbers of oncology specific staff have also increased to a half time senior medical officer, a shared basic physician trainee rotating from Cairns, a resident medical officer, a cancer care coordinator, two chemotherapy nurses, Aboriginal liaison officers and others, as required.

Table 9.1
Service capability of Mt Isa hospital in 2013

Town	Specialist cancer clinic via videoconference	Patient types	Chemotherapy	Comment on travel to and from Townsville
Mt Isa	3-4 times a week and on demand	All new and reviews, urgent ward consults	All solid tumour regimens	No need for travel by patients and specialists

Increased staff numbers, outpatient and chemotherapy occasions of service together with comprehensiveness of the service provided locally led to success in securing regional cancer centre funds from the Commonwealth Government to build a five chair state-of-the-art chemotherapy facility in Mt Isa.

9.2.4 Discussion

One of the main reasons for the success of this teleoncology model of care was the expansion and capacity building of remote sites to accommodate services from TCC. Since most of the barriers are related to the resource levels at the receiving rural sites, it is logical to identify and rectify them at the outset to enable buy-in from rural sites.

The selection of sites for chemotherapy was based on service capability of each site as per Queensland Health's Service Capability Framework. Service capability frameworks can be followed in two ways. One approach is to avoid sites that do not meet the criteria for further development. The other, more proactive approach, would be to select the sites for new service developments and work on resourcing them adequately, to the point that they meet the service capability frameworks, as we have done for Mt Isa.

Over the years, Mt Isa has become a complete medical oncology unit with specialist medical oncologists available on demand through videoconferencing, supported by rural health professionals (Figure 9.1). Now it has the capacity to provide all solid tumour chemotherapy regimens. In addition, savings resulting from a reduction of patient travel to Townsville can be used for making this model of care self-sustainable.

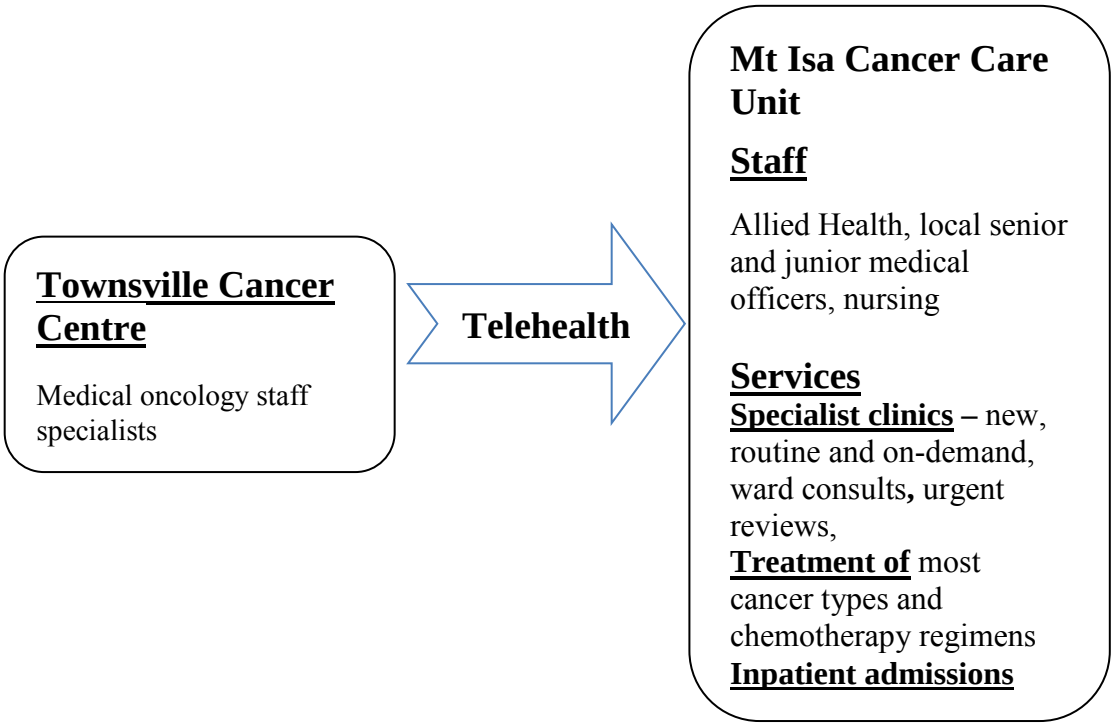

Figure 9.1 A model of a rural specialist oncology unit with specialist support via a telehealth model of care.

Exposure to combined rural generalist/specialist telehealth service models and high quality training at rural centres networked with tertiary centres may attract trainees and mature workforce to rural communities. This could further improve the rural service capabilities in the future.

Chapter 10 Summary

The article "Medical models of teleoncology: Current status and future directions" is an invited paper for the ***Asia Pacific Journal of Clinical Oncology***, (invited paper), published ahead of print 17/6/2014. DOI:10.1111/ajco.12225. This article aims to provide a summary of current teleoncology models used in the field of medical oncology and results of their evaluation and suggest some areas for future models. For the purpose of this thesis, future directions are discussed separately in chapter 11.

10.1 Medical models of teleoncology: Current status and future directions

10.1.1 Abstract

Teleoncology has been adopted by many centres to provide cancer care closer to home for rural, remote, Indigenous and other disadvantaged people of our communities. A variety of medical models of teleoncology exist to provide various medical oncology services. While most centres use teleoncology to complement their face-to-face outreach services, some centres have replaced face-to-face with teleoncology models. Selection of patients and scheduling of clinics would depend on various factors including experience of the clinicians, complexity of treatment provided, capabilities and workforce of rural sites and patient preferences. Many small studies reported high satisfaction rates with these models among health professionals and patients, including Indigenous populations. One single centre study reports that it is safe to supervise chemotherapy delivery remotely and many studies report cost savings to the health systems. Further studies on the safety aspects of teleoncology are needed to further improve the current models. Future teleoncology models would need to include web-based models, mobile technologies and remote chemotherapy supervision models so that patients from most rural towns could have at least some of their cancer care closer to home.

Keywords

Telehealth, telemedicine, rural, cancer, models of care

10.1.2 Introduction

Telemedicine for cancer care (teleoncology) has been adopted by many centres around the world to provide cancer care closer to home for rural, remote, Indigenous and other disadvantaged people of our communities.[9] The overall aim of teleoncology is to decrease the disparity in access and health outcomes between metropolitan and rural/remote/ patients.[9] This review aims to discuss various medical oncology models of teleoncology, clinic models, outcomes of evaluation of these models and future directions.

10.1.3 Medical oncology models of teleoncology

A variety of medical models exist to provide various services. These models are:

1. Face-to-face (FTF) outreach visits complemented by teleoncology for consultations and supervision of chemotherapy administration,

2. Teleoncology for consultation and supervision of oral medications,

3. Teleoncology (replacing FTF models) for consultations and supervision of administration of chemotherapy, and

4. Teleoncology for case discussions as in multi-disciplinary team meetings (MDTs).

Many centres around the world adopt the first two models of teleoncology to complement their face-to-face outreach services.[83] In these two models, patients usually attend major centres for the first medical consultation and at least the first dose of their chemotherapy. Subsequent care is provided via teleoncology models.

Examples of the third model, in which the majority of the specialist supervision is provided via telehealth include the Townsville Teleoncology Network (TTN), Queensland, Australia, the

Kansas telemedicine network, Kansas, USA and Kelowna, British Columbia (BC), Canada.[13,15,32] In the TTN model, medical oncologists conduct new and review consultations, as well as urgent ward and emergency consultations via real time videoconferencing. They also supervise most types of solid tumour chemotherapy regimens using videoconferencing.. These consultations are supported by the presence of rural based nurses, doctors and allied health professionals. A brief description of the telehealth model and an example of training and a medical consultation is illustrated by a video case study that can be accessed via the link; RACP Introduction to telehealth (Video case studies), located at https://www.youtube.com/watch?v=N5l7UexKcTU.

10.1.3.1 Existing clinic models

Teleoncology clinic models appear consistent across most centres. Usually a medical oncologist provides consultations, which are supported by rural based health professionals (nurses and/or doctors). The Kansas model relies on nurses as proxies for physical examination whereas TTN relies on doctors and nurses when complex chemotherapy regimens are supervised remotely.[13,32] In smaller rural centres, where workforce shortages exist and patients often have low acuity and less complex conditions, the medical oncologist may provide a consultation without the support of the locally based rural health professionals.

10.1.3.2 Multidisciplinary Meetings (MDT)

Many centres around the world have adopted videoconferencing for multidisciplinary meetings to connect tertiary, regional and rural centres.[20] Initial evaluation of the Adelaide-Darwin link in Australia revealed high levels of patient satisfaction with the process of decision making at their MDT model.[20] A Swedish study evaluating a head and neck MDT reported that accuracy of assessment and management plans were similar for patients assessed face-to-face and on telehealth.[84]

10.1.4 Evaluation of Teleoncology models of care

As part of research and continuous quality improvement, various outcomes have been evaluated and reported in the literature. These outcomes include patient and health professional satisfaction with teleoncology models, safety of remote supervision of chemotherapy and cost comparison analysis. All of these studies are limited by lack of randomisation and/or small patient numbers. Due to small patient numbers in rural communities, randomised controlled trials may not be feasible to show survival outcomes in these settings. In the absence of such studies, policy decisions need to be based on findings from the studies published in the literature.

10.1.4.1 Patient satisfaction with teleoncology

A number of small studies have evaluated patient satisfaction using various methodologies. These are summarised in Table 10.1.

Table 10.1
Summary of patient satisfaction studies of teleoncology

Author	Country	Methodology	Results
Mair et al[50]	Kansas, USA	Qualitative study of 22 patients	All participants were satisfied, 9/22 were concerned with lack of physical examination.
Mooi et al[51]	Townsville, Queensland, Australia	Mixed methods of 18 Indigenous patients and family members	> 80% in agreement in Likert scale for closeness of relationship with specialists, ability to ask questions and satisfaction with overall care.
Sabesan et al[1]	Townsville, Queensland, Australia	Questionnaire based survey of 55 patients	76% regarded physical examination by specialists as necessary 76% did not regard the presence of local health professionals important 78% preferred to be seen in Mt Isa via videoconferencing rather than travelling to Townsville, 96% were satisfied with overall care.
Taylor et al[15]	Kelowna, BC, Canada	Questionnaire based survey of 100 patients	65% felt it was important for doctors to examine patients 95% preferred to be seen via videoconferencing rather than travel to major centre.
Weinerman et al[14]	Vancouver, BC,Canada	Questionnaire based survey of 30 patients reviewed via telehealth and 30 FTF clinics	No difference between FTF and teleoncology in relation to patient satisfaction.
Sabesan S et al[85]	Townsville, Queensland, Australia	Qualitative interviews of 29 patients (All were seen first on telehealth and 69% were never seen in person)	Five Major themes identified: Quality of the consultations, communication and relationships, familiarity with technology and fears, local services and support and coordination of care. There were positive responses in relation to first four themes. Coordination of care needed further improvement.

FTF-Face to face, BC-British Columbia, Canada

In these six studies, the technology used was traditional videoconferencing equipment. Overall, it appears that telehealth models are acceptable to, and welcomed by, both Indigenous and non-Indigenous patients. Of note, Mooi et al did not find any cultural barriers to acceptance by Indigenous patients in Australia.

In relation to whether consultations need to be supported by rural based health professionals, a Townsville study of an earlier model of care, in which patients travelled to major centres for the first consultations, 70% of patients found the presence of rural based health professionals during consultations was superfluous.[1] In two recent Townsville studies[51,85] of the model of care where FTF was completely replaced by teleoncology, the presence of the locally based health professionals during consultations was found to be important for many reasons, including the availability of a local contact person, the provision of continuity of care and for locally based emotional support. These findings are consistent with current telehealth guidelines that recommend consultations be supported by rural based health professionals.[55]

10.1.4.2 Health professional satisfaction

Qualitative studies and questionnaire-based surveys reveal high acceptance rates of teleoncology by health professionals. In two Canadian studies[14,15] (Table 10.1), physicians were less satisfied with the overall experience of telehealth consultations than were the patients. In other studies, health professionals welcomed these new models of care for many reasons. These reasons include networking, support, professional up-skilling opportunities and shared care.[1,15,51] Acceptance and uptake of teleoncology models by various health professionals can be enhanced through training and education in telehealth models of care. One example of a web-based training tool is “Three steps to telehealth” by the University of New South Wales, Australia accessed via the link: http://www.goodeyedeer.com.au/telehealth/.

10.1.4.3 Physical Examination

One of the concerns cited in the literature is the inability of the providers to physically examine patients when using telehealth models of care.[1,15] This concern was overcome in the Townsville model by explaining to the patients why a physical examination was not always required. Once an adequate explanation was given, patients accepted this rationale. If a physical examination is required, rural based doctors perform the necessary physical exam during consultations.

In the BC study, of the 76 patients who had videoconference consultations, 53% had a physical exam within 60 days of their telehealth consultation. Importantly, there were no changes in the clinical management due to the lack of physical examination by specialists.[15] In the same study, 60% of the specialists felt it was unnecessary to perform a physical examination. However, for the doctors who wish for physical examination to occur or when a physical examination is required, this concern may be addressed if a physical examination is performed by the local health professionals during the teleconsultation, or examination findings are summarised in the referral letters to the specialist prior to the clinics.

10.1.4.4 Safety of remote supervision of chemotherapy

Despite concerns raised by tertiary clinicians regarding management of post chemotherapy complications at rural centres, it appears safe to administer intensive chemotherapy agents to rural patients at the same dose intensity as urban patients.[76]

It is worth noting, however, that studies reporting the safety aspect of remote supervision of chemotherapy are limited. A Townsville study comparing the safety of chemotherapy regimens at the tertiary centre and a rural centre (Mt Isa) reported that side effect profiles and dose intensities are similar to those reported in the literature.[33]

10.1.4.5 Cost comparison analysis

A review of studies of the economic benefits of telehealth models revealed no net savings.[57] This review included studies of rural centres with both short and long distances from tertiary centres, many sub-specialities and varying methodologies. Conversely, studies from Kansas and Townsville, sites that provide care to rural centres with long travel distances, did reveal cost savings to the health systems. These studies did not, however, include savings to the patients, so are likely to be an underrepresentation of the true benefits. In Kansas, the cost of outpatient consultations decreased as the services continued to grow.[86] The Townsville study showed significant savings to the health system due to reduction in the travel and accommodation costs for patients, their escorts and specialists.[34] Over 4.5 years, the cost of establishing and running the network was AUD$442,276 and the savings created by preventing patient and escort travel, specialist travel and by reducing aeromedical transfers was AUD$762,394 with the net savings of AUD$320,118. As the number of patients increased, not surprisingly, the health system savings also increased. In smaller rural centres where the number of patients is small, sharing of the telehealth equipment by several specialities would improve cost effectiveness.

10.1.5 Selection of patients for teleoncology models

Most patients can be managed under teleoncology models at some stage of their cancer journey. Patient selection depends on many factors including the experience of the providing physicians and rural based health professionals, individual circumstances, patient preferences, service capabilities of rural sites and complexity of cases.[87] When practitioners are unfamiliar with telehealth consultations, an approach that may be useful is commencing telehealth consultations with simple cases. As the practitioner becomes more familiar and comfortable with the technology, he/she may then manage more complex cases.

10.1.6 Scheduling of teleoncology consultations

Patients can be scheduled to participate in a teleoncology consultation as part of a face-to-face clinic or as a separate clinic. Scheduling of teleoncology clinics depends on many factors, including the availability of space, preference of the clinicians, type of technology and number of patients to be seen.

10.1.7 Closing the CQI loop

As described in Chapter 2, a CQI framework involves seven steps: forming the team, setting aims, establishing measures, selecting changes, testing changes, implementing changes and spreading changes.[24] Establishment of the TTN was to fulfil the TCC's aim of decreasing the disparity in access to cancer services between rural and remote patients and their urban counterparts and therefore initiated the CQI loop before the project pertaining to this thesis was initiated. As a medical oncology departmental activity, teleoncology was integrated in to clinical practice as core business, with a policy mandating that all patients from rural areas be seen for their initial consultations through videoconferencing unless otherwise indicated. As a result, with the help of the administration officers, uptake increased steadily over time.

The aim of the current project was to evaluate the TTN so that further improvements could be achieved. Using the research questions, factors requiring changes were identified. These factors were related to the feasibility of providing various services in a large geographical area, patients' satisfaction and perspectives on the operation of the model, cost effectiveness and the safety of remote chemotherapy supervision.

Safety issues had been already addressed by establishing guidelines for the conduct of clinics and the prescription and supervision of chemotherapy. Fortunately, our results suggested that chemotherapy could be given in rural towns at the same dose intensity and with the same safety profile as in urban centres. While it was obvious that it was feasible to provide various services safely, several aspects of the model required further measures for improvement as listed below.

- Disparity in timing of access to care between rural and urban patients mainly because of the policy requirement that initial consultations be conducted face-to-face,
- Coordination between sites, maintaining of privacy and confidentiality, clinical documentation and staffing levels,
- Management of savings, and
- Medicolegal concerns.

In terms of improving access closer to home for rural patients, establishment of the teleoncology model of care itself seemed to have closed one of the CQI loops as shown by the increase in medical oncology services in rural towns. Based on the results of the safety study and the improved capacity of the rural workforce to provide cancer care closer to homes, our department implemented a policy change that allowed patients to be seen through teleoncology for their initial consultation. This policy change resulted in closing the gap in the disparity between rural and urban patents in waiting times to access services.

The results of our studies also called for improving the coordination between sites, by increasing administration support time and regularly discussing coordination at departmental meetings. Medical, nursing and administrative staff were made aware of the need to maintain good documentation, privacy and confidentiality as part of good departmental clinical practice. Some rural centres had an increase in nursing times/fractions and at centres that provided chemotherapy, plans were put in place for annual upskilling at TCC. In order to close the CQI loop for the measures described here and create and perpetuate further CQI loops, further ongoing audits are necessary so that the quality of the service can be continuously challenged and improved.

Our health professionals did not raise medicolegal and ethical concerns, although the number of staff providing comments were too small to make any firm conclusions. Fortunately, many authorities in Australia, including the Medical Board of Australia, specialist medical colleges and societies and the Commonwealth Government endorse telehealth models as core business.

This is demonstrated by the fact that they publish guidelines for good telehealth practice and subsidise clinics. Adequate governance, adherence to good clinical practices and the results of safety studies should be able to allay any concerns regarding medicolegal risks. Ultimately, any personal concerns held by health professionals should be outweighed by the need to provide equality of access closer to homes for rural and remote patients as a social responsibility.

Chapter 11 Conclusions and future directions

Despite their limitations, studies on teleoncology in the literature, including those from our institution, suggest that teleoncology models of care can stand the test of quality improvement questions and challenges. A schematic summary of the evaluation of the Townsville teleoncology model is illustrated in the Figure 11.1.

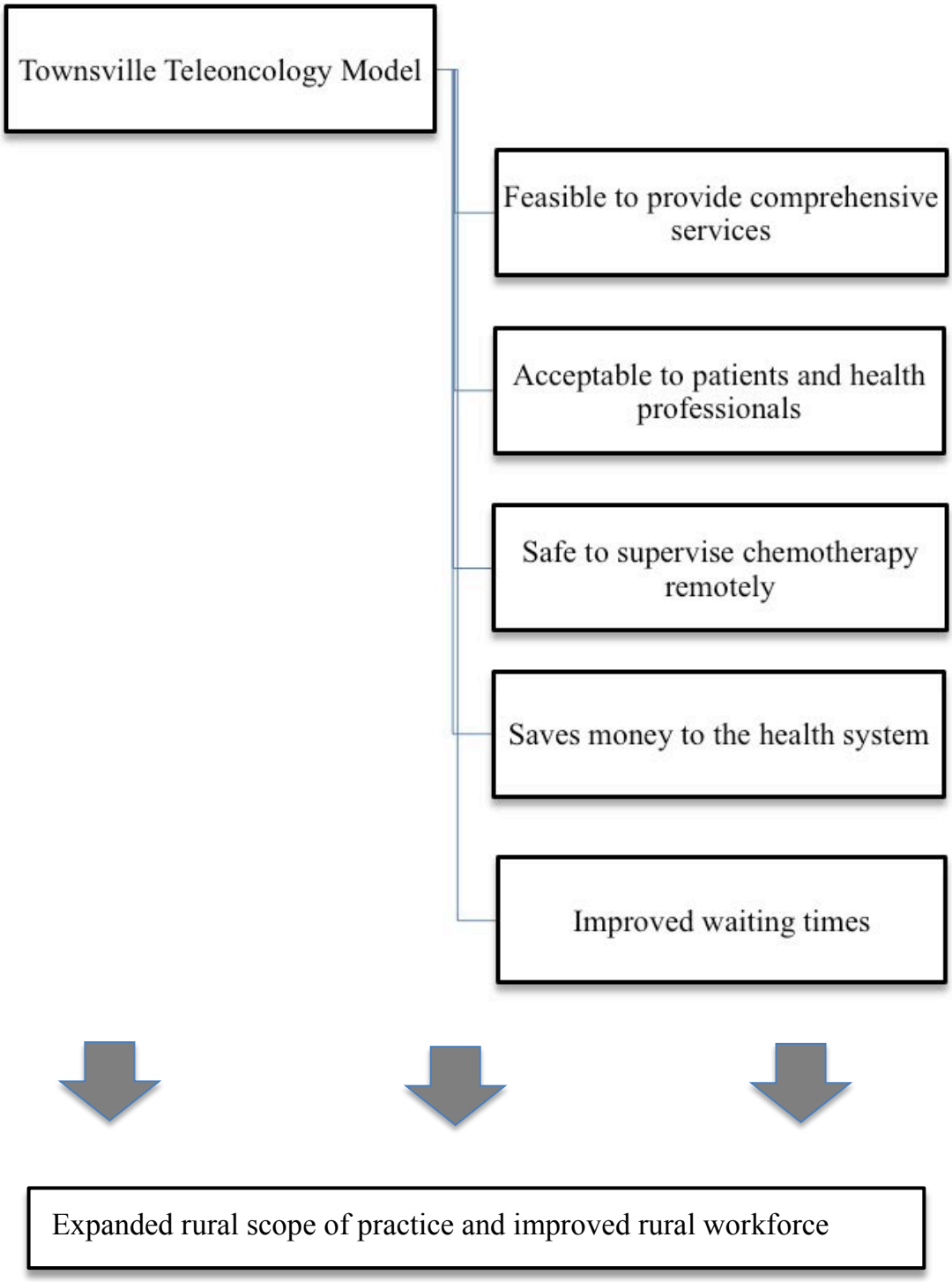

Figure 11.1 Summary of evaluation of the Townsville Teleoncology network

In addition to the ability of the models to match clinical benchmarks, these models can also facilitate the building of rural health systems. Over five to seven years, Mt Isa became a standalone rural medical oncology unit due to the gradual shifting of all local medical oncology services to Mt Isa from Townsville and lobbying for resources to adequately fund an

appropriate workforce and infrastructure to sustain those services. The end result was that patients from Mt Isa could receive most of their medical oncology services closer to home without the need for costly long distance travel. These results are summarised in Figures 11.2 and 11.3.

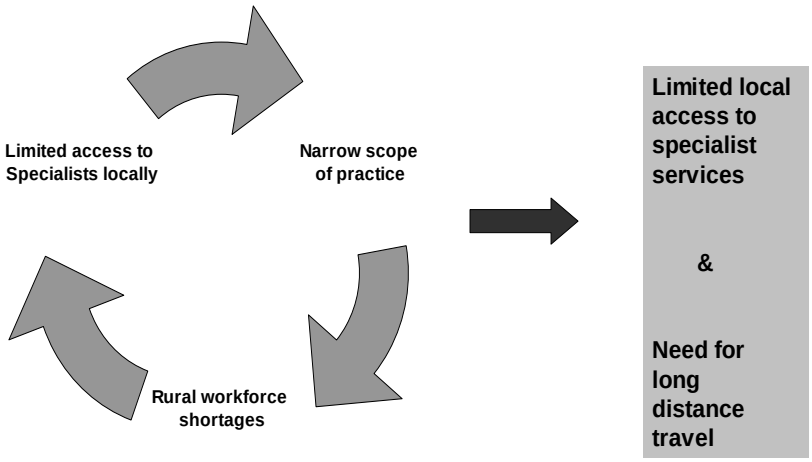

Figure 11.2 Limited rural access to specialist services and the need for travel

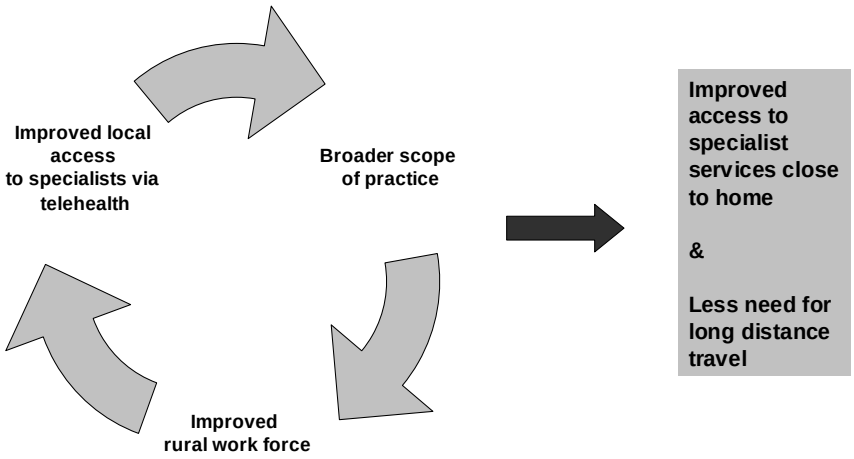

Figure 11.3 Telehealth to improve rural capabilities and to provide care close to home

Our study has many strengths and limitations. Since the provider of the service is the Townsville Cancer Centre, it was easier to implement common agreed standards in service delivery. Another advantage was that it was easier to incorporate teleoncology into the day-to-day business of the TCC by creating departmental teleoncology-related key performance indicators. Limitations include that our study is from a single network, serving patients from long travel distances and that direct service providers were involved in the evaluation as part of an action research-based CQI model. The Townsville teleoncology network comprises many specialists who are champions of rural and telehealth. Therefore, it will be difficult to know whether the results of our studies can be generalised to networks with shorter travel distances and to real life settings where telehealth models are not part of core business.

11.1 Future directions

The current teleoncology models facilitate the provision of chemotherapy services at larger rural centres. Smaller rural and remote centres suffer from the inability to have resident

chemotherapy trained nurses and high turnover of staff, thus making it difficult to sustain chemotherapy services locally. Therefore, new models of chemotherapy supervision that accommodate rural difficulties are required to provide some services to all rural centres. One such model is the Queensland Remote Chemotherapy Supervision (QReCS) model (http://www.health.qld.gov.au/qldclinicalsenate/docs/pp-140724-qrecs.pdf), currently being developed by the Queensland State-wide Rural and Remote Clinical Network (http://www.health.qld.gov.au/caru/networks/rural-remote.asp) (Figure 11.4).

The governance and training requirements for this model were informed by the experience of two pilot sites at Ingham and Bowen, which are part of the TTN.[88] Under this model, a general nurse, under the direct supervision by chemotherapy competent nurses connected via videoconferencing, performs chemotherapy administration in rural towns (telenursing). Medical oncologists and pharmacists support this telesupervision approach via teleoncology and telepharmacy, respectively. Since training requirements for rural health professionals are minimal, this model will address the issues of high staff turnover and small patient volumes in rural locations.

In addition to providing cancer services to rural hospitals, new approaches are needed to provide shared care models with general practice providers. New approaches are also needed to provide services in patients' homes using web-based systems. Tele-supervision models can be beneficial in training medical, nursing and allied health trainees and staff at rural centres.

Going beyond the use of videoconferencing technologies, there are opportunities for the use of asynchronous store and forward applications and newer mobile technologies. Mobile technologies may be used to provide patients with more continual support and coaching, through the use of SMS messaging and other applications, as we continue to strive to deliver better care for our patients closer to home regardless of the geography.

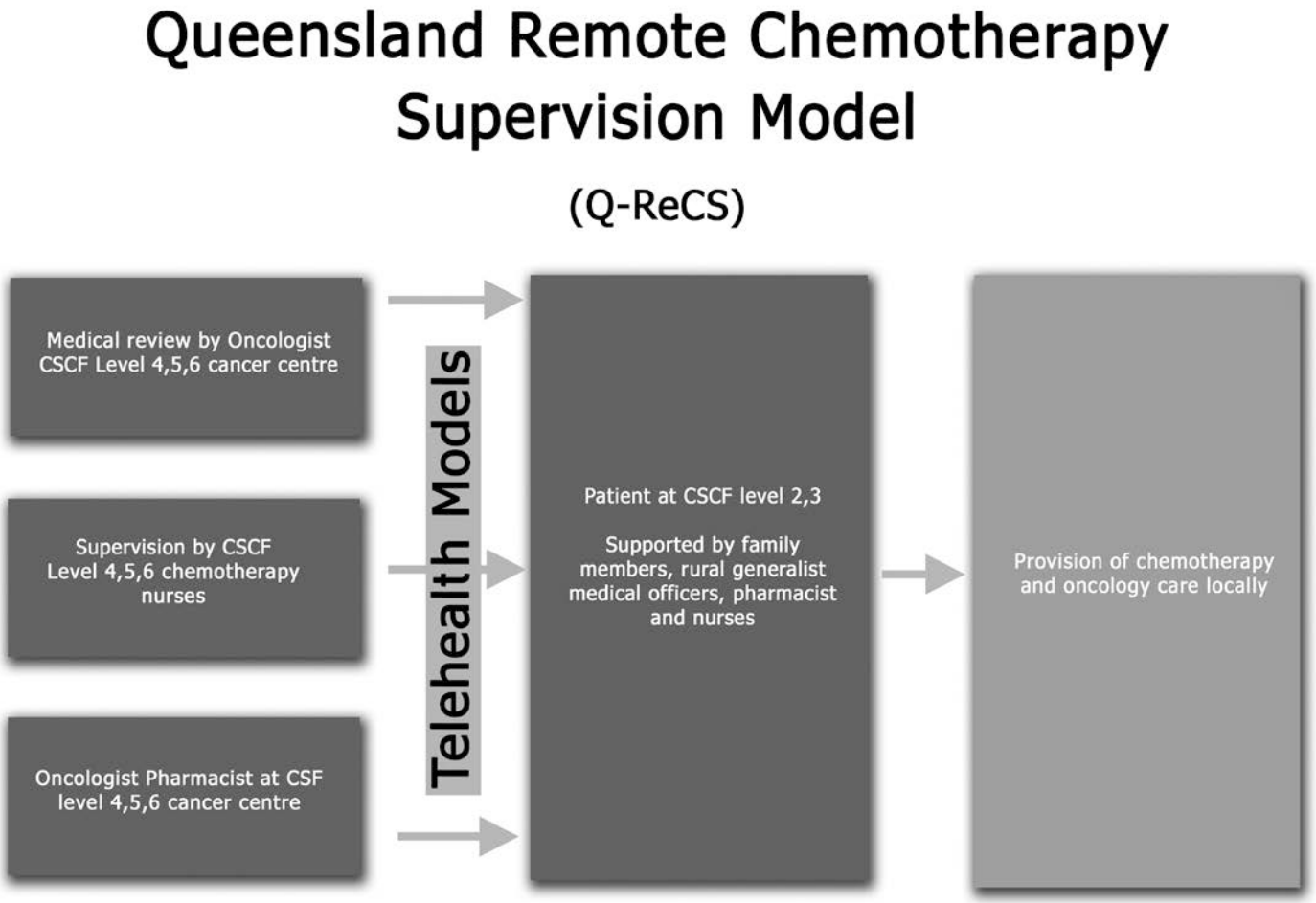

Figure 11.4 Queensland Remote Chemotherapy Supervision (QReCS) model

All of these potential future applications and the evolution of teleoncology are likely to provide great and various benefits to patients, healthcare providers and health systems. However, as exemplified by this thesis, continuous quality improvement activities should be integral where any new service models are implemented, thus ensuring acceptability to patients and health professionals, cost-effectiveness and safety, and ensuring equity of access is attained or preserved appropriately.

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Appendix 1: Published papers

Sabesan S, Larkins S, Evans R, Varma S, Andrews A, Buettner P, Brennan S, Young M, Telemedicine for cancer care in NQ: bringing cancer care home, ***Aust J Rural Health,*** 2012**,**20:259-264

AJRH The Australian Journal of Rural Health

Aust. J. Rural Health (2012) **20**, 259–264

Original Research

Telemedicine for rural cancer care in North Queensland: Bringing cancer care home

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Abstract

***Objective*:** *To describe the use of telemedicine in cancer care (teleoncology model of care) for rural patients in North Queensland.*

***Design*:** *This is a descriptive study. Data on demographical and clinical factors were retrieved from the teleoncology database of Townsville Hospital and review of medical records for the period between May 2007 and May 2011.*

***Setting and Participants*:** *The medical oncologists at the Townsville Cancer Centre, a regional cancer centre in North Queensland, have been providing their services to rural hospitals in Townsville and Mt Isa districts via videoconferencing since 2007.*

***Intervention*:** *Cancer care delivery to rural sites via Townsville teleoncology model.*

***Main Outcome Measures*:** *The ability of the teleoncology model to provide the following services to rural towns: (i) specialist consultations; (ii) urgent specialist medical care; (iii) care for Indigenous patients; and (iv) remote supervision of chemotherapy administration.*

***Results*:** *Between May 2007 and May 2011, 158 patients from 18 rural towns received a total of 745 consultations. Ten of these patients were consulted urgently and treatment plans initiated locally, avoiding interhospital transfers. Eighteen Indigenous patients received consultative services, being accompanied by more than four to six family members. Eighty-three patients received a range of intravenous and oral chemotherapy regimens in Mt Isa and oral agents in other towns through remote supervision by medical oncologists from Townsville.*

***Conclusion*:** *Teleoncology model of care allows rural and Indigenous cancer patients to receive specialist consultations and chemotherapy treatments closer to home, thus minimising the access difficulties faced by the rural sector.*

KEY WORDS: *access*, *indigenous health*, *model of rural services*, *oncology*, *rural health*, *teleoncology*.

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Conflict of interest: None from any authors.

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Aust. J. Rural Health (2014) **22**, 156–159

Quality Improvement Report

Timely access to specialist medical oncology services closer to home for rural patients: Experience from the Townsville Teleoncology Model

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Abstract

***Problem*:** *Prior to 2009, the teleoncology model of the Townsville Cancer Centre (TCC) did not achieve its aims of equal waiting times for rural and urban patients and the provision of reliable, local acute cancer care. From 2007–2009, 60 new patients from Mt Isa travelled to TCC for their first consultation and their first dose of chemotherapy. Six of these patients required inter-hospital transfers and eight required urgent flights to attend outpatient clinics. Only 50% these rural patients (*n *= 30) were reviewed within one week of their referral, compared with 90% of Townsville patients.*

***Design*:** *A descriptive study.*

***Setting*:** *TCC provides teleoncology services to 21 rural towns; the largest is Mt Isa, Qld.*

***Key measures for improvement*:** *Specialist review of 90% of urgent cases within 24 hours, and 90% of non-urgent cases within one week of referral via videoconferencing. A 50% reduction in inpatient inter-hospital transfers from Mt Isa to Townsville.*

***Strategies for change*:** *Employment of a half-time medical officer and a half-time cancer care coordinator, and implementation of new policies.*

***Effects of change*:** *Between 2009 and 2011, TCC provided cancer care to 70 new patients from Mt Isa. Of these new patients, 93% (65/70) were seen within one week of referral. All 17 patients requiring urgent reviews were seen within 24 hours of referral and managed locally thus eliminating the need for inpatient inter-hospital transfers.*

***Lessons learnt*:** *Provision of timely acute cancer care closer to home requires an increase in the rural case complexity and human resources.*

KEY WORDS: *health service models, new models and frameworks, rural, telehealth, telemedicine.*

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Quality Improvement Report

Teleoncology for Indigenous patients: The responses of patients and health workers

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Abstract

***Problem*:** *Townsville Cancer Centre provides video-consultation (VC) services to patients in rural/remote regions of North Queensland in order to improve access to specialist cancer care. The experience and responses of indigenous patients using this service have not been studied. Our objective is to assess the level of satisfaction and the responses of Indigenous patients, their families and health workers (HWs) to VC and such teleoncology service.*

***Design*:** *Descriptive study, using semistructured interviews.*

***Setting*:** *Tertiary referral centre (Townsville Cancer Centre) and various rural and remote towns in Queensland.*

***Key measures for improvement*:** *Satisfaction levels of Indigenous patients, their family members and Indigenous HWs with various aspects of the teleoncology service.*

***Lessons learnt*:** *Our evaluation suggests that teleoncology is an acceptable model of care for Indigenous patients, with high levels of satisfaction expressed from patients, families and HWs. Health professionals involved with providing this service need to be adaptive to the needs of individual patients and local communities in order to provide culturally appropriate care. Formal skills training for staff, effective communication between specialist and local HWs, and informed consent procedures are essential to maintain safety of practices. Strategies for change are:*

- *Mandatory informed consent procedure for all patients offered with VC.*
- *Formalised competency training for staff in skills essential to maintain safe practices in teleoncology.*
- *Clear clinical documentation to facilitate improved communication in patient management between medical staff at main centre and distant sites.*
- *Further efforts in promotion, education and support for staff to participate in telemedicine.*

KEY WORDS: *cancer care, health services access, Indigenous health, rural/remote service, telehealth/telemedicine.*

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A tele-oncology model replacing face-to-face specialist cancer care: perspectives of patients in North Queensland

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Summary

We explored the experiences of patients using the Townsville Tele-oncology clinic, where most patients are no longer seen face-to-face. All medical oncology patients who received services via telehealth at the Townsville Cancer Centre in 2012 were invited to participate in an interview. None refused. Thirty two patients were interviewed by telephone and three via videoconference at their local health service facility. Data analysis identified five major themes (quality of the consultation; communication and relationships; familiarity with technology and initial fears; local services and support; and lack of coordination of services between the local rural hospital and the major regional hospital) and each major theme included a number of sub-themes. Most patients interviewed (69%) had not seen their oncology specialist face-to-face, but 86% of them found the video-consultation to be of high quality and were extremely satisfied with the interaction. The acceptance of teleconsultation appeared to be linked to the patients' trust with their local health system and staff. Overall, the tele-oncology model that replaced face-to-face care in North Queensland was accepted and welcomed by patients.

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Cost savings from a telemedicine model of care in northern Queensland, Australia

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Abstract

Objective: To conduct a cost analysis of a telemedicine model for cancer care (teleoncology) in northern Queensland, Australia, compared with the usual model of care from the perspective of the Townsville and other participating hospital and health services.

Design: Retrospective cost–savings analysis; and a one-way sensitivity analysis performed to test the robustness of findings in net savings.

Participants and setting: Records of all patients managed by means of teleoncology at the Townsville Cancer Centre (TCC) and its six rural satellite centres in northern Queensland, Australia between 1 March 2007 and 30 November 2011.

Main outcome measures: Costs for set-up and staffing to manage the service, and savings from avoidance of travel expenses for specialist oncologists, patients and their escorts, and for aeromedical retrievals.

Results: There were 605 teleoncology consultations with 147 patients over 56 months, at a total cost of $442 276. The cost for project establishment was $36 000, equipment/maintenance was $143 271, and staff was $261 520. The estimated travel expense avoided was $762 394; this figure included the costs of travel for patients and escorts of $658 760, aeromedical retrievals of $52 400 and travel for specialists of $47 634, as well as an estimate of accommodation costs for a proportion of patients of $3600. This resulted in a net saving of $320 118. Costs would have to increase by 72% to negate the savings.

Conclusion: The teleoncology model of care at the TCC resulted in net savings, mainly due to avoidance of travel costs. Such savings could be redirected to enhancing rural resources and service capabilities. This teleoncology model is applicable to geographically distant areas requiring lengthy travel.

Patients with cancer who live in rural and remote areas of Australia and other countries with large rural populations travel long distances to major centres to receive specialist care.[1,2] Some of these patients require overnight accommodation for themselves and their escorts. In Australia, all or part of the travel costs and part of the accommodation costs are usually borne by jurisdictional governments.[3] Telemedicine has the potential to provide specialist consultations to patients in their home towns and minimise the need for distant travel, although evidence for the relative costs and benefits of telemedicine is mixed.[4-7]

Townsville Cancer Centre (TCC) provides tertiary cancer care to people living in northern Queensland, Australia. As people living in this area must travel long distances to receive cancer care, the Medical Oncology department at TCC embarked on a teleoncology model of care for its rural satellite sites in 2007.[8] Questionnaire-based satisfaction surveys carried out in 2009 found this model was acceptable to patients and health professionals.[9]

The Townsville teleoncology model involves videoconference sessions in which medical oncologists consult with patients who may be supported during the videoconferences by local health care professionals. Referrals to the teleoncology service are managed by a coordinator at TCC. The need for local health care professionals to be present during videoconferences is determined by the complexity of the cases. This means that, in some cases, patients attend videoconferences alone. Consultations may involve review of new cases, follow-up of existing cases or urgent review for acutely ill patients, usually within 24 hours of request. New cases usually take up to 30–40 minutes and reviews take about 10–20 minutes.

We aimed to conduct a cost–savings analysis of the teleoncology model of care at the TCC compared with the usual care model. This analysis was performed from the perspective of savings to the Townsville and other participating hospital and health services.

Methods

Demographic details of patients managed by means of teleoncology between 1 March 2007 and 30 November 2011 were collected from the oncology database of the TCC. Data collected included age, sex, ethnicity, type of consultation and diagnosis.

Costs

We considered project establishment and equipment costs to be "one-off" costs, and maintenance, communication and staff costs to be "running" costs.[10,11] Cost calculations for the study period are summarised in Box 1.

One-off costs: The total equipment cost was $23 726 per centre (Queensland Health unpublished data), which included a camera ($16 700), an LCD monitor ($1200), a cart ($1020), wall mount brackets ($300), a shelf for holding the camera ($156) and miscellaneous costs such as consumables ($100), freight ($1000), one-off license cost ($250), installation ($2350), and assembly, testing and implementation ($600).

Installation costs varied depending on the location and complexity of the project; they included the travel costs of a telecommunications service provider of $3000, and installation of power and data cabling ranging from $1000 to $4000, depending on the area.[11] The average satellite installation cost was $6000 per centre.

Running costs: Maintenance costs included the salary and costs of travel to and accommodation at each site for technical experts performing system monitoring and annual check-ups. As technical experts are employed regardless of telehealth, their salaries added no extra cost to our model. The average annual cost for travel to and accommodation at each site for one technical expert was $750.

1 Costs of the Townsville teleoncology model over 56 months from 1 March 2007 to 30 November 2011

Type of cost	Cost per centre	Cost for six centres	Total
Project establishment	$6 000	$6000 × 6	$36 000
Equipment	$20 376	$20 376 × 6	$122 256
Maintenance	$750 per year	$750 × 6 × 4.6	$21 015
Communication	0	0	0
Teleoncology coordinator for TCC	$48 000 per year	$48 000 × 4.6	$224 160
Nurse in Mt Isa (0.1 FTE)	$8 000 per year	$8 000 × 4.6	$37 360
Total cost for the study period			**$442 276**

TCC = Townsville Cancer Centre. FTE = full-time equivalent. ◆

The cost of establishing telehealth networks also generated no additional costs, as video connectivity within the Queensland Health network uses the same link as all other data sources.

Staffing costs included the annual salary and overheads of employing the teleoncology coordinator for 3 days a week — $48 000 per year. The role of the coordinator was to receive referrals from doctors and coordinate appointments at rural and tertiary venues. Additionally, as the population of Mt Isa (a mining town approximately 900 km inland from Townsville) is sufficiently large to support having a chemotherapy nurse sit in with patients during sessions one morning a week, there was a cost of $8000 per year for the nurse's salary.

Savings

Savings in our model were attributed to:

- avoiding travel by patients and escorts to a tertiary centre;
- avoiding overnight accommodation for patients and escorts in Townsville;
- avoiding aeromedical retrievals; and
- avoiding travel by specialist oncologists.

Savings from avoiding travel by patients to a tertiary centre were calculated by multiplying return travel cost for two people (the patient and one escort) by the number of consultations at every satellite site; as determined and fully reimbursed by the Queensland Health Patient Travel Subsidy Scheme.[3] Proserpine was not included in calculations as travel to and from there involved a 3-hour road trip in a privately owned car and did not require overnight accommodation.

Under the usual care model, overnight accommodation in Townsville after treatment was required, on average, by 10% of patients. Normally, Queensland Health reimburses 30% of the accommodation cost with the patient paying the remainder. Hence, a cost for overnight accommodation was calculated as required for 10% of the total number of consultations.

Seeing patients urgently by means of videoconferencing and advising the necessary management plan to local medical services avoided aeromedical retrieval of patients from satellite sites to the tertiary centre, thus representing further savings.

Finally, regular 3-weekly visits to satellite sites by a specialist oncologist became unnecessary. We based savings calculations for specialist travel and accommodation on the same prices used to calculate costs for patient travel and accommodation.

Exclusions

Costs excluded from the calculations of costs and savings were:

- the social cost of disruption to patient work routine, family routine and loss of income;
- indirect benefits, such as prevention of loss of wages by patients and relatives and reduction in workload at the home site;
- loss of time incurred by specialists during travel to the satellites (on average, a specialist would spend 6 hours for a return trip between Townsville and Mt Isa, including time spent at the airport and on the plane);
- the cost of staff (other than the new teleoncology coordinator and a nurse) at the tertiary centre and in the six satellite sites, who were employed regardless of the teleoncology model.

Statistical analysis

One-way sensitivity analysis was performed to test the robustness of the findings in net savings.[10] This analysis was based on a number of assumptions about contributing variables. The robustness and extent to which the findings could be generalised were explored by varying the values given to the variables in the one-way sensitivity analysis.

Ethics approval

The project was approved by Townsville Hospital Ethics Committee (HREC/12/QTHS/29).

Results

There were 605 consultations with 147 patients between TCC and six satellite centres from 1 March 2007 to 30 November 2011. The remoteness of the centres, and distribution of patients and consultations per centre are shown in Box 2. Ninety-two per cent of all consultations were with patients in Mt Isa and Proserpine. Patients were about equally distributed by sex, with 69 men (47%) and 78 women (53%), and 24 (16%) were Indigenous. A wide variety of cancer types were seen, with breast cancer being the most common (31%), followed by lung cancer (18%), gastrointestinal cancers (8%), genitourinary cancers (7%), melanoma (8%) and other cancers (16%). There were 54 consultations in the first year of the project (2007–2008). This number increased to 129 in 2008–2009, 136 in 2009–2010, and 286 in 2010–2011. The number of new patients enrolled increased each year (25 in 2007–2008; 31 in 2008–2009; 37 in 2009–2010; and 54 in 2010–2011).

Over the period of the study, four patients from Mt Isa required urgent consultations, which were performed either on the day of or within 24 hours of referral. Before the teleoncology clinics began, these patients would have required transfer to TCC. There have been no interhospital transfers from Mt Isa since the teleoncology clinics began. Details of savings realised are shown in Box 3.

Our analysis showed that total cost of the teleoncology project in the first year was $115 825, while savings were $59 195. In the second year, there were only running costs of $45 457 while, as a result of an increased number of consultations, the savings were $157 929. In the third year (2009–2010), four new centres were started, and the total cost of the estab-

2 Remoteness of the centres and distribution of patients and consultations per centre

Teleoncology centres	Distance from Townsville	No. of patients	No. of consultations
Mt Isa	900 km	122 (82%)	516 (85%)
Proserpine	200 km	14 (10%)	40 (7%)
Hughenden	400 km	2	11
Winton	600 km	4	21
Doomadgee	1200 km	1	3
Gulf of Carpentaria (Normanton, Mornington Island, Karumba)	1400 km	4	14
Total		**147**	**605**

lishment and running of the centres was $221 302 against savings of $164 795. In 2010–2011, the cost of running the existing centres was $59 692, while savings amounted to $380 475 as a result of a significant increase in the number of consultations. Overall, the total cost of the teleoncology project over 56 months was $442 276, while the estimated expense avoided was $762 394; this represents a net saving of $320 118.

The break-even point (the point at which costs equal savings) varied depending on distance, patient numbers and the complexity of cases managed. For example, in Mt Isa, the establishment and running costs in the first 12 months were $75 926. At a travel cost of $1000 for a patient and escort, excluding overnight accommodation, savings were generated after 76 consultations. This means that smaller towns and towns closer to the major centres with low patient numbers will take longer to generate savings, or may not generate savings at all. Overall, under the TCC teleoncology model, initial costs were negated after 105 consultations at Mt Isa.

Sensitivity analysis

Net savings: The net saving over 56 months was $320 118. Therefore, the costs would have to increase from $442 276 to $762 394 (ie, by 72%) for the net savings to decrease to zero.

As the net savings were large, making the small increase in cost variables unlikely to affect the outcome, we did not proceed with a sophisticated sensitivity analysis.

Equipment use: While the equipment purchased and installed was for teleoncology services, it is now used by other services for more than 50% of the time. As we attributed the establishment and equipment cost entirely to the teleoncology service in our analysis, the cost was an overestimation.

Travel with escort: We assumed that all patients travelled with escorts. However, taking the example of Mt Isa (the largest centre), if we assume that only half of the 516 patients from there travelled with escorts, the cost of travel decreases by $154 800, leaving a net saving of $165 318.

Air travel cost: We used the lowest price available in our calculation, but a proportion of the specialist oncologist and patient travel is booked only a few days before travel, costing two to three times the lowest price. Therefore, our analysis probably underestimated this cost.

3 Estimation of savings of Townsville teleoncology model over 56 months from 1 March 2007 to 30 November 2011

Description of expenses prevented	Calculation of cost	Total
Return travel cost for patient and one escort to Townsville*		$658 760
Mt Isa	516 × 2 × $600 = $619 200	
Hughenden	11 × 2 × $260 = $5720	
Winton	21 × 2 × $320 = $13 440	
Doomadgee	3 × 2 × $1150 = $6900	
Normanton	8 × 2 × $480 = $7680	
Mornington Island	4 × 2 × $580 = $4640	
Palm Island	1 × 2 × $110 = $220	
Karumba	1 × 2 × $480 = $960	
Overnight accommodation in Townsville† (10% of total consultations)	$60 × 2 × 30	$3600
Urgent aeromedical retrieval of four patients from Mt Isa	$13 100 × 4	$52 400
Specialist/registrar travel once every 3 weeks for 56 months‡	17 × $600 × 4.67	$47 634
Total savings for the study period		**$762 394**

* Number of consultations × 2 (patient and escort) × return travel cost. † 10% of total consultations × 2 (patient and escort) × the subsidy amount. ‡ Number of visits per year × return travel cost. ◆

Discussion

The TCC model of cancer care is one example of the use of telemedicine to facilitate the provision of specialist cancer services to rural patients. It reduces travel for patients and doctors, reduces interhospital transfers and provides access to ongoing medical education for staff working in remote areas by improving access to specialist oncologists.[12] However there are drawbacks such as possible depersonalisation, excessive dependence on technology and increased clinical risk (eg, supervision and management of side effects of chemotherapy remotely), although early safety analysis results from our model show promising results.[13,14]

Evidence for cost-effectiveness of telemedicine services in comparison with conventional face-to-face consultations is mixed. A 2012 systematic review concluded that there was no conclusive evidence that telemedicine and telecare interventions were cost-effective compared with conventional health care over 20 years.[4] However, the studies in this systematic review varied in their methods of cost analysis, patient travel distances, number of patients served, types of specialties involved and extent of services provided, making it difficult to arrive at firm conclusions.

Studies in Kansas in the United States reported that the telemedicine cost for cancer care was lower than the face-to-face clinic cost and that the cost of telemedicine clinics had declined over the years due to increase in patient numbers.[6,15] Similarly, a study from Queensland, Australia, reported savings from

paediatric telemedicine clinics.[7] In contrast, a US cost analysis reported no cost benefit for a telemedicine model that provided various specialty services to eight rural centres in Arizona; this was attributed to low patient numbers.[5]

Like the previous studies from Kansas[6] and Queensland,[7] our study shows significant savings to the health system. We found that small changes in cost were unlikely to affect the outcome because there were large net savings. Therefore, a simple one-way sensitivity analysis was adequate for the purpose our study. The major contributor to cost savings was avoiding travel by patients and their escorts and specialist oncologists. In comparison with other studies, the models in the earlier Kansas[6] and Queensland[7] studies and in our study served patients from very long distances and in larger numbers.

In our model, in Mt Isa, all the medical oncology services were able to be provided locally by telehealth, which avoided interhospital transfers and led to further cost savings. However, our findings may not be generalisable to models with smaller patient numbers and with patients travelling smaller distances. Since July 2011, more than 80% of our consultations have been eligible for a Medicare rebate by the Australian government. While we did not include this in our cost analysis, these rebates would provide further financial benefit to the hospital and health services from the telehealth model.

At TCC, the number of consultations doubled every year. Mt Isa and Proserpine had large increases in the number of consultations as these centres also provided increasingly complex chemotherapy treatments over time. Other centres, where such large growth did not occur, may not generate savings because of smaller patient numbers. For these centres, the decision to continue the service should be based on equity of access and social justice, not on economic grounds. At smaller rural centres, sharing of the system by more than one specialty will be likely to improve the savings further.

In conclusion, the Townsville teleoncology model saves money for participating health service districts while providing cancer care to rural northern Queensland closer to patients' homes. The main driver of net savings is avoidance of travel costs for patients and their escorts and for specialists. Ideally, net savings should be redirected to further improving rural infrastructure and capabilities.

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Sabesan S, Allen DT, Caldwell P, Loh PK, Mozer R, Komesaroff PA, Talman P, Williams M, Shaheen N, Grabisnki O**,** Practical aspects of telehealth: establishing telehealth in an institution, ***Internal Medicine Journal*** 2014,44:202-205

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TELEHEALTH SERIES

Practical aspects of telehealth: establishing telehealth in an institution

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Key words
telehealth, video consultation, telemedicine, Townsville Teleoncology Network, teleoncology.

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Abstract

The fifth in a series of papers on practical aspects of telehealth, this paper discusses telehealth models that can facilitate the provision of specialist services to rural and remote patients closer to home. Some of the barriers to successful implementation of these models relates to workforce, funding and infrastructure at rural sites, as well as the traditional mindset of healthcare professionals. Therefore, the rural sector needs to be adequately resourced for telehealth models to be substantive and successful. This paper describes the development of a large teleoncology network over a vast geographical area in North Queensland. Adequate resourcing for the rural sites and undertaking quality improvement activities has continually enhanced the model over a 5- to 6-year period. The benefits of this model of care are twofold: (i) patients received their care closer to home and (ii) the workforce, service capabilities and infrastructure for the hospital in Mt Isa (a rural town 900 km away from its tertiary centre) has improved.

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REVIEW ARTICLE

Medical models of teleoncology: Current status and future directions

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Abstract

Teleoncology has been adopted by many centers to provide cancer care closer to home for rural, remote, Indigenous and other disadvantaged people of our communities. A variety of medical models of teleoncology exist to provide various medical oncology services. While most centers use teleoncology to complement their face-to-face outreach services, some centers have replaced face-to-face with teleoncology models. Selection of patients and scheduling of clinics would depend on various factors including experience of the clinicians, complexity of treatment provided, capabilities and workforce of rural sites, and patient preferences. Many small studies reported high satisfaction rates of these models among patients and health professionals including Indigenous populations. One single center study reports that it is safe to supervise chemotherapy delivery remotely and many studies report cost savings to the health systems. Further studies on safety aspects of teleoncology are needed to further improve the current models. Future teleoncology models would need to include Web-based models, mobile technologies and remote chemotherapy supervision models so that patients from most rural towns could have at least some of their cancer care closer to home.

Key words: cancer, model of care, rural, telehealth, telemedicine.

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Telestroke, teleoncology and telenephrology: a systematic review to analyse the outcomes of active therapies delivered with telemedicine support to manage strokes, cancer and chronic kidney disease.

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Summary:

Mortality and morbidity is significantly higher in rural and regional areas due to various factors including a deficiency in the availability of specialist care leading to later diagnosis and delays in treatment. Telemedicine attempts to address some of these issues. The main fields that deliver medical therapies through real time videoconference (VC) are oncology for chemotherapy, neurology for stroke thrombolysis and nephrology in supervising haemodialysis (HD). This review studies the effectiveness of these telemedicine models in terms of patient outcomes and satisfaction. This systematic review involved a search of MEDLINE, CINAHL and INFORMIT databases using key terms. 563 articles on telemedicine were found; from these 67 full texts were perused yielding 8 articles for telestroke, 3 for telenephrology and 2 for teleoncology. Observational studies conducted in the field of telestroke have shown favourable outcomes when comparing face to face and VC aided thrombolysis with no significant disparity between survival and intra-cerebral bleeds between the two cohorts. HD supervised through VC also showed no change in patient outcomes when compared to HD at dialysis centers. Evidence regarding the efficacy of using real time VC for infusion delivery is however limited. Administering active therapeutic interventions seems feasible given the presence of certain factors at the rural sites such as CT scanning facilities for stroke management, chemo-competent nurses to deliver chemotherapy and dialysis nurses.

Keywords: telemedicine, videoconference, stroke, thrombolysis, chemotherapy, oncology, renal, dialysis.

Introduction

Cancer is responsible for about 29% of all deaths in Australia and up to 25% of excess deaths in regional areas. In regional areas death rates are 10% higher for males and about 5% higher for females than in major cities.(1) Such disparity in health outcomes for cancer between urban and regional populations can be attributed to later date of diagnosis, poorer access to health care, different health seeking behaviour, health workforce shortages in regional areas (especially amongst specialists) and higher Indigenous population.(1) Cancer risk factors such as smoking, obesity and alcohol consumption are also higher in rural and regional populations.(2)

To overcome barriers and improve access to oncology treatments various models have been instigated in regional and rural areas, such as face to face outreach clinics or more recently telehealth models.(3) One of the longest running teleoncology services, first established in 1995, is in Kansas. This has demonstrated success by incorporating more rural sites under its service and also reducing the cost of delivery.(4) Teleoncology has also secured its roots in nations such as Canada, UK and Scotland where health resources are concentrated in major cities but the population is dispersed over a large area.(5, 6) Many existing telehealth models across Australia and other developed nations have focused on providing consultations and follow up for their regional and rural patients, where most patients continue to travel to larger centers for treatment. Few medical specialties have embarked on remotely supervising active medical therapies via Real Time (RT) videoconference (VC) to provide a more comprehensive service closer to home. Stroke, cancer and kidney disease management are areas where telemedicine has

progressed to supervising active treatment through providing thrombolysis, chemotherapy and dialysis via VC. Thus, this review will aim to explore the outcomes of using telemedicine supervision to deliver active therapeutic treatment to rural patients in the fields of stroke, medical oncology and nephrology (widely known as telestroke, teleoncology and telenephrology respectively).

Methods

A systematic review was conducted applying the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.(7) Computerised literature searches were performed using the terms telemedicine AND oncology, telemedicine AND "medical oncology" and telemedicine AND stroke, telemedicine AND renal or kidney/s or dialysis with language restricted to English. These searches were performed on MEDLINE, Cumulative index of nursing and allied health literature (CINAHL) and INFORMIT databases. Some articles were also identified by reviewing the bibliographies and search terms of selected articles.

Inclusion criteria were the following: articles that utilised models of telehealth to actively deliver treatment to rural, regional or remote patients as chemotherapy, thrombolytic infusions or dialysis (as these were three major areas where therapeutic interventions have begun to be administered by VC as determined by prior preliminary searching of MEDLINE and expert advice from consultants within the fields). Articles also had to assess patient outcomes and/or satisfaction from delivering therapeutic infusions via telemedicine in a scientifically valid manner. In addition studies were required to clearly explain the

models used to deliver the treatment. Only observational studies and randomised controlled trials would be included in an attempt to ensure the assessment of patient outcomes was objective.

The exclusion criteria required rejection of articles that solely described the various telemedicine models, their description and details about technical feasibility. Articles that utilised telemedicine for consultations, follow-up clinics or specialist reviews and did not include providing treatment were excluded. Telemedicine for follow-up appointments after provision of thrombolysis, chemotherapy or pre/post dialysis was also excluded. Telepsychology and telerehabilitation of cancer and stroke patients were excluded. Letters, conference proceedings, editorials were also excluded.

Initial screening of articles was based on review of their titles followed by abstracts. All abstracts were read by the primary author independently, and selection of relevant articles relied on the abstracts fulfilling the inclusion criteria. Full length articles within the last 15 years were then perused to assess for eligibility according to the inclusion and exclusion criteria. Final articles were selected in accordance and after formal meeting with the supervising author and consultant. Data extraction forms and tables were developed and data was extracted and reviewed by three authors. Critical assessment of possible sources of bias and confounding in the studies was undertaken. Study results and effect sizes were also extracted and compared where possible.

Results

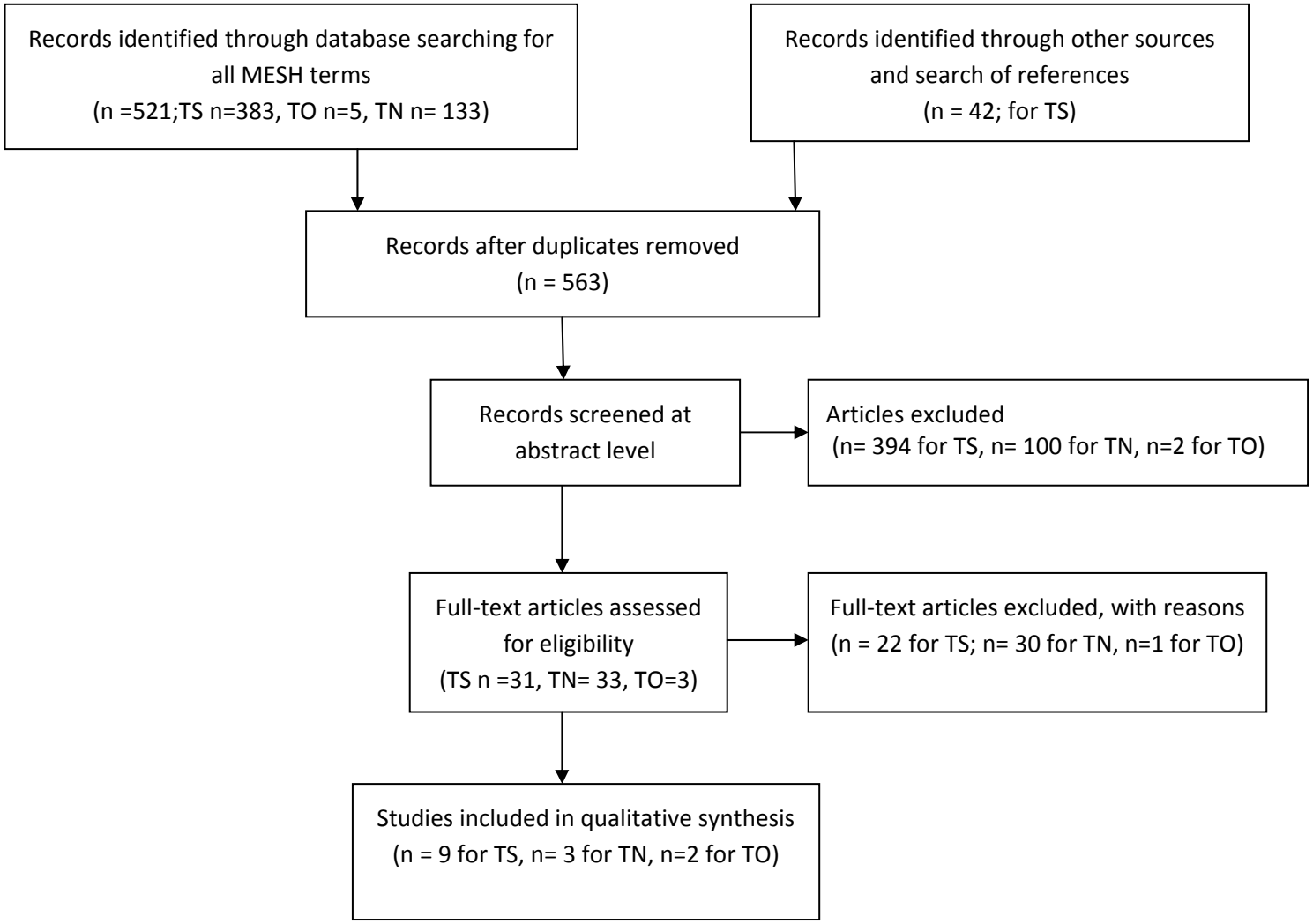
Records identified through database searching for all MESH terms
(n =521;TS n=383, TO n=5, TN n= 133)
Records identified through other sources and search of references
(n = 42; for TS)
Records after duplicates removed
(n = 563)
Records screened at abstract level
Articles excluded
(n= 394 for TS, n= 100 for TN, n=2 for TO)
Full-text articles assessed for eligibility
(TS n =31, TN= 33, TO=3)
Full-text articles excluded, with reasons
(n = 22 for TS; n= 30 for TN, n=1 for TO)
Studies included in qualitative synthesis
(n = 9 for TS, n= 3 for TN, n=2 for TO)

Figure 1: The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analysis) flow diagram.(7) TS= telestroke, TO= teleoncology, TN= telenephrology

521 articles dealing with all forms of telemedicine were found on MEDLINE of which 394 articles included telestroke and all forms of stroke diagnosis, evaluation, investigation and management via telemedicine. 394 abstracts were reviewed from which 31 articles were chosen, those excluded either did not utilize telemedicine for direct stroke management or the study design was substandard in nature. 31 full texts were perused in detail finally yielding eight articles fit to be included in this review. The process is depicted in the flow chart above. 23 articles were excluded due to: 1) lack of administration of therapeutic thrombolytic infusion and managing stroke more passively with observation, anti-platelet therapy and other medication regimens or 2) articles that focused on stroke rehabilitation and psychosocial therapy or due to 3) limitations in study design including case studies, letters and so on.

The second search was conducted in the field of medical oncology and yielded five articles from which two were chosen and three excluded as they did not have appropriate information on patient outcomes or satisfaction rates. From the 133 articles identified in telenephrology only 3 met the inclusion criteria and were hence selected for this review.

Table 1- Quality Assessment Table-Risk of bias assessment using the Cochrane risk of bias tool (8)

Bias domains	Chowdhury 2013 (9)	Zaidi 2011 (10)	Johansson 2011 (11)	Khan 2010 (12)	Audebert 2006 (13)	Pedragosa 2009 (14)	Meyer 2008 (15)	Sairanen 2011 (16)	Schwab 2007 (17)
Study Design	Retrospective cohort study comparing FTF with telemedicine model.	Retrospective cohort comparison between spoke sites and the hub. FTF care at hub and telemedicine were provided by the same neurologist	Retrospective cohort comparison between peripheral hospitals and stroke centre	Single centre case series	Retrospective, Comparison of outcomes pre and post implementation of telestroke services	Randomised controlled study of telemedicine vs. telephone decision making and supervision of tPA	Prospective cohort study. Comparing outcomes at community hospitals with hub	Prospective cohort study. Comparing outcomes at community hospitals with hub	Prospective cohort study. Comparing outcome between regional and stroke centres
Randomisation	No	No	No	No	No	Yes	No	No	No
Allocation concealment	No	No	No	No	No	No	Yes	No	No
Blinding	No	No	No	No	No	No	No	No	No
Incomplete outcome data	No	No	No	Yes	No	No	No	No	No

Selective outcome reporting	No	No	No	Unclear	No	No	No	No	No
Other	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Risk of bias	Unclear	Unclear	Unclear	High	Low	Low	Low	High	Low

Using the Cochrane risk of bias tool, Table 1 depicts that most studies utilized did not undertake randomization, allocation concealment or selective outcome reporting making their risk of bias high or unclear. But most, except one study satisfactorily reported complete outcome from the data analyzed. From the four out of nine studies that were deemed to be at low risk of bias, one was randomised, the other had allocation concealment and all four reported complete patient outcomes. The risk of bias from others was high or unclear as they did not fulfill the major criteria. Table 2 summarises the studies selected, their study designs and outcomes reported in each study.

Table 2: Summary of articles describing the stroke management setting, study design and outcome

Reference	Country	Setting	Study design	Interventions at remote sites	Participants	Outcomes
Chowdhury 2013(9)	UK	Single stroke centre	Retrospective cohort study	Evaluation and tPA via real time VC	97 patients were thrombolysed; 46% were via telemedicine	●Intracranial bleed: FTF 7.7% vs. telemedicine 4.4% (NS), ●3 month FO: FTF 36.5% vs. telemedicine 42%(NS), ●Process times significantly shorter for face to face. E.g. admission to treatment median 33min vs. 61 min.
Zaidi 2011(10)	USA	12 spoke sites and 1 stroke hub	Retrospective cohort	Evaluation and tPA via real time VC	Number of patients: telemedicine 83, FTF 59,	●3 month FO: 42% vs. 37.5% (NS) ●No difference in ICB ●Arrival to treatment: mean 68 min vs. 90 min($p<0.01$), ●3 month mortality 30% vs. 31%.
Johannson 2011 (11)	Austria	Peripheral hospitals 20 -129 km away and stroke unit	Retrospective cohort	Evaluation and tPA via real time VC followed by transfer to stroke unit	Number of patients: Periphery 47 , stroke centre 304,	●ICB 6.4% vs. 7.6% (NS), ●3 months FO 47% vs. 43% (NS), ●3 month mortality 19% vs. 13% (NS)
Khan 2010 (12)	Canada	7 remote hospitals and 1 hub	Single centre case series	Evaluation and tPA via real time VC or telephone	At 2 years, 50 patients received telemedicine review	●At 2 years, 50 patients received telemedicine review, ●tPA within 3 hours 73%, ●ICB 11.4%, ●3 month mortality 22.5%, ●3 month FO 40%, ●92.5% decline in transfer rate.
Audebert 2006 (13)	Germany	12 regional clinics and 2 stroke centers	Prospective cohort study,	Evaluation and tPA via real time VC	115 at community hospital versus 110 at stroke	●Rate of tPA: community hospitals 115/4727(2.4%) and Stroke centre 110/1889(5.8%), ●ICB 7.8% vs. 2.7% ($p<0.05$),

					centre	●In hospital mortality 3.5% vs. 4.5 % (NS).
Pedragosa 2009 (14)	Spain	Community hospitals >70 km away from tertiary centre.	Retrospective cohort study	Evaluation and tPA via real time VC	Total of 399 stroke patients admitted over 2 years	Significant outcomes pre vs post implementation: (Total of 399 stroke patients admitted over 2 years). ●Specialist review 17% vs. 38%, ●Inter-hospital transfers17% vs. 6%, ●Rate of tPA 4.5% vs. 9.6%, ●Time to tPA 210min vs. 162 min, ●tPA within 3 hours40% vs. 63%
Meyer 2008 (15)	USA	4 remote spoke sites	Randomised controlled study of Telemedicine vs. telephone decision making and supervision of tPA	Evaluation and tPA via real time VC or telephone. CT images were available in the telemedicine arm; Only report was available in the telephone arm.	Number of patients: 111 in telemedicine and 111 in telephone arms	●Correct decision making 98% vs. 82% ($p<0.05$), ●Rate of tPA 28% vs. 23% (NS), ●90 day FO-no difference ●90 day mortality19% vs. 13% (NS) ● ICB7% vs. 8% (NS),
Sairanen 2011 (16)	Finland	5 community hospitals 130-800 km away and one hub	Prospective cohort study,	Evaluation and tPA via real time VC	106 patients within 5 community hospitals	●At 2 years, number of patients in community hospitals: 106, ●Rate of tPA 57.5%, ●ICB 6.7%, ●3 month mortality 11.5%, ●3 month FO 49% at spoke sites vs. 58% at hub (NS).

Schwab 2007 (17)	Germany	12 Community hospitals vs. 2 stroke centres	Prospective cohort study,	Evaluation and tPA via real time VC	Over 22 months, Patient number: Community hospital 170 and stroke centre 132,	●Mortality rate at 3 months 11.2% vs. 11.5%, at 6 months 14.2% vs. 13% (NS), ●FO at 6 months 39.5% vs. 30.9 % (NS).

VC- videoconferencing, tPA-thrombolysis, ICB-intra-cerebral bleed, FTF-face to face care, FO-favourable outcome, NS-not significant

Table 3: Summary of articles describing the chemotherapy management setting, study design and outcomes

Reference	Country	Setting	Study design	Intervention at remote sites	Outcomes
Sabesan 2012 (3)	Australia	Rural town 900km away from tertiary centre	Single centre case series	Medical review and supervision of chemotherapy administration via real time VC by tertiary centre	• Number of patients receiving IVCT 83, • No inter-hospital transfers after teleoncology implementation.
Sabesan 2012(18)	Australia	Rural town 900km away from tertiary centre	Single centre case series- Questionnaire based survey of patient satisfaction	As above	• Participants 50, • 96% of patients in >80% agreement with statement "I am getting satisfactory care from the specialist on video link".

VC-videoconferencing, IVCT-intravenous chemotherapy.

Table 4: Summary of articles on telenephrology: dialysis management setting, study design and outcomes

Reference	Country	Setting	Study Design	Intervention	Participants	Results
Rygh et al 2012 (19)	USA	Patients living with home dialysis	Qualitative using semi-structured interviews	NA	N=11 patients (PD=8, HHD=3)	• Satisfied with home option • Continued to require close communication and follow up • Recognised a need for telemedicine models to increase independence.
Sicotte et al 2011 (20)	Canada	Two James Bay Cree communities-Chisasibi and Chibaugamau	Pre and post design	Tele-HD	N=19 patients (followed for 12 months pre and post)	• Health outcomes met markers from the National Kidney Foundation; pre and post. • HD sessions= 11.8 pre, 11.1 post (Chisasibi); 12.5 pre, 12.4 post (Chibaugamau) • Medication changes=8.1 pre, 3.1 post (Chisasibi);2.2 pre, 1.8 post (Chibaugamau) • Transfers to university hospitals=1.1 pre, 1.6 post (Chisasibi); 1.3 pre, 1.4 post (Chibaugamau)
Rumpsfeld 2005 (21)	Norway	University hospital of north Norway and its 2 satellite sites: Alta and Hammerfest	Prospective study	VC for daily visits and ward rounds.	9 patients followed for 8 months	• Technological (28%) and logistical (10%) problems noted • 5 hospitalisations and 1/3 of planned visiting rounds were avoided. • Economically non-viable at

						pilot level: running costs higher • Nurses reported satisfaction with technology and care provided.

NA= not applicable, HHD=home haemodialysis, PD=peritoneal dialysis, VC=Video-conference

It is apparent from viewing the tables above that telemedicine has not added to significant adverse outcomes and has safely delivered therapies such as thrombolysis, chemotherapy and dialysis to remote patients who would otherwise suffer worse health outcomes if they were unable to access these cornerstone treatments.

Discussion

The quality of most of the studies selected for this review was weak due to lack of randomised controlled trials (RCT) and small number of patients. However, given the small number of rural and remote patients and the novelty of the three fields, as well as the importance of maintaining patient autonomy around the difficult area of oncology treatments, a RCT may never be feasible in many geographically large areas. These studies have used different study designs and comparators. However, all the studies reported on similar outcomes and reported side effects, and other outcome parameters like intra-cranial bleeds, arrival time to treatment, in-hospital mortality and 3 month mortality rates were consistent across these studies. Though firm conclusions cannot be made from these studies, it seems that telestroke and teleoncology for the delivery of active interventions

are feasible and safe. Furthermore, it is apparent the real time videoconferencing is preferable to telephone-based systems in terms of patient outcomes.

One limitation in implementing telestroke widely which was identified from the studies is availability of CT scanning facilities. Since most rural towns lack this, wide introduction of such models seems unlikely.

Chemotherapy administration through telemedicine is a more recent addition to the telemedicine field and thus there has not yet been significant literature on the safety and survival of these patients given the novelty of these models. However, although it is feasible to remotely supervise many toxic chemotherapy regimens via real time videoconference, the Townsville teleoncology model is suited to larger rural centers where there are resident chemotherapy-competent nurses. Therefore patients from smaller rural towns continue to travel long distances for their stroke and chemotherapy care.

To provide access to at least some part of medical therapy closer to homes, new models are required. For example, a remote chemotherapy supervision model is currently being trialed at the Townsville Cancer Centre to address this issue. In this model, selected chemotherapy regimens are administered by non chemo-competent nurses guided and supervised via real time VC by a chemo-competent nurse from TCC.

Dialysis too can be adequately provided with guidance from central renal centers. The studies looking at dialysis via VC were however scant and reported on various aspects such as economic analysis, hospital transfers and health outcomes and thus comparison and solid conclusions cannot be drawn from such one-off studies.

Within telenephrology, monitoring of rural patients on peritoneal dialysis via VC or mobile phones to address their acute complications such as infections with treatment response from urban peritoneal dialysis units has also begun. Although in one study this was complimented with n intensive home visit program, the other study used VC as a solitary trouble shooting method and monthly evaluations for their rural patients. These studies concentrated more on tele-monitoring as opposed to delivering therapies or infusions via VC. (22-24)

Gallar et al presented the results of home monitoring patients using peritoneal dialysis by installing VC equipment in their home and found this a clinically useful model for long term follow up of stable patients minimizing travel, costs and burden on patients. Medication changes were undertaken through VC and only 2% of patients required hospital presentation for management. In all cases the abdomen was successfully examined for infection or oedema in and around the catheter exit site. (25) Two other studies conducted at the same centre in the United States, first looking at health outcome and cost analysis in using nursing oversight to conduct telehealth consults with remote patients. This pilot demonstrated improved health outcomes and cost benefits. The second larger study looking at 99 patients over 3 years showed again a significant cost benefit with decrease in hospitalization and days in hospital; and reduced requirement to conduct telehealth consults with patients taking

further ownership of their health. (26, 27) VC is continually being used for clinical consultation required frequently for kidney disease patients. (28)

Conclusion

Though the quality of the studies are weak, studies from all three fields report outcomes similar to standard practice and these models seem both feasible and safe to implement. Current models are suited to larger centers with adequate imaging and service capabilities. To provide equitable coverage to most rural patients, new telehealth models and more rigorous studies of their effectiveness, acceptability and safety are required.

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Medical oncology clinics through videoconferencing: an acceptable telehealth model for rural patients and health workers

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Key words
telehealth, teleoncology, videoconferencing, medical oncology.

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Abstract

Background: Since 2007, Townsville Cancer Centre (Queensland, Australia) has provided routine and urgent medical oncology services to rural and remote communities through videoconferencing. At remote sites, patients were accompanied by doctors and other health workers. The aim of this study was to describe satisfaction of patients and rural health workers with this model of teleoncology.

Methods: Between May 2007 and June 2010, 55 videoconferencing patients were invited to participate in a questionnaire-based telephone survey after informed consent. The survey included responses to 16 satisfaction statements using a 5-point Likert scale. Perspectives of health workers involved were recorded using open-ended questions on six themes related to telehealth.

Results: Among the 50 participating cancer patients, median age was 56 years (range 28–83). Seventy-six per cent of patients thought specialist physical examination was important despite local doctors performing it. Seventy-six per cent of patients felt the presence of accompanying local health workers was not important. Seventy-eight per cent of patients preferred to be seen in Mt Isa for the first consultation through videoconferencing than travelling to Townsville. More than 80% of patients were in agreement with the rest of the satisfaction statements. Ninety-six per cent of patients were in agreement with the question relating to overall satisfaction. Eighteen health workers participated and their responses and attitudes were favourable towards telehealth.

Conclusion: Satisfaction with this model of care was proven to be high among both patients and health workers. Benefits perceived included effective communication between patients and specialists, reduced travel time and money expenditure, and superior specialist support for rural health workers.

Funding: None.
Conflict of interest: None.

Appendix 2: Quality improvement activity

Structured questionnaire

Patient satisfaction survey of video linked clinic.

Patient information sheet and consent form:

Townville Cancer Centre has been consulting patients via video linked technology for the last 5 years.
Since there is shortage of specialists in North Queensland, this technology allows specialists to provide service to the rural and remote patients so that specialist and the patients don't have to spend time travelling and staying away from families.

Since it is a new model of care, views of the patients and their suggestions are needed to improve the service.

Participants are invited to take part in this survey that takes about 15-20 mins to complete. All the details will remain confidential and non participation will not affect the care TCC provides.

Patients initial:

I agree to participate in this survey.

Yes/ no.

Person interviewing:

Patient Satisfaction Survey of video linked clinics to Mt Isa.

Age	_____ years
Sex (please circle)	Male Female
Ethnicity	_____
Place of residence	Where? _____ How far from Mt Isa Hospital(approx. Km)? _____ How far from GP (approx. Km)? _____
Education (please circle)	Less than high school High school TAFE or similar University Tertiary, non university
Marital status(please circle)	1. Married/Defacto 2. Single 3. Separated/divorced 4. Widowed
Difficulties with hearing	Yes___ No__, if yes explain
Difficulties with vision	Yes___ No___, If yes, explain
Cancer type?	_____
Previous cancers?	_____
	•
	i)
	□

Type of visit:
(Please tick one)

(a) new consult

Yes		No	

(b) pre chemotherapy review

Yes		No	

(c) routine follow up

Yes		No	

Patient Questionnaire

Please circle the response.

1. do not agree and
5. strongly agree.

1. I could talk to the specialist easily and openly.

1	2	3	4	5

2. I felt I could ask my specialist questions.

1	2	3	4	5

3. I did not feel that anything important was missed during my visit with my doctor.

1	2	3	4	5

4. I understood what the specialist told me.

1	2	3	4	5

5. I felt that the doctor and the nurse answered all my questions and concerns.

1	2	3	4	5

6. I felt the specialist was able to understand my situation and provide satisfactory care.

1	2	3	4	5

7. I felt my privacy and confidentiality were preserved during my first visit with my doctor.

1	2	3	4	5

8. I felt that it is important for the specialist to examine me. Remember the doctor could also examine if neededand you don't always have to be examined

1	2	3	4	5

9. It is important to have the local doctor or nurse with me when my specialist is consulting.

1	2	3	4	5

10. I would rather travel to Townsville to see my specialist than participate in a video consultation again.

1	2	3	4	5

11. I had no difficulty seeing and hearing the doctor through the video link system.

1	2	3	4	5

12. I would rather video consult with my doctor now than have to wait for a few weeks to see him/her in person.

1	2	3	4	5

13. I felt that being able to video consult with my doctor was convenient and/or saved me time and money.

1	2	3	4	5

14. I was able to develop a friendly relationship with my specialist

1	2	3	4	5

15.I am getting satisfactory care from the specialist on videolink with the help of doctors and nurses locally

1	2	3	4	5

16. I was able to take medications <u>safely</u> after the consultation with the specialist and or the doctor in Mt Isa.

1	2	3	4	5

□ Please tell us how we could improve the services via the videolink:

How did you feel before the consultation and how do you feel after it?

Anything you feel important that we need to address to improve?

How do feel that you never met the specialist in person but having treatment?

How do you feel about discussing prognosis on V/C?

Appendix 3:Assessment of patient satisfaction with teleoncology model Qualitative method

Patient information sheet

Townsville Cancer Centre (TCC) has been providing its services to rural patients through videoconferencing technology, to improve the access of rural cancer patients to specialist services locally. This model is called teleoncology model of care. Unlike many other centres, TCC provides supervision of chemotherapy to Mt Isa and Proserpine patients remotely via this model.

Since this model is relatively new, it is important for the TCC to understand the perspectives of patients and health workers.

We invite the patients to participate in this evaluation/research to examine the following: (1) Quality of video consultations, (2) Rapport with specialists, (3) Benefits of V/C over F2F, (4) Satisfaction with care.

An administrative officer or a research nurse from TCC will conduct the interviews that take approximately 30 mins. Interview will be recorded and then transcribed to do further analysis. Details of the interview will be kept confidential and the name will be de identified. Results of this study will be published in journals to educate others about this model.

Participants have the right to terminate the interview if and when they become uncomfortable with it. They are reassured that non participation would not affect the way or the level of service participants receive from this model of care.

I have read the information sheet and agree to participate in this study.

Name:_____ Date:_____
Interviewer:_____ Date:_____
Witness:_____ Date:_____

Appendix 4: Interview guide

●Opening: Greeting, thank you, make sure setting is ideal.
●Same as the patient information sheet,
●Demographic details: age, sex, cancer type, whether they were seen face to face, how many videolinked consultations they attended, prognosis, whether they had chemotherapy via V/C.
●What is working and not working?

Then:

1. Quality of video consultations:

This section has questions relating to the quality of the video consultations that you have with the oncologist in Townsville.
Could you please tell me about:

1a) Ability to ask questions "How easy was it for you to ask the oncologist questions while you are in a videoconference consultation?"

- If the patient responds with no difficulties: "So you found it quite easy to ask any questions that you might have about your cancer, treatment, medications?"
- If the patient responds with finding some difficulty: "In what way/s did you find it was difficult to ask questions of the oncologist while you were in the videoconference consultation?"

1b) Addressing concerns. "Do you think your concerns were adequately addressed in the videoconference consultation?"

1. Yes. Progress to question 1c).
2. No. "In what ways did you find your concerns were not addressed?" (patient may have examples)

"Do you think that your concerns may have been better addressed if you were in a face-to-face consultation rather than video-conferenced consultation?"

1c) How thorough is the consultation
1d) Vision and hearing issues
1e) Ability to understand the content when it is finished.

2. Rapport with specialists:

Tell us about :
Closeness to the specialists/rapport,
How comfortable are you when you talk to specialists

3. Benefits of V/C over F2F

Tell us about your preference—travel to TSV (if yes,why)or see specialists in Mt Isa(if yes,why),
Other benefits (family, travel, work and anything else)
Other issues or disadvantages-

4. Satisfaction with care.

Tell us how satisfied are with the care provided in this manner,
Tell us about the value of having local nurses and doctors with you
Under this model, specialists don't examine you. Tell us about how you feel about it.

Closing:
Anything else we haven't covered about the videoconference consultations that you would like to tell me about.

Thank you.