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An evaluation of a telehealth-based specialist
consultation service for Indigenous people
living with diabetes in Queensland

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Abstract

Indigenous Australians living in regional Australia have limited opportunities to access specialist health services within their own community. Some of the reasons for this problem include the lack of specialists practising in regional or remote (distant) areas; preference of Indigenous people to access care at culturally appropriate facilities only (hence preference towards Indigenous centres); and the distance to metropolitan-based tertiary hospitals. In Queensland, due to the vast distances (and the geographical spread of relatively small communities), the challenges seem greater.

In 2015, a tele-diabetes service was established at a tertiary hospital in Brisbane (Princess Alexandra Hospital - PAH) connecting several distant Aboriginal Medical Services (AMSs – Aboriginal community-controlled health services) across Queensland. Videoconferencing equipment was installed at each local AMS and Indigenous clients were able to consult with a specialist from the PAH by videoconference at their local AMS. The first clinical sub-speciality to use telehealth services was endocrinology consultations, which predominantly provided for clients managing diabetes. At the time this new service was established, there was minimal evidence to substantiate whether the service would be a useful addition to these communities.

The aim of this study was to evaluate the usefulness of a telehealth service for Indigenous people *living with diabetes* in selected regional towns. Three Aboriginal Medical Services (i.e. three centres) located in distant parts of Queensland (Charleville, Cunnamulla, and Gladstone) were selected for the study. Both qualitative and quantitative methods were used for this multi-method study to explore the benefits and challenges. The study included Indigenous people, clinicians (e.g. general practitioners and specialists) and local Aboriginal health workers from the AMSs. Acceptability (client acceptance of the telehealth modality), comfort (in using the service for specialist consultations) and satisfaction with the service was assessed from the perspective of the specialist and Indigenous client (Strand 1 studies). The short-term clinical utilisation and clinical outcomes were appraised using activity data and client HbA1c levels (Strand 2 studies). An economic evaluation was also conducted using cost-minimisation analysis principles to compare the cost of the telehealth service with conventional service methods (Strand 3 study).

Nine specialist clinicians involved directly in case management of Indigenous clients and who used teleconference services (for endocrinology, geriatrics, orthopaedics, gastroenterology, dermatology and general practice clinical subspecialties) were interviewed. These clinical-subspecialties were identified as important for managing Indigenous clients with diabetes, in the process of providing comprehensive care. All specialists interviewed found videoconferencing a useful and clinically appropriate method for consulting with Indigenous clients (given the circumstances of limited access in distant areas). For clients who accessed the videoconsultation service, the clinical management decisions were comparable to an in-person consultation (as perceived by the interviewed specialists), if a comprehensive pre-consultation workup was available and a local general practitioner actively participated in the care process. However, streamlining the consultation at the remote end required a significant investment of time from local staff.

Twenty-three Indigenous clients (from Charleville and Cunnamulla) with a diagnosis of diabetes were interviewed during the study. Most clients interviewed, at the time of the interview had experienced at least one videoconsultation through the telehealth service. Clients found the service acceptable and were willing to use the service for diabetes care for as long as needed. However, they found that clinical quality (ability to achieve meaningful personal clinical conclusions) of the service was dependent on the active participation of local staff members or if available, a local general practitioner. The clients who accessed the service for videoconsultations, also found the experience comfortable and satisfactory. Client satisfaction was also confirmed through a separate study, using a satisfaction survey. This study also found that clients were satisfied (78%; n=18) with their videoconsultation experience. Importantly, all factors relating to client satisfaction were heavily dependent on the active participation of the local health worker at all stages of the care process.

Reports on clinical utilisation (for all three sites) showed that when an Indigenous community had no alternative options to access an endocrinologist - such as a regular outreach program, uptake of the videoconsultation service was higher (and 'no-shows' lower), as was the case for Charleville (n=35) and Gladstone (n=16); when compared with Cunnamulla (n=8) which was supported by a visiting outreach program. Evaluation of HbA1c levels of clients (of Cunnamulla and Charleville) over the first 24 months of the service showed that there was minimal improvement (an improvement assumed as an average reduction of HbA1c of 0.5 units or more) - only 0.3-unit reduction for Cunnamulla and a 0.1 increase in Charleville for the selected cohorts. Analysis of client-matched pre-post HbA1c levels showed that improvements

were shown among six clients (66%) from Cunnamulla and five clients (43%) in Charleville. The analysis of hospital and emergency department admissions (grouped data) of the two local hospitals at Charleville and Cunnamulla for diabetes-related admissions were, however, inconclusive (only a small numerical reduction in Cunnamulla; and an increase in Charleville).

A cost-minimisation analysis showed that when fixed costs of establishing the telehealth service (AUD \$9,520) were excluded, telehealth was the cheapest option (AUD \$95 per videoconsultation) for accessing a specialist for a consultation when compared to an outreach program (AUD \$513 per consultation). However, if the overall workload per site was less than 23 consultations per annum, then the visiting outreach program would have been less expensive.

This research demonstrates that in the right circumstances, telehealth can be used to provide Indigenous clients with diabetes, a convenient mode of access to a specialist. Whilst satisfaction and acceptance of telehealth services has been overall positive, different levels of activity were reported in each of the three communities. Several barriers or challenges seem to be associated with the uptake of the telehealth service. These include pre-existing outreach programs in telehealth-supported sites (reducing need for telehealth), lack of interest or motivation amongst staff at distant sites especially due to frequent turnover telehealth competent staff, the competence of clinicians and willingness of remote staff to work through problems such as time constraints (high case-load or competing health programs).

Introducing telehealth as a routine method of delivering health services to Indigenous communities is a complex process. In the context of supporting Indigenous communities, there are additional requirements which must be met to assist with the implementation and operation of telehealth in a culturally acceptable and sustainable manner. However, as clients become more familiar with accessing telehealth, they may expect the integration of telehealth-based services into all aspects of Indigenous health services in the future.

Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, financial support and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my higher degree by research candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

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Publications included in this thesis

1. **Wickramasinghe SI**, Caffery LJ, Bradford NK and Smith AC. Enablers and barriers in providing tediabetes services for Indigenous communities: A systematic review. J Telemedicine and Telecare. 2016; 22: 465-71. (Incorporated as chapter 3)

Contributor	Statement of Contribution
Wickramasinghe SI (Candidate)	Collected and analysed data 100%; Wrote manuscript 90%,
Caffery LJ	Wrote manuscript 5%
Bradford NK	Revised and edited the draft manuscript
Smith AC	Wrote manuscript 5%

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Contributions by others to the thesis

Professor Anthony Smith assisted in designing the service, in developing the evaluation framework and in critically revising the findings of the study. Dr. Liam Caffery and Dr. Natalie Bradford assisted in designing the study and interpretation of data. Professor Jeanine Young, Associate Professor Peter Hill and Associate Professor Anthony Russell reviewed the work at various stages of the study and prior to submission.

Statement of parts of the thesis submitted to qualify for the award of another degree

None.

Research Involving Human or Animal Subjects

Ethical clearance for this research was obtained from the behavioural and social sciences ethical review committee of the University of Queensland - number 2015001105 (copy attached in annexure).

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List of Abbreviations

ABS	Australian Bureau of Statistics
AHW	Aboriginal Health Worker
AMS	Aboriginal Medical Services
ATSI	Aboriginal and Torres Strait Islanders
DA	Diabetes Australia
DR	Diabetic Retinopathy
GP	General Practitioner
HbA1c	Glycated haemoglobin
ICD	International Classification of Diseases
IHW	Indigenous Health Worker
MS Excel	Microsoft Excel
NDSS	National Diabetes Services Scheme
NSW	New South Wales
PAH	Princess Alexandra Hospital
QH	Queensland Health
RCT	Randomised Controlled Trial
SES	Socio-Economic Status
Telediabetes	Specialist diabetes services provided via telecommunication platforms
VC	Videoconferencing
WHO	World Health Organization

Chapter 1: Introduction

1.1. Background to the thesis

The poor health outcomes of the Australian Indigenous people are well documented ^{1, 2}. Even with several Indigenous community-focused programs implemented across Australia, the life expectancy of Indigenous Australians has failed to catch up to other Australians. However, recent reports (2017) show that some improvement in the life expectancy of Indigenous Australians had been achieved: by 1.8 years for Indigenous males (from 68.3 to 70.1 years) and by 0.6 years for Indigenous females (from 73.9 to 74.5 years). Furthermore, these increases appear across all ages, though the changes were not significant for females ³. However, with increased life expectancy predicted for the Australian population⁴ in general, this gap could further widen in the future.

For the purpose of this thesis, the Australian Indigenous people, also known as Australian Aboriginal people or Aboriginal and Torres Strait Islander people, will be referred to as 'Indigenous people' or 'Australian Indigenous people'. The Indigenous people who were interviewed for this research are referred to as 'clients' throughout this thesis. However, the term 'patient' is used context-specifically, where relevant.

'The tyranny of distance'

The reasons for poor health outcomes among Australian Indigenous populations are multifaceted. The social determinants of health (education, poverty, etc.) play a significant role in contributing to these poor outcomes. Poor access to specialist health services has also been a contributor to this problem, especially for those living in remote or regional (distant) areas. Even to date, approximately one-fifth of the Australian Indigenous population still live in areas considered remote ^{5, 6}. The distance needed to travel to a metropolitan tertiary health care facility and the lack of specialists in rural areas create significant barriers to accessing specialists. Unfortunately, the Australian Indigenous people have been witness to this "*tyranny of distance*" for many generations ⁷. In most cases, general practice, nursing and allied health

services (e.g. Country Health Service Nursing Posts in Western Australia) substitute for the lack of specialist services for these remote Indigenous clients.

Among Australian Indigenous people, the most prevalent chronic disease today (apart from others, such as heart disease) is diabetes mellitus ⁸. Diabetes is nearly three times more prevalent amongst Indigenous Australians when compared to the non-Indigenous populations of Australia ⁹.

The telehealth service

In 2015, the Princess Alexandra Hospital (PAH) telehealth centre initiated a telehealth-based (using videoconferencing for specialist consultations) service for Indigenous communities in distant (regional) parts of Queensland. The primary aim was for this service to bridge the gap in access to specialist health services for Indigenous communities in distant parts of Queensland, by connecting clients with specialists through a videoconsultation service. One of the first specialist clinical services delivered by the service was a tele-endocrine service, mainly providing assistance for clients with diabetes.

The potential usefulness of this telediabetes service to Indigenous clients, at the time of service initiation, was unknown.

1.2. Research question, aim, and scope of the thesis

The primary research question for this work was whether the telediabetes service (videoconsultation-based specialist consultations for diabetes) has the potential to be useful to Indigenous clients with diabetes who live in distant parts of Queensland.

Therefore, the primary aim of this research was to evaluate the potential usefulness of the telediabetes service. The evaluation was undertaken from the perspective of the health service.

The work evaluates acceptability and comfort (to the Indigenous client and local health workers) with the service, satisfaction, uptake through analysis of activity, outcomes through evaluation of HbA1c levels, and economics.

1.3.The research context and methodology

Optimal long-term care for diabetes includes lifestyle modification, minimising complications by early diagnosis of complications, and continuity of clinical management ¹⁰. A patient-centred management plan¹¹ prepared early in the diagnosis may provide clients with a quality of life comparable to that of a person without diabetes.

Indigenous people who live in remote areas have difficulty in accessing specialist services due to the distance to metropolitan hospitals¹². Diabetes is one of the most significant problems among Indigenous communities and has been for over a decade ¹³. The problem is even more acute for Indigenous people residing in rural and remote areas. For these distant Indigenous communities, inefficiencies in the delivery of optimal specialist healthcare services have been further augmented by distance and the lack of rural diabetes (endocrine) specialists ^{14, 15}. Queensland's healthcare delivery system follows a regionalised model where specialist tertiary centres are built amongst larger population masses, mostly in metropolitan areas.

Telehealth provides a unique opportunity to provide a solution to Indigenous clients from distant areas, who are otherwise burdened by a lack of specialists and remoteness. In early 2015, telediabetes services (specialist diabetes services provided via a videoconference platform) were set up in several distant Queensland communities and delivered from the PAH.

The PAH telehealth service to Indigenous communities

The telehealth service based at the PAH was established in 2012. The initial clientele were generally non-Indigenous populations, as services were only extended to Queensland Health facilities. Three years after its initiation, the service planned extensions to the program, to include some Indigenous communities in regional parts of Queensland. Cunnamulla Indigenous medical service was the first such community to be set up with telehealth capability through the PAH telehealth service.

The use of telehealth is a novel approach in delivering health care to Indigenous communities in distant areas. It promises greater accessibility and reduced costs to the client as well as to the public health service. It is anticipated that the improved access to specialised diabetes services, delivered via the telediabetes service, will improve individual longer-term outcomes with improved control and compliance.

The Indigenous telediabetes service currently delivered by the PAH telehealth centre will be a platform for investigating and exploring the potential of these telehealth services for remote Indigenous communities. During the time of this study, an outreach service was also delivered to Cunnamulla (only) - provided by the endocrinology department at the PAH (by the same team providing the telehealth service). It was hoped that (comparative) findings would be helpful in future decision-making about the development and possible upscaling of such services.

Research methodology

This research was initiated by reviewing the literature on examples of how telehealth has been used successfully for Indigenous health provision for clients with diabetes. Examples from any Indigenous community from around the world were included in the review.

The main study included three strands of research.

Strand 1: Stakeholder perceptions. This strand included two qualitative studies, identification of enablers and barriers (through interpretation) and a survey of satisfaction of Indigenous clients who have had at least one videoconsultation. The qualitative studies reviewed perceptions of Indigenous clients, local health workers, and specialist clinicians.

Strand 2: Outcome evaluation. This strand evaluated activity data of the new service and clinical parameters of clients, through a review of HbA1c levels.

Strand 3: Economics. An economic analysis was conducted using cost-minimisation principles.

1.4.Original contributions to knowledge

The thesis makes several contributions to the evidence base relating to telehealth services in regional Indigenous settings of Australia.

1. Through the analysis of interviews with stakeholders, an understanding of the acceptability of the telediabetes service amongst the Indigenous clients was established (chapter 5).
2. Perceptions of local health workers (including GPs) on how Indigenous clients of the area connected with and utilised the telehealth service was ascertained (chapter 5).

3. A survey to assess satisfaction regarding the telediabetes service was developed and the level of satisfaction (among clients) in using videoconsultations for diabetes care was assessed (chapter 6).
4. Through short-term service evaluation, various aspects of patient management and improvements made to clinical care (as a direct result of the videoconsultations) were identified (chapter 7).
5. The current activity level of the service was evaluated at each site as a guide to the uptake of service (chapter 7); in sites where telehealth was the only option to access an endocrinologist, uptake was satisfactory.
6. Short-term changes to the hospital and emergency admissions, pre- and post-introduction of telediabetes services, were reviewed (chapter 8).
7. Clinical outcomes of clients (through review of HbA1c levels over two years) who accessed videoconsultations were reviewed (chapter 8).
8. An evaluation of the costs of providing the telehealth service and a cost comparison between other methods of providing care was conducted. Telehealth as the lowest cost model was identified (chapter 9).
9. Diabetes-related culturally appropriate educational material (as brochures) for the Indigenous communities in which the study was conducted was developed and distributed (Chapter 5).

1.5. Research outline

The structure of the thesis is outlined below (see tables 1 and 5 below).

Chapter 2 provides an introduction to the study. The research intersects three domains: telehealth, Indigenous people and diabetes. Each of these domains is described in this chapter as a measure of providing context to the study.

Chapter 3 is a review of the literature. Enablers of, and barriers to, telediabetes services for Indigenous communities have been described (the submitted manuscript of a publication is included).

Chapter 4 of the study provides an overview of the research design. Methodological approaches of the study and the four strands of the study are described here.

Strand 1 studies

Research question: What are the perceptions of stakeholders regarding the usefulness of the new telediabetes service?

The research question is examined, and findings are detailed in chapters 5 and 6.

Chapter 5 is a qualitative evaluation of stakeholder perceptions of acceptability and comfort. These aspects are evaluated through interviews with specialist clinicians, clients, and local health workers. Enablers of, and barriers to, the new telehealth service were also identified through analysis and interpretation.

Chapter 6 is a quantitative measure of client satisfaction after accessing at least one videoconsultation to consult with a specialist for diabetes. The study describes the development and validation of the survey and the assessment of satisfaction of the Indigenous clients accessing the telediabetes service.

Strand 2 studies

Research question: How is the uptake and what are the outcomes of the service, as measures of the usefulness of the service in delivering specialist care?

The research question is examined and findings are described in chapters 7 and 8.

Chapter 7 is an evaluation of activity data. It reviews clinical records of clients after one year of service operation from three sites (Charleville, Cunnamulla, and Gladstone). This short-term evaluation explores scheduling data and usage rates at each site, rates of non-attendance to scheduled appointments and the demographic profile of the patient cohort.

Chapter 8 is an evaluation of hospital admissions for diabetes-related morbidities, pre- and post-introduction of telehealth to the communities. Anonymised HbA1c levels of clients are also evaluated pre- and post-telehealth intervention. This study uses quantitative methodologies.

Strand 3 study:

Research question: What are the costs of the new service and how do they compare to other options?

The findings of this study are described in chapter 9.

Chapter 9 is an evaluation of the actual costs of the telediabetes service, compared with the costs of a visiting outreach program. The study uses cost minimisation principles. The analysis includes a threshold point calculation and sensitivity analysis.

Chapter 10 is the synthesis of findings of each of the studies above, a discussion of the implications and concluding remarks.

Table 1: Tabular representation of the research outline

Study: An evaluation of the telediabetes service to Indigenous communities in Queensland		
<i>Background and Literature Review</i>		
Strand 1: <i>Stakeholder perceptions</i> - Stakeholder perceptions (clients, local staff and specialist clinicians) - Client satisfaction with the telediabetes services	Strand 2: <i>Outcome evaluation</i> - Evaluation of service utilisation - Evaluation of clinical outcomes (HbA1c and emergency admissions)	Strand 3: <i>Economic analysis</i> Cost-minimisation analysis of telehealth and outreach options for Cunnamulla
<i>Conclusions and Recommendations</i>		

Contribution

The study contributes to the evidence base on the usefulness of telehealth services for Indigenous clients with diabetes living in distant communities. Though findings are from Indigenous communities in Queensland, they may be applicable to other Indigenous communities in Australia or in other countries. However, the local contexts, availability of local health services and circumstances of clients are likely to be different at each location; hence, the utility of findings is most likely to be affected by local factors. Therefore, the interpretation

of findings of this study with relevance to other Indigenous communities should be considered carefully.

1.6. Conclusion

The purpose of this chapter is to introduce the research and describe how the study was conducted. The context of the study and its outline has been described initially. The research question, its aims, the scope of the study and the structure of the thesis have also been described. In the next chapter, telehealth services, functionality of telehealth, relevant aspects of Indigenous health services and diabetes will be described in depth.

Chapter 2: Contextual background

2.1 Overview

The research question, and the aims and scope of this thesis were described in the previous chapter. In this chapter, important aspects of the overlapping domains of this research (Indigenous communities, diabetes, and telehealth) are investigated. The chapter consists of four main sections - factors affecting uptake of traditional western health services by Indigenous people (section 2.2), diabetes and its effect on Australian population groups (section 2.3), evidence to the probable effects telehealth services have on Indigenous people (including the factors that will affect uptake of such services (section 2.4)) and a description of the new telehealth service to the distant Indigenous communities in Queensland (section 2.5).

2.2 Indigenous Australians

Australia is a continent with a relatively small population. The population density of Australia is 2.91 persons per square kilometre, making Australia the third least-densely populated country in the world ¹⁶. The Australian Indigenous population is spread across this large country, across several small communities dispersed mainly throughout the internal areas of the country.

Heritage

The first Indigenous people arrived in Australia approximately 50,000 years ago, having migrated from the African continent ¹⁷. They lived as separate clans, hunting and gathering food from the waterways and bushlands. As time passed, these native populations developed vibrant and complex languages, customs, art forms and cultures. Many of their customs were strongly connected to the lands in which they lived ¹⁸.

In the 1770s, the first European settlers arrived in Australia. They first arrived in the general area now identified as Sydney. With these European settlers came diseases unfamiliar to the native

population, decimating native population numbers in the ensuing years. Added to this were the armed conflicts between the natives and the settlers, further reducing native population numbers ¹⁸.

Recent times

Between 1910 and 1970, various Australian governments adopted a process known as assimilation: the forcible removal of Indigenous children from their native families. These children were forced to embrace European culture and to reject their own Indigenous heritage. This process has heralded a continuing legacy of trauma and loss that affects many Indigenous families, even to date ¹⁹.

At present, there are about 500 different Indigenous population groups living throughout Australia, each having specific cultural and language origins. By the turn of the 21st century, there were around 150 Aboriginal languages in use amongst these groups. However, at present, around 90% of these languages are considered endangered ²⁰.

Health outcomes

There is a large gap in health outcomes for Indigenous people compared to other Australians. Many factors have contributed to this, but factors related to the social determinants of health (poor employment conditions, social exclusion, inadequate early childhood care, and poor gender equity) are some of the main causes. In some instances, small inequalities have led to large differences in health equality.

For Indigenous Australians, lack of (or limited) inclusion in mainstream society (social exclusion) is an important factor in accessing health services. As mainstream (conventional) western health services are poorly adjusted to cater to Indigenous people (or not preferred by them), access to, or use of, any available health service is relatively poor.

Social disadvantage

Poor educational achievement among Indigenous groups, stemming from either the lack of opportunity or the poor uptake of available resources, has led to significant social disadvantage for some Indigenous communities. As a result, these problems have led to lower employment rates, higher rates of substance abuse, and poor nutrition among those communities. Furthermore,

collectively, these factors have contributed to poor outcomes in long-term chronic health conditions, lower life expectancy and higher death rates for Indigenous Australians ²¹.

‘Closing the gap’

In view of these factors, in 2006 Australian Indigenous and non-Indigenous organisations, human rights organisations, and the State and Commonwealth Governments developed the ‘Closing the Gap’ initiative. The main aim of this program was to bridge the gap in health outcomes between Indigenous and non-Indigenous (to improve Indigenous health outcomes and to close the gap in outcomes between Indigenous and non-Indigenous) Australians, so that Indigenous children born by 2030 would have the same life expectancy as any other Australian person ²². Several programs aimed at improving child health, health promotion, and disease prevention have been funded by either the Commonwealth Government or the state governments throughout Australia ^{23, 24}.

Population parameters of Indigenous Australians

The most recent population estimate for the resident Aboriginal and Torres Strait Islander (ATSI) population in Australia (2016) is approximately 800,000. Of this, the largest population of Indigenous people, 265,000 (approx.), lives in New South Wales (NSW), followed closely by Queensland. Population projections show that by 2026, the Indigenous population in Queensland will equal that of NSW²⁹.

Diabetes and the Indigenous person

The health of an Indigenous person with diabetes is influenced by several factors, such as family, community connections, rurality, socioeconomic conditions and race. Within the socio-ecological model (where external layers of society affect an individual’s behaviours), living with diabetes for Indigenous people means that health-related behaviour is influenced by external persons or institutions. There is a rich history of diabetes as an iconic disease in Indigenous communities, often described by Indigenous persons as a direct inheritance of dislocation, removal from lands, and other issues ³⁰. This is also overlaid by issues of rurality and remoteness as the effect of (poor) social determinants of health is more acute in distant areas.

An Australian Indigenous person's perception of Diabetes

Diabetes self-management generally requires regular monitoring of blood sugar, medications, attention to diet, and regular exercise. Adhering to these and managing personal well-being appropriately usually means that an Indigenous person must attempt to change their lifestyle (routinely affected by external events). Perceived severity of the disease, perceived need for continuous self-care and self-control of nutrition, and regular exercise are lifestyle changes often difficult for an Indigenous person to make (primarily due to strongly held beliefs regarding diabetes) ³⁰.

Poor acceptance

Indigenous people often don't accept the diagnosis of diabetes (or having high blood sugar levels) easily. Acceptance of the diagnosis (of having diabetes) is a prerequisite to making the necessary changes to lifestyle essentially needed to cope with the disease. However, evidence shows that Indigenous people have often had difficulty accepting the required chronic disease care ³⁰ and medication advice ³¹.

Dietary changes

The present-day Indigenous diet is described as significantly different from the past: abundant with fats and sugars ³⁰. When Indigenous people were living off their lands (as hunter-gatherers), the major proportion of energy was from meat or food collected from the land. Furthermore, the process of gathering food included an abundance of exercise, as it required moving from place to place.

Alcohol consumption

The consumption of alcohol is also significantly higher among Indigenous people today ³². The lack of gainful employment in distant communities, limited opportunity, and social disadvantage are important aspects affecting this issue. Furthermore, the high per capita alcohol intake may also be contributing to the reduced health indicators and lower life expectancy observed for Indigenous communities. Importantly, these factors demonstrate the complex relationship Indigenous people have (including restricted access) with the paradigm of healthcare-seeking itself ³³.

Family connections

Several inter-related factors affect how Indigenous people seek care when living with diabetes. *Firstly*, family and community connections of an individual strongly affect health-seeking. For an Indigenous person, connections with the family and their local Indigenous community have a significant effect on the individual diabetes self-management journey and healthcare-seeking behaviour. Thompson *et al.* ³⁴ alludes to this fact:

*“When Melbourne Aborigines talk about trying to manage their diabetes, it is not only their sugar that is out of balance, it is their whole life. And when they talk about stabilizing their sugar, these discourses are often woven into wider narratives about individual and community struggles to maintain a sense of coherence, control and stability over present life circumstances and the future. **Achieving a ‘balance’ in life requires the maintenance of meaningful connections to family, the land, the past, and future, all of which are important for health and wellbeing.**”*

These external (family or community) connections also mean that irrespective of their disease status, clients will conform to the traditions of the family (or clan) and try to be a part of family/community events. An example of such behaviour would be when an Indigenous adult male joins the family meal disregarding nutritional advice or restrictions, as a way of contributing and bonding with the family. However, these external parties (and related socio-ecological contexts) can influence the response and uptake of new health services for clients. Therefore, any new health service has to be able to provide relevant services holistically. For example, when a patient’s diet is influenced by the family who cooks the patient’s meals, the service has to be able to meet the education needs of the family as well as those of the client (e.g. by extending educational programs).

Secondly, Indigenous people viewed their day-to-day activities as routinely influenced by unpredictable events. These included family activities, community commitments, social and cultural responsibilities, and even the local weather. This is also referred to as living per ‘*decrees*

of nature, in harmony'. As a result, Indigenous people find it difficult to regularly act in conformity to advised ways of managing diabetes ³⁰.

The third factor affecting diabetes self-management of Indigenous people is the mismatch created by the contemporary 'top-down' delivery approach of traditional western health systems. A 'top-down' approach means that health services for Indigenous people are developed excluding the recipient from the design process. Such an approach can disconnect the Indigenous person from the health care delivery system. When a health service is not developed in such a way that Indigenous cultural features or mannerisms are accepted, they are easily turned away. This is further influenced by the politics of Indigenous health (inequitable policies, unequal distribution of resources, etc.), rurality and the local context.

However, the limitations with poor self-management of diabetes in Indigenous patients do not seem to correlate well with their level of understanding of the ill-effects of the disease. Thompson *et al.* reported that the Indigenous people interviewed for the study were 'well aware' of the impacts of diabetes on themselves and their communities ³⁰. Results from the DRUID (Diabetes and Related conditions in *Urban* Indigenous people in the Darwin region) study ³⁵ also finds that Indigenous people understood the negative effects of diabetes and its complications ³⁰. It is possible that the understanding is yet to be translated into meaningful action or change in lifestyle.

Diabetes and the younger Indigenous population

The burden of diabetes among the younger Indigenous population is also increasing ³⁶. For young Indigenous clients with diabetes, close and lifelong management of diabetes is essential to minimise complications (of living with a chronic disease). Furthermore, diabetes has a different social-complications profile for younger patients compared to older adults. These include stigma, difficulties of living and managing the disease for a longer duration and the feelings of guilt and being different from peers.

Socio-economic status

The DRUID study reported above showed an inverse relationship between socio-economic status (SES) and diabetes among younger Indigenous clients. This relationship was true even when the

diagnosis of diabetes was not apparent in the younger client group³⁷. Such an inverse correlation related to the SES directs the need for distinctly separate care programs dependent on the age of the client and also considering their social circumstances. It is likely that similar relationships exist for other Indigenous population groups as well.

Mode of care delivery

Acceptance of the health care delivery mode is also important when long-term working alliances are developed with Indigenous clients. For young Indigenous clients, who are essentially more ‘tech-savvy’ than their older generations, novel intervention strategies such as mHealth or telehealth have the potential for being better accepted than traditional methods. Better acceptance of the healthcare delivery model can also assist the agreement with care options, increased uptake, and continuity of care. However, interventions that include information technology need to include the target population—the young Indigenous adults—in its development.³⁸ It is most likely that using technology-based options for older Indigenous clients (due primarily to the fear of change) would not be as easy as for the younger Indigenous client.

Uptake of traditional western healthcare

Uptake of traditional western healthcare service by an Indigenous person is affected by several factors. The utilisation of the locally available health resource is dependent on an optimal association (including trust, respect, and cultural appropriateness) between the Indigenous community and the local health centre. Importantly, Indigenous clients who live in distant and rural areas have limited options to access health care resources other than for their local health centre. In some circumstances, if a particular service is unavailable locally, clients would need to travel several hours to a metropolitan hospital to access care. However, in reality, most Indigenous clients may simply forego travelling long distances to access care or may even try inept home remedies.

Another important factor affecting the uptake of traditional health services by Indigenous people is the perception that care provided to them is ‘suboptimal’. In most instances, this is subsequent to an event where a poor understanding of the Indigenous client’s cultural and social contexts had

preceded³⁰. The ‘substandard treatment’, as perceived by an Indigenous client may also be a consequence of the health staff not understanding what Indigenous people may distinguish as appropriate. Indigenous people may prefer to be treated in a certain way at a health centre, in accordance with their cultural practices, but most traditional western health services are not accustomed to accommodating these needs. Furthermore, Indigenous people are known to keep silent about any ‘perceived maltreatment’ witnessed at western health centres, leading to a process of mute rejection. When traditional western health services do not provide services as per Indigenous requirements they are more likely to ‘stay away’ and refrain from accessing the care ³⁹.

Fear of racism and discrimination at health institutions are some of the other reasons Indigenous people refrain from seeking western health services. They perceive that speaking out against ‘maltreatment’ may make things worse for them in the future. As a result, by delaying or avoiding seeking care at the appropriate time, the health status of the client will deteriorate, and when care is eventually sought the health problem would have become complicated⁴⁰. Therefore, western healthcare services should aim, not only to alleviate disease but also to care for the needs and aspirations of an Indigenous person during an interaction. However, in many instances, as some authors have found, this has not been the case, leading to prejudice and discrimination:

*"Prejudice and discrimination change the sort of treatment they receive; it also makes them feel unwelcome, uncomfortable, not deserving or prejudged. There are **“lots of scenarios” of Aboriginal people being considered to be seriously intoxicated when in fact they’ve been seriously ill.**" ⁴¹*

Access to traditional western health services

The Australian Bureau of Statistics (ABS) estimates that 18% of the Australian Indigenous population lives in Indigenous communities considered to be remote. Only 10% of these people live in a community with a hospital. Although more than 140 community-controlled Indigenous medical centres are available across Australia, fewer than 50% of these centres had a regular medical doctor. However, in some instances, to access the doctor patients had to travel significant distances (up to 100 km) outside their community. Only 41% of Indigenous communities had local

access to a doctor at least once a week or once a fortnight and only 20% of the Indigenous people (from distant areas) had access to a doctor on a daily basis ⁴².

Cultural appropriateness of conventional western health services

Conventional health services or western health refers to the traditional way general health services are delivered in Australia, where a health service is funded and managed by the state or federal governments. Contrarily, even though Indigenous health services are funded by the state and federal governments, the local management of each service is the responsibility of a committee appointed by the local Indigenous community or clan. Such a service, managed by local leaders and community elders is able to make changes quickly (e.g. including cultural aspects) according to local needs.

Cultural appropriateness

Cultural appropriateness is an important aspect of any health service for Indigenous people when accessing care. When Indigenous clients are provided with culturally appropriate health services (as perceived by them), they are comfortable and more accepting of the care received²⁵. It also increases the attraction and retention of clients within the health service. Other features that make a health institution culturally appropriate for Indigenous clients are having Indigenous artwork on the walls of the institution, use of cultural ceremonies such as a smoke ceremony prior to any clinical work, and the presence of local Indigenous health workers to support Indigenous clients during consultations²⁶. Furthermore, acceptance of the Indigenous lifestyle and belief systems by the non-Indigenous health staff is also important. In this context, Hart and others have also shown that, when a health service fails to provide culturally appropriate Indigenous characteristics in the health service, clients have difficulty in identifying themselves with the health centre²⁷. This may lead to poor uptake of services even if the service was easily available locally.

Cultural competence

Another important characteristic of cultural appropriateness (of a health service) to Indigenous clients is ‘cultural competence’. Cultural competence is defined as ‘*a set of behaviours, attitudes, and policies that come together to enable a system, agency, or professionals to work effectively in cross-cultural situations*’²⁸. Cultural competence (of health workers and institutions) allows Indigenous clients to be comfortable with how they seek care at a health institution.

The Australian Institute of Health and Welfare (AIHW) describes cultural competence as ‘*more than just cultural awareness*’. It is an inclusive process of tailoring health services to suit Indigenous client needs, with close consultation and dialogue with all stakeholders - clients, local community leaders, and elders, as needed. Any changes made to a traditional western health institution (primarily its staff) to develop cultural competence should reflect on aspects of respect to Indigenous culture and their history and a sensitive exploration of perceptions. Such changes make Indigenous clients feel comfortable and at ease when seeking care at health institutions usually catering to a non-Indigenous clientele. Education of non-Indigenous health care workers to increase engagement with the local community and be understanding of the ordinary Indigenous cultural characteristics (such as ‘sorry business’ during a bereavement period) is also important. Once strong relationships are built with local Indigenous communities, delivering health services can be expediently attained²⁸.

Primary healthcare services for Indigenous people

Primary care services for Indigenous communities include general practice services, primary care providers at the local hospital and allied health personnel, all providing the first point of contact within the health system⁴³. As described above, most distant and rural Indigenous communities only have access to primary healthcare services. Hence, response to acute illness or injury becomes the responsibility of these local primary care services.

In Indigenous communities, the primary care service provides several community health facilities. These include screening programs and population health programs, such as youth education or substance abuse prevention programs, to the local community. Community screening is an important measure of Indigenous health services, as it can detect risk factors for previously

unrecognised chronic diseases, such as diabetes, among adult Indigenous people. Primary care services in Indigenous communities also act as gatekeepers for specialist and tertiary care services of the public health sector through screening, triage, and referral ⁴⁴.

In remote Indigenous communities, primary care services to the Indigenous population are mainly provided by an 'Aboriginal Medical Service' (AMS). By June 2007, there were 248 AMSs funded by the Australian Government providing direct health services to Indigenous communities; 198 of these were Indigenous community controlled ⁴⁵. Community-controlled health services are wholly managed Indigenous community health centres providing a variety of health services to the local Indigenous community. The health service is managed through a committee of Indigenous community leaders in the local community. Remote Indigenous communities are commonly provided with general practice services through these AMSs or through independent GPs servicing the area.

Approximately half of the AMSs in remote regions provide outreach primary care and dental care services to even distant parts of the local community (especially for those clients who have difficulties in accessing care due to disability or advanced age) ⁴³. These primary care services also manage shared care needs (specialist and primary care by visiting clinicians) of their clients ⁴⁶. Significantly, up to 94% of the AMSs provide at least one specialist service in addition to the usual primary care service. Arrangements are made with visiting specialists and allied health specialists of the public and private health sector to provide services, mostly through contractual outreach arrangements.

Politics of Indigenous health

The political context of Indigenous health affects the context in which Indigenous health services are delivered. Dysfunctional policies, policy inertia, and political systems have all contributed to poor health outcomes, resulting in Australian Indigenous people having significant gaps in life expectancy compared to other Australians. Some of the other problems (e.g. poor access, overlapping services or programs) are also due to complexity in local health systems and poor communication between Indigenous health services ⁴⁷.

The utilisation of primary care services

Since access to specialised diabetes services for an Indigenous client (living in a distant area) is generally through their GP, mostly in the form of a referral letter, it is important to understand how Indigenous people access their local primary care provider. Generally, the Australian Government finances primary care services to Indigenous clients either through the Medicare Benefits Scheme (MBS) or through special programs such as ‘Closing the gap’³⁹.

In 2004, the Australian Government reported that Indigenous Australians accessed the Medicare Benefits Scheme (MBS) and the Pharmaceutical Benefits Scheme (PBS) at less than half the rate compared to that of non-Indigenous Australians⁴⁴. However, by 2011, access to primary services by Indigenous Australians had somewhat improved. When reviewed through usage rates of Medicare-reimbursed general practice-type consultations, access by Indigenous populations showed similarity in access rates to those of non-Indigenous Australians⁴⁸. However, these statistics do not show the disparity between different communities where access is dependent on geography and the care needs of the population. It is possible that Indigenous clients accessed general practice services repeatedly, for morbidities that simply needed specialist care, in the first place.

Furthermore, for complicated health problems, the primary care physicians may wish for the patient to be seen sooner than if it was for a minor ailment. With the lack of access to specialist services due to unavailability, Indigenous clients from remote areas may present to the local primary care services at a more complicated point in their disease process and thus would lead to an increased number of encounters with primary care providers.

Another possible impact of telediabetes (telehealth) services is the effect on relationships and communication between involved stakeholders, e.g. communication of recommendations to the GP. Evidence shows (from tele-oncology services) that primary care services are able to adapt and take up the change in service delivery at short notice. However, how primary care services adapt to delivering chronic disease care (considering oncology services as critical) would also be important, given the long duration clients live with a disease such as diabetes.

Access to specialist health services

In Queensland, specialist health services for Indigenous people are generally provided through the Queensland Health (QH) network of hospitals, local private practices, and outreach services from community-controlled Indigenous health services. Indigenous clients access specialists mainly through the public health system (funded by the government) with minimal access to private specialists, as this commonly requires out-of-pocket payments.

In 2010 access to Medicare-reimbursed specialist consultations by Indigenous Australians was slightly lower than for non-Indigenous Australians. The Indigenous client usage rates of Medicare-reimbursed specialist services were 5,600 per 1,000 population and the non-Indigenous usage rate was 6,300 per 1,000 population⁴⁹. This disparity could be the result of a lack of specialists in rural areas and the distance needed to travel to metropolitan hospitals to meet with a specialist, leading to lower access rates. As described above, Indigenous clients probably compensated for specialist services by accessing their local GP frequently.

2.3 Diabetes Mellitus

Diabetes is a chronic non-communicable disease, which becomes apparent when the human body is unable to produce adequate quantities of insulin to compensate for bodily needs⁵⁰.

Subtypes of diabetes

To date, several subtypes of diabetes have been described⁵¹. The type 2 subtype of diabetes predominates in adults (age 20 -79) all across the world. This type develops over many years, initiating with end-organ insulin resistance. The body compensates by producing more and more insulin, which eventually leads to inadvertently destroying insulin-producing cells in the pancreas. At the time of diagnosis, patients would have lost >50% of the beta cells of the pancreas. Therefore, a diagnosis of type 2 diabetes entails a combination of inadequate and ineffective use of insulin with an ongoing destruction of insulin-producing cells⁵².

The type 1 subtype of diabetes, diagnosed mostly among children, is, on the contrary, an autoimmune destruction of insulin-producing cells, with the patient becoming dependent on injectable insulin for their total lifespan. This subtype accounts for 10% of all cases of diabetes world-wide⁵³.

Diagnosis and Management

Some of the first signs and symptoms of diabetes include an increase in thirst, increased frequency in urination, tiredness and a ‘pins and needles’ sensation in hands and feet⁵². Screening for diabetes complications such as retinopathy, renal disease, and diabetes-related lower limb complications is also important. Management of diabetes requires constant review and follow-up with primary care providers, with a periodic review by an endocrinologist. Management of the disease requires early detection and appropriate use of medication to lower blood glucose and lifestyle modification.

A tightly defined schedule for periodic review by allied health professionals such as optometrists, dietitians, and podiatrists is also necessary.

Among the complications of diabetes, chronic renal failure is the most important. Patients who end up with diabetes-related end-stage chronic renal failure need to be dialysed for survival – a very costly exercise for the patient and the public health service. A more permanent solution is to carry out a kidney transplant. Still, patients would need to be on a host of anti-rejection medications for an extensive period.

Diabetes as a global epidemic

Diabetes is a global epidemic. The current *prevalence* of diabetes in the global population is approximately 8.5%, amounting to 422 million people living with the disease across all regions of the world⁵⁴. Importantly, the prevalence of diabetes is found to be continuously growing in every country around the world. In 2012, diabetes was estimated to be directly or indirectly related to 1.5 million deaths worldwide.

The *financial burden* of diabetes on the individual with the disease, family and health services of a country is also immense. The costs associated with diabetes include direct medical costs of

medication, laboratory tests and indirect costs such as loss of productivity and loss of earnings due to premature death.

The estimated global cost of *managing diabetes* is estimated to be US\$827 billion per annum. Furthermore, during the decade of 2003 to 2013, the cost of managing diabetes was estimated to have tripled ^{54, 55}. Most of these increased costs are associated with increased prices of patented drugs and the use of branded medications, although none of them have shown to be superior to generic medications. Importantly, the association of diabetes and catastrophic individual medical expenditure is also well-established and has increased among families from developing and middle-income countries ⁵⁵.

Prevalence of Diabetes in Australia

Approximately 115,000 people were registered as living with diabetes in Australia in the last 12-month period (as at March 2019). According to the Diabetes Australia (DA) data, the national peak body for diabetes in Australia, more than 1.3 million people are currently (2019) registered with the National Diabetes Services Scheme (NDSS). The NDSS provides all registered patients with several diabetes care services, free at the point of delivery ⁵⁶.

In 2014, people aged above 60 years accounted for more than 700,000 of the registered patients of the NDSS. Diabetes Australia also reports that the prevalence of diabetes is twice as high in remote areas as in major cities. The prevalence of diabetes in the Indigenous populations is also around four times higher when compared with non-Indigenous Australians ⁵⁷.

2.4 Telehealth services

The definition of telehealth, in its simplest form, is the use of telecommunication platforms to deliver healthcare. The World Health Organization (WHO) defines telehealth as:

“The delivery of healthcare services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and

evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities”⁵⁸.

Telediabetes services

A telediabetes service is the use of telehealth to deliver health services to people living with diabetes. An example of a telediabetes service is when a patient in a remote community has a consultation with an endocrinologist via a videoconference facility. A telediabetes service may use a range of synchronous and asynchronous communication techniques. These include telephone services, email, facsimile, and videoconferencing services.

Videoconferencing

Videoconferencing is the synchronous (real-time) transfer of audio and video image. A teleconsultation that uses videoconferencing will need a pre-consultation workup for the transfer of patient data, pathology and laboratory reports prior to the consultation. Usually, email, facsimile or telephone services are used to communicate these prior to the actual consultation. Since both synchronous (video) and asynchronous (email) modalities are used together, these consultations can also be referred to as blended or hybrid consultations.

Asynchronous telehealth

Use of asynchronous telehealth is when there is a time gap between the patient and the clinical activity. This method is also called ‘store and forward’ telehealth. It gives the specialist the ease of reviewing the patient records at a convenient time. However, store and forward methods in isolation create poor patient-clinician relationships, leading to a nominal working alliance between the patient and the care provider. In contrast, videoconferencing can contribute to building trust, transference of emotions and show of empathy between the patient and the care provider. These aspects are especially important in building relationships with Indigenous people.

Synchronous telehealth

Synchronous telehealth occurs when a consultation happens in real time. Videoconferencing (VC) is the best example of a synchronous technology. A wide variety of clinical settings uses videoconferencing services throughout Australia, connecting remote sites with metropolitan-based specialist health centres. At present, several speciality services such as endocrine, geriatrics, orthopaedics, hepatology, correctional health, and dermatology services use videoconferencing successfully in the Australian healthcare system.

Advantages and disadvantages of using telediabetes services

Synchronous and asynchronous telehealth services (for diabetes care) both have several positive and negative effects with regard to patient care. However, Klonoff shows that either method can provide timely and early access to specialised services over a long period, leading to improved clinical outcomes and a reduction in unnecessary admissions to hospitals ⁵⁹. Efficient access reduces the burden of out of pocket costs to patients as regular travel to metropolitan hospitals to meet with specialists is diminished ⁶⁰. Long-term costs to the public healthcare system can also be reduced by the reduction of long-term complications, such as chronic renal failure, through optimised care.

Disadvantages in using the telediabetes services include the lack of opportunity for a good patient-clinician relationship to develop (as interactions are limited to the video screen), difficulties in coordination and scheduling, technical complications in the transfer of patient records and cybersecurity risks. For chronic diseases such as diabetes with its protracted clinical course, developing a close working alliance between the clinician and the patient is very important, and telehealth alone may not be sufficient to develop an optimum interaction.

Telehealth for diabetes care is also not suited for urgent and emergency situations such as hypoglycemic events when care must be provided immediately. Patients with multiple comorbidities would also not be well-suited for telediabetes services due to the difficulty in coordination between multidisciplinary teams, via only a telehealth consultation.

Usefulness of telehealth for diabetes care

Due to difficulty in scalability, specialist health services are usually not available in rural and remote areas of Australia. Telehealth is a useful tool for linking these rural and remote areas. Clients with diabetes can use telehealth for consultations, for receiving health education and for transmission of daily clinical data such as blood sugar levels to the healthcare provider-database, for review and action later on. Store and forward telehealth methods can also help the transfer of non-urgent information such as daily dietary intake and duration of daily exercise to healthcare providers to evaluate intermittently. Telehealth is also useful for medication review, review of absences from planned consultations and for assessing the frequency of emergency hospital admissions ⁶¹. If patient care warrants, transfer of information can happen between different healthcare providers as well ⁵⁹.

Research evidence

Is telehealth/videoconferencing effective for diabetes care?

A systematic review of randomised controlled trials (RCTs), which included 4,207 diabetes clients from 13 separate studies, found that using telehealth with usual care, compared with usual outpatient care alone (no telehealth component) reduced HbA1c levels in patients by 0.44% ⁶². Improvements in behavioural and psychosocial outcomes of patients are also reported with using telehealth for diabetes care ^{63, 64}. Telehealth provides improved health outcomes, especially for older patients with diabetes; this enhanced control results in increased quality of life ⁶⁵.

Videoconferencing is one of the commonly reported methods of communication between specialist clinicians and patients from remote areas. A systematic review, which included 22 studies from around the world, reported no significant reduction in HbA1c levels in patients using videoconferencing alone, compared to usual care (inclusive of visits to allied health specialists) for diabetes. However, satisfaction with the technology, improved disease control and increased involvement of the family in the care process have been reported due to using videoconferencing systems ⁶⁶. Interventions using videoconferencing has also reported a reduction in overall costs ⁶⁷. Therefore, videoconferencing alone for diabetes care could be described as not yet clinically proven to be superior to the usual care of diabetes management, but the ease of access and

increased clinician-patient interaction to remote patients would be greatly supportive. Most of these findings are from studies conducted among non-Indigenous populations and, therefore, the direct application of findings to Indigenous circumstances could be inaccurate.

Currently, there is minimal evidence (or none) describing the use of telehealth in clinical care for diabetes among Indigenous Australians. However, a recent study by Fatehi and others, conducted among non-Indigenous Australians in Queensland, found patients to be satisfied with using videoconferencing for specialist diabetes services. However, these patients also reported a lack of in-person contact as an impediment to receiving care sometimes, yet it did not affect rapport between specialists and patients ⁶⁸.

Australian Indigenous people and telehealth

Several telehealth interventions for Indigenous Australians have been successfully used to date in mental health care, oncology services, and retinopathy screening ⁶⁹. Based on these findings, it seems logical to extrapolate that telehealth can be a useful option for Indigenous patients with diabetes, for their continued care. Yet, the evidence base for using telehealth for clinical diabetes services among Indigenous communities is still poor. As mentioned above, in the Australian context, there are no peer-reviewed publications to date describing the use of videoconferencing for specialist consultations for diabetes care in remote Indigenous communities.

2.5 The new telediabetes service to distant regions of Queensland

This Indigenous telediabetes service, primarily to provide clinical services to the Indigenous communities of Queensland, was first established in 2015. It used the telehealth infrastructure already established at the telehealth centre in the Princess Alexandra Hospital (PAH), Brisbane, for its services (see Figure 1).

The telehealth centre at the PAH had been operational since 2012. It provided telehealth services to mainly non-Indigenous clients across the Queensland Health network of hospitals. In 2015, a telehealth service was planned for the Indigenous communities by extending the existing service. This service was to be based at the telehealth centre and would utilise the videoconferencing

facilities to connect with AMSs throughout Queensland. The first telehealth service delivered to Indigenous communities was a tele-endocrine service, which this study evaluates.



Figure 1: The telehealth centre at the Princess Alexandra Hospital, Brisbane (The central service)

Aboriginal Medical Services (AMS)

An AMS is a community-controlled Indigenous health service, staffed mainly by Indigenous health staff from the local area. Management of the AMS is by a local committee consisting of community and clan leaders and elders. Each of these services is independent of the control of the government and of each other ⁷⁰.

These AMSs are usually only served by General Practitioners, either on a full-time or on a locum basis, and Indigenous health workers, usually on a full-time basis. The main role of GPs is to provide primary health care services to Indigenous clients of the community and refer to specialist services when required. The local (Indigenous) health workers will support this process through care coordination and follow-up. Referral to the new telehealth service was similar to previous referrals where the local general practitioner acting as the gatekeeper would refer clients to the specialists and the videoconsultation would happen between the specialist and the client through a

pre-scheduled appointment. The process is coordinated by the local Indigenous health workers and staff from the telehealth centre at the central service (PAH).

During these interactions, Indigenous clients were treated not as traditional ‘clients’ or ‘care seekers’, but more as friends. Local health workers knew clients by their first name (on most occasions), without needing to refer to their charts. Whilst at the AMS, clients were welcome to go to the kitchen and make a tea or coffee for themselves if needed. In Cunnamulla, the kitchen was placed near the reception area, and in Charleville, there was a separate open area on the ground floor for refreshments. Due to these reasons, the relationships between clients and local Indigenous health staff were closer and more cordial (client-centred) when compared to a traditional hospital setup (disease-centred).

Initial telehealth services

In Queensland, Cunnamulla was the first AMS to establish telehealth facilities (equipment). Later on, several other distant Indigenous communities across Queensland were supplied with telehealth facilities.



Figure 2: Equipment installed at each AMS (a videoconference unit)

Initial consultations with local Indigenous leaders from these sites were successful, and support was expressed for setting up services as well as for the research component. The telehealth equipment was funded by the Diamond Jubilee Trust ⁷¹. Equipment was installed at the AMSs in early 2015 (figures 2-4). Cunnamulla, Gladstone and Charleville AMSs were selected for the purposes of this study in 2015.

The video-linked consultation rooms at either end were equipped with Cisco C20 codecs and the consultations rooms at the telehealth centre at the PAH with Cisco C40 codecs. Each system was equipped with Sony TVs and Cisco “InTouch” touch panel controllers, at either end. All systems at the PAH were connected to the Queensland Health (QH) private Wide Area Network (WAN) infrastructure. Each AMS had a dedicated broadband connection via a commercial internet service provider, which was used to connect with the internet for service to be connected. Local staff were trained (see figure 3) in using the equipment and the firmware (in-built software) by staff from the Centre for Online Health (COH) and the telehealth centre at the PAH. Refresher training was conducted in an ad hoc manner, as and when the requirement arose.

Telehealth coordinators from remote sites and the central PAH site coordinated the videoconsultations. The Indigenous clients and the endocrinologists were connected using a high-quality video-link. During the videoconsultation, the specialist was able to diagnose, treat, devise management plans, coordinate plans for screening and management by local primary care services (general practice and allied health services) and could schedule further reviews if warranted.

Telehealth bookings

Telehealth bookings were made by the telehealth coordinators, at either end. When a local GP planned to refer a client to the telehealth service, the referral was faxed to the central service in Brisbane for scheduling. Clients were reminded of the appointment the day before by telephone or text message, and sometimes transport was also arranged for clients.



Figure 3: A staff training program in progress

Technical problems

During the initial period, there were several instances where technical difficulties (problems with internet connectivity) made clinicians resort to calling up the client on a telephone landline, abandoning the videoconsultation for the time. The PAH telehealth service uses several store and forward methods, as supportive measures to its videoconferencing facility. These methods were useful if the videoconferencing was not possible (records made available offline). The telehealth service was able to connect non-Indigenous clients with endocrinologists (for diabetes care), clinical nurses and diabetes educators, in some instance for the first time for these communities. The increased frequency of contact with specialists gave the opportunity of diagnosing at-risk or new patients or to be diagnosed with complications early. The videoconferencing platform also provided an opportunity for clinical training to staff at the AMSs and transfer client data and pathology reports to the central PAH facility database.



Figure 4: A specialist (based in Brisbane) consults with a patient by videoconference.

Local availability of general practitioners

In the early part of 2015, when this research was first started, the Cunnamulla remote Indigenous community did not have regular access to a GP. By late 2015, several GPs were hired at the AMS in Cunnamulla on a locum basis, and patients could access primary care year-round. Several GPs served Charleville and Gladstone AMSs during this time and at least one of them was available for the community throughout the year. Access to Charleville and Gladstone communities were relatively easy as the domestic airports were connected to the state capital (Brisbane) through commercial air travel. This may have been another reason for the easy attraction for GPs to serve these communities.

Operational decisions

In the initial period, planning and early operational decisions of the telediabetes service were mostly made by the PAH central service, due to the complex nature of the technical and financial aspects involved. Therefore, when the service first became operational, there was no extensive community education campaign, although local elders and senior AMS staff were extensively included at all stages of critical decision-making. However, from the perspective of the local Indigenous clients, the service was ‘supply-push’ health care delivery, even though local elders

had been included throughout the process. It would be understandable if Indigenous clients were not interested in the new service, due to the lack of an initial community consultation process.

Other clinical services

The telehealth facilities at the AMSs were also used for geriatric, dermatology and mental health services, alongside the diabetes service. Indigenous clients could link with relevant specialists via the videoconferencing facility if referred by the local GPs. The diagnosis and management process of these clients were also assisted by the local GPs. Hence, clients were exposed to the ease of meeting with a specialist (from another clinical subspecialty) and could compare it with when they had to travel or, alternatively, wait for an outreach program. It is likely that clients discussed these new services at family or community gatherings, resulting in early uptake. Furthermore, many of the local health workers were related to the clients, and the availability of this new service would have been confirmed through discussions.

2.6 Study sites

As described above, the Indigenous telehealth service was established across several sites in Queensland. For the purpose of this study, three AMSs (Cunnamulla, Charleville, and Gladstone) were selected. These sites were from the first group of AMSs where teleconferencing services were set up (though telehealth services were set up in several other sites consequently, these were not suitable to be included in this study as the time duration for close contact with the communities were inadequate). Figure 5 shows the study sites on a map of the state of Queensland in relation to other townships in Queensland. These regional Indigenous communities that were visited during the work are described as ‘distant communities’. For the purpose of this study, the term ‘distant’ was defined as ‘an Indigenous community a significant distance away from the nearest health service (where specialist diabetes services were available), and travel for care could not be possible without leaving the community for several days.



Figure 5: Selected study sites and the telehealth centre (in Brisbane), depicted on the map of Queensland, Australia

Cunnamulla

The township of Cunnamulla (registered population of approximately 1,200) lies 800 km to the west of Brisbane. It is the largest township of the Paroo Shire of the Western Downs region and is situated on the banks of the Warrego River ⁷². The Department of Health's Australian Standard Geographical Classification of Remoteness Area (ASGC-RA) classifies Cunnamulla as an area in the RA 5 category, denoting a very remote location.

The National Diabetes Services Scheme (NDSS) identified 143 people from Cunnamulla (and surrounding smaller communities) as registered clients living with diabetes ⁷³. According to these records, this represents 6.8% of the population. From the data obtained from the NDSS, 135 individuals (94%) have type 2 diabetes mellitus (T2DM). It is estimated that the NDSS captures only between 80-90% of clients with a current diagnosis of diabetes. Hence, the actual number of diabetes clients may be slightly higher. The reason for incomplete registration with the NDSS is due to clients not being registered in the early stages of the disease (e.g. when conservatively managed, on diet control only, etc.). Registration with NDSS is also incomplete when T2DM is undiagnosed ⁷⁴.

The Cunnamulla AMS is, at present, served by locum GPs and visiting medical specialists. At the time the telehealth service was set up in 2015, there was a GP who would fly in once a month.

This service has now ceased. Even though specialists (irregularly) come into the community through various outreach programs, some clients must still make the road trip to Toowoomba (675 km, approximately 7 hours) or Brisbane (805 km, approximately 8.5 hours) for specialities not offered. However, these travels are often supported by a reimbursement from the Patient Travel Subsidy Scheme (PTSS) of the Queensland Health (QH) service⁷⁵.

Other diabetes education programs

At Cunnamulla, diabetes clients were exposed to several programs in health education (however, not through the telehealth service), including the ‘Sugar shakers’ group for females and the ‘BROOM’ group for males in Cunnamulla. These programs were delivered as group sessions comprising 8–12 clients. Such programs may have improved diabetes-related knowledge among Indigenous clients, and it is likely the diabetes educator accessed through the telehealth service was able to supplement the health education process.

Charleville

Charleville is a township in South Western Queensland, approximately 683 km west of Brisbane. It is the largest town and administrative centre of Murweh Shire, of an area covering 43,905 square kilometres (km²). Charleville is served by routine domestic air transport from Brisbane. The Department of Health’s Australian Standard Geographical Classification of Remoteness Area (ASGC-RA), classifies Charleville as an area in the RA 4 category, which denotes a remote location. The NDSS data shows that 5.8% (243/4217) of the population of Charleville as registered diabetes clients requiring services.

The Charleville AMS is currently served by three full-time GPs. Due to its easy connectivity with the state capital, attracting GPs has been relatively easy. Furthermore, several specialist services, such as the IDEAS-van for visual assessment and the Heart of Australia mobile cardiac assessment centre, visit Charleville frequently. Indigenous clients from several small communities, such as Mitchell and Quilpie further away from Charleville, also seek care at the AMS in Charleville. Data from the Charleville AMS database showed that 171 Indigenous clients with diabetes were registered for care in 2015.

Gladstone

Gladstone is a city north of Brisbane, in the Gladstone region of Queensland. It is about 500 km from Brisbane, and about 100 km away from the nearest city, Rockhampton. Gladstone is home to a multi-commodity shipping port, the largest in Queensland. The Australian Standard Geographical Classification of Remoteness Area (ASGC-RA) classifies Gladstone as an area in the RA 2 category, which denotes an inner regional location. Though Gladstone is not a remote township, the distance from the state capital (and the nearest city with specialist services) and the lack of specialists makes it difficult for Indigenous clients to access care.

The Nhulundu Wooribah Indigenous health organisation provides health services to Indigenous people of Gladstone, including a dental service, permanent General Practitioner (GPs) and a variety of visiting specialists. It was first started in 2000 and now employs nearly 30 staff members.

The population of Gladstone is approximately 60,000 (inclusive of the non-Indigenous population). There are 2,800 clients registered with the NDSS as having diabetes in Gladstone. This is 4.7% of the Gladstone population. The Indigenous population of Gladstone is approximately 3.5%; i.e. around 2,300 people. The prevalence of diabetes in the Indigenous community of Gladstone is estimated to be 10%; hence, services for diabetes are likely to be useful for up to 230 (approximately) Indigenous clients.

2.7 Conclusion

This chapter has outlined some of the important investigative domains of this study. The new telehealth service setup in the distant Indigenous communities (in AMSs) has also been described in detail. In the ensuing chapters where results of the study are described, further descriptions of the service are made where relevant.

In the next chapter, literature relating to Indigenous telediabetes services is evaluated and enablers of, and barriers to, telediabetes services are investigated. This knowledge was helpful in understanding interactions of Indigenous clients and telehealth (teleconsultation-contexts) of the new service in the AMSs.

Chapter 3: Literature review

3.1 Overview

In the previous chapter, functionality of telehealth services, Indigenous health services and diabetes and its care were discussed in-depth. The telehealth service delivered from the Princess Alexandra Hospital was also described. In this chapter, the literature on interventions using tediabetes services for Indigenous communities (Australian or other) have been evaluated and key enablers (what works), and barriers (impediments) were identified^{69, 76}. Identifying these issues helps in the evaluation of the service and assists in development of an appropriate research framework and methodologies. (The manuscript of a publication is incorporated as the chapter – see annexure 4.)

3.2 Study aim

The main purpose of this review was to understand the types of interventions in the domain of tediabetes services to Indigenous communities and to identify their enablers and barriers.

3.3 Methods

Search strategy

A combination of search terms was used to search the PubMed, Scopus, Embase and Informit databases (Table 2). These combinations included keywords as well as medical subject headings (MeSH) terms, and Emtree terms unique to the Embase database. Hand searching of reference lists of included articles was also conducted. Grey literature was searched using Google Scholar. The searches were conducted in July 2016. (In November 2017 the searches were updated again, but no new articles were found.)

Table 2: Query syntax

Database	Syntax
PubMed, and Informit	(Telemedicine [MeSH] OR telemed*[All fields] OR tele*[All fields] OR teleconsultation [All fields] OR teleconsult*[All fields] OR (Remote consultation)[MeSH]) AND (Diabetes[All fields] OR Diab*[All fields] OR Diabetes Mellitus[MeSH]) AND (Indigenous [All fields] OR (Health service, Indigenous) [MeSH] OR Indigen*[All fields] OR Aboriginal [All fields] OR Aborigin* [All fields] OR Tribal [All fields] OR Native [All fields] OR (First nations) [All fields] OR native* [All fields] OR Indian OR Inuits [MeSH] OR Maori [All fields] OR Eskimo [All fields] OR Islanders [All fields])
Embase	(Telemedicine [Emtree] OR teleconsultation [Emtree]) AND (Diabetes Mellitus [Emtree]) AND (Indigenous Healthcare [Emtree] OR Indigenous Australian [Emtree] OR Indigenous people [Emtree] OR Alaska Native [Emtree] OR American Indian [Emtree] OR Native Hawaiian [Emtree] OR First Nation [Emtree] OR Eskimo [Emtree] OR Inuit [Emtree] OR Maori [Emtree])
Scopus	(teleconsult* OR Telemed*) AND Diab* AND (Indigenous OR Indigen* OR Aboriginal OR Aborigin* OR Tribe OR Native OR (First nations) OR native* OR Indian OR Inuit OR Maori OR Eskimo OR Islanders)

Inclusion and exclusion criteria

Articles that described specific telehealth services for Indigenous patients with diabetes were included. Services included screening, medical consultation and diabetes education. Abstracts, reports and short communications were included in the review. Only articles published in English were included in the review.

Selection process

The title, keywords and the abstract were screened to determine eligibility for inclusion. Full text reviews were carried out if abstract summaries were inconclusive. Screening was undertaken by two authors (the researcher and a supervisor).

Data extraction and quality assessment

The full text of articles meeting the inclusion criteria were read and data extraction was undertaken. The data extraction fields are summarised in Table 3. Articles were excluded if barriers and enablers were not reported. Enablers and barriers did not need to be the primary outcome measure in the selected studies; hence, articles where barriers and enablers were described elsewhere in the paper were also included.

Table 3: Data extraction

Data extraction category	Fields
Article information	Author, country, year of publication, type of article (journal article, conference abstract, letter to the editor, report), and study design
Service	Telehealth modality (video conferencing, store and forward, remote monitoring, hybrid), diabetes subspecialty (e.g. diabetic retinopathy screening, diabetes education), service description
Context	Barriers to delivering telediabetes service, identified solutions to barriers, enablers for successful delivery of telediabetes services, and key findings.

The quality of included articles was assessed using a modified Cultural Identity Interventions Systematic Review Proforma tool ⁷⁷. This tool was developed to help bridge the gap between traditional review tools and Indigenous health by incorporating measures to comply with Indigenous specific health values and guidelines ⁷⁷. The tool comprises three domains with a rating scale (high-moderate-low) for each. The three domains were: study design assessment; adaptability of the service; and Aboriginal responsibilities in the research process. For the purpose of this study, the first two domains were selected as they were more generic and aligned well with the search strategy. Two reviewers (researcher and a supervisor) independently performed the data extraction and quality assessment. In cases where consensus was not reached, a third reviewer (primary supervisor) was used to judge the quality assessment and adaptability to scoring.

Review procedure

The systematic review protocol was registered with PROSPERO (CRD42016033151). Findings of the review were reported using PRISMA guidelines with a narrative synthesis ⁷⁸.

3.4 Results

Fourteen articles were included in the review. The process of screening and selection of articles is shown in Figure 6.

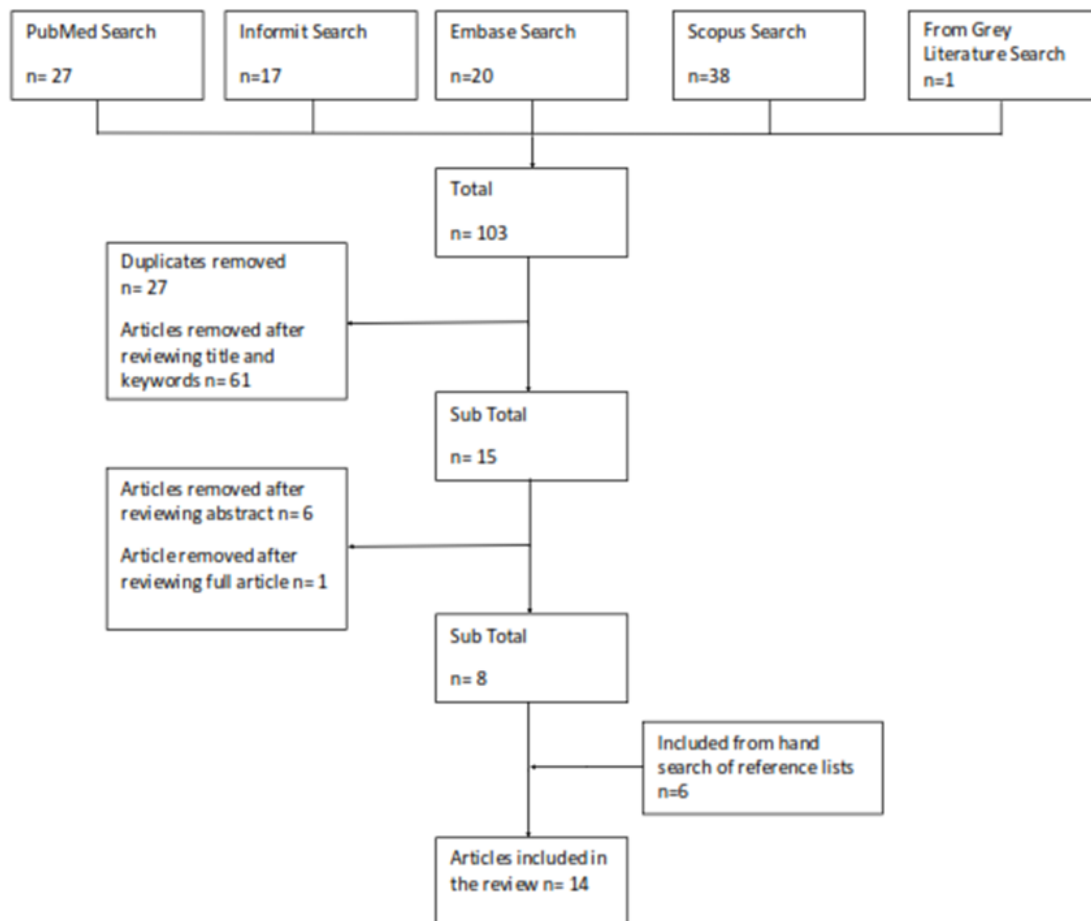


Figure 6: PRISMA flow diagram of searches

There were six articles from Canada, six from Australia and one article from India and the United States of America. Articles were published between 1996 and 2015.

Characteristics of the teliabetes services

Eleven (78%) articles described diabetic retinopathy (DR) screening services. Four articles provided other clinical investigation or consultation services in addition to DR screening ⁷⁹⁻⁸². Store-and-forward telehealth methods were mainly used for DR screening. Images were captured by a visual technician travelling to distant communities ^{80,81,83}, or a local Indigenous health worker trained in fundal photography ⁸⁴⁻⁸⁶. Grading of ophthalmic images was done remotely (teleophthalmology) by an ophthalmologist at a different centre.

In six (43%) of the interventions, clinical investigations were conducted at the referring site and findings were reported to the provider of specialist services. These services included medical history taking and general examination, vascular risk factor identification, pathology (urine for albumin, HbA1c, plasma glucose, serum cholesterol, serum creatinine), blood pressure measurements and diabetes education. Diabetes education was delivered using some method of telehealth in five interventions. These included services of diabetes specialists ⁸⁷, diabetes nurse educators ^{80,81}, diabetes educators ⁸⁸, and computerised information kiosks ⁸⁹, to provide diabetes-related health information. Videoconferencing was used in one intervention to deliver medical consultations with diabetes specialists ⁸⁷.

Enablers and Barriers

Cultural appropriateness (use of cultural and spiritual elements, acknowledgement of local beliefs and traditions, and appropriate community engagement) was recognised as an enabler of teliabetes services. Aurora *et al.* reported increased patient satisfaction and improvement in patient attendance from 20% to 85% after inclusion of cultural and spiritual ceremonies, as part of the service ²⁶. Participation of Indigenous health workers (IHWs) was important in making teliabetes services culturally acceptable to the local community.

Indigenous health worker participation in the delivery of teliabetes services was commonly reported as an enabler. The specific roles of Indigenous health workers included: communication of local language, helping clinicians understand the community; and transportation of patients. Similar findings have been reported in tele-oncology ⁹⁰, ear health screening ^{91, 92}, and primary care ⁹³, where Indigenous health workers were considered integral to the success of the service.

Barriers associated with the delivery of telediabetes services included the lack of technical skills associated with operation and maintenance of retinal cameras and the collection of clinical information. This highlights the importance of effective training programs for local staff responsible for screening^{94,95}. Karagiannis *et al.* found that 76% of images captured by Indigenous health workers were of good quality following a two-week intensive training program⁸⁵. Credentialing has also been reported to improve the quality of images collected by health workers⁹⁶. Improved camera technology and automation⁹⁷ may simplify the technical skills required and reduce training requirements.

The difficulty in recruitment of patients for screening and interval-appropriate repeat screening was another barrier identified. Conducting imaging and clinical consultation services on the same day can help improve screening/rescreening rates⁹⁶. Failure to attend rates of clinic appointments were a commonly reported barrier amongst many services^{26,96}. For the management of chronic diseases, continuity of care through screening and monitoring is important for the early detection of complications. Chen *et al.* described lack of awareness of the importance of screening, and limited availability of screening resources to be major barriers amongst Indigenous people with chronic renal disease⁹⁸. Enablers and barriers identified in the selected articles are listed in Table 4.

Table 4: Enablers of, and barriers to, telediabetes services

Description		Context			
Author Reference/Country	Service/Modality	Enablers	Barriers	How barriers were overcome	Key Findings
Arora <i>et al.</i> ²⁶ ; Canada	DR screening; S&F	Spiritual ceremonies before and after each clinic; local workers who spoke local languages provided education; acknowledgement of local beliefs and traditions	Poor attendance; not feeling at ease with the hospital-based screening	Clinics were made appealing to patients by incorporating Indigenous cultural elements	Attendance rates increased from 20% to 85% within a two-year period
Barry <i>et al.</i> ⁸⁴ ; Australia	DR screening; S&F	Trained local health staff provided education and transport	Difficulty of maintaining camera equipment during transport; poor quality of images	Custom-built foam moulded cases for transport of equipment; increasing staff training	High number of patients identified with various stages of eye disease - Program 1: 41.5% of patients with DR (n= 2,543); Program 2: 22.6% patients with DR (n=164); Program 5: 15.6% DR+ (n= 77)
Dawson <i>et al.</i> ⁸¹ ; Canada	DR screening and Clinical Ix.; S&F	-	Delay in follow-ups	-	DR screening over the first 6 years of the service - 1,221

					assessments on 750 people with Type 2 DM
Dawson <i>et al.</i> ⁸⁸ ; Canada	Clinical Ix. and DE; Audio-visual	Audio-visual material included messages from local Indigenous people	-	-	Included screening and education for diabetes patients. 3 education programs: Circle of diabetes self-management for adults; Our spirit lives on program; Health warriors' program
Dean <i>et al.</i> ⁸⁷ ; Australia	Clinical consultation and DE; VC	Telehealth-trained local health staff member	Scheduling issues; Lack of staff training	Direct links with primary care team	Increasing number of videoconsultations during the first four years of service (Yr.1 - 15; Yr. 2 - 45; Yr. 3- 263; Yr. 4 - 365)
Diamond <i>et al.</i> ⁸³ ; Australia	DR screening; S&F	-	Inferior quality of retinal images associated with photography of undilated pupils	Pupil dilation prior to DR screening	Image quality improved with pupil dilation; but the overall proportion of inadequate images remained similar between the techniques.
Jin <i>et al.</i> ⁸⁰ ; Canada	DR screening, DE and Clinical Ix.; S&F	-	Waiting period for clinical decisions	-	Mean service cost per client was less than the cost of each patient

					travelling to a tertiary centre
Joshi <i>et al.</i> ⁸⁹ ; India	DE; Health information kiosks	-	Accuracy about information provided by patients couldn't be validated	-	Increased awareness. 79% of the tribal people did not know that they had diabetes previously
Karagiannis <i>et al.</i> ⁸⁵ ; Australia	DR screening; S&F	-	Un-interpretable slides; Lack of training; Poor working environments	-	Skills improvement. IHWs were trained for two weeks and 76% of slides were interpretable
Kim <i>et al.</i> ⁸² ; Canada	DR screening, Clinical Ix. and DE; S&F	Pre-intervention community engagement	-	-	Screening was conducted on 524 diabetes patients from 43 First Nations communities. Telehealth staff rated the service positively for overall user satisfaction, system quality, information quality, etc.
Mak <i>et al.</i> ⁹⁶ ; Australia	DR screening; S&F	-	Recruitment of patients for screenings and rescreening difficult; problems with transport of camera	-	Positive relationship between credentialing health staff and the quality of images; >90% of retinal photographs

					were of excellent or adequate quality
Mansberger <i>et al.</i> ⁹⁹ ; U.S.A.*	DR screening; S&F	-	Poor quality retinal images increasing referrals	Pre-intervention training of retinal photographer in the use of the camera	Better access to services. Patients receiving telemedicine services were much more likely to receive a DR screening within the first year compared with traditional surveillance group (94% versus 56%, p<0.001)
Murray <i>et al.</i> ⁸⁶ ; Australia	DR screening; S&F	-	Shared single camera being rotated; de-skilling of staff during intervals	Shorter rotation cycles implemented	1,318 Indigenous patients screened: 21% with diabetic retinopathy; 19% with non- proliferative retinopathy; photograph quality was generally high and <i>not</i> related to qualifications, certification or experience.
Rudnisky <i>et al.</i> ⁷⁹ ; Canada	DR screening and Clinical Ix.; S&F	-	Separate clinic dates for clinical and imaging services	-	The median time in progressing to

					proliferative retinopathy was 7.6 years.

DR - Diabetic Retinopathy; DE - Diabetes Education; Ix. Investigations; S&F - Store and Forward; DM – Diabetes Mellitus; – means data not reported.

Quality assessment

The assessment made using the modified version of the Cultural Identity Interventions Systematic Review Proforma ⁷⁷, showed that *study design assessment* was classified as high (21%), moderate (36%) or low (43%). The *ability to adapt the program/study elsewhere* was scored high (25%), moderate (50%) and low (25%).

3.5 Discussion

This review has identified a number of important enablers and barriers, associated with the delivery of telediabetes for Indigenous people. Some of the key considerations included: engagement with the community; involvement of the Indigenous health workers; appropriate staff training; choice of equipment; and reliable processes for appointment scheduling and clinic coordination. Unique to certain communities were the traditional activities (such as welcome ceremonies), which were planned as part of the service. A broader review encompassing the grey literature (such as service web sites, service provider reports) and qualitative examination of other clinical services for Indigenous populations may have revealed other enablers and barriers; however, this was not within scope of the present study.

This systematic review was focused on specific factors relevant to the delivery of telediabetes services to Indigenous people. The barriers and enablers identified in this review are similar to telehealth services for other specialties. In addition to the barriers and enablers identified in our study, other important considerations include funding for telehealth, and the use of Indigenous health care facilities for delivery of telehealth consultations ¹⁰⁰. Additional barriers include regulation of health workers (scope of practice) and lack of available workforce ^{101, 102}. These findings may be useful as a guide to planning and implementing new telediabetes services.

Limitations

Our review was limited to telediabetes services in the published literature. It is likely that there are other telediabetes services not reported in the scientific literature, which could have contributed to the findings.

3.6 Conclusion

Knowledge of the barriers and enablers associated with the delivery of health services within Indigenous communities is important when planning telehealth. In the right circumstances, the delivery of tediabetes services is promising, especially in circumstances where specialist services are not available or are difficult to access.

3.7 Key Findings

- The most important element for success of an intervention was the participation of local Indigenous health workers – irrespective of the type of intervention.
- Training local staff prior to the intervention will be needed as staff from regional areas have limited expertise to use newer technology.

Chapter 4: Research design

4.1 Overview

In chapter 2, the telehealth service to distant Indigenous communities of Queensland delivered from the Princess Alexandra Hospital (in Brisbane) was described. In chapter 3, the enablers and barriers of similar telehealth services (to Indigenous communities) were identified by reviewing previous telediabetes interventions described in peer-reviewed literature (review of literature). This chapter provides an overview of the methods and materials used in conducting this research project. As described previously (in chapter 1), the research project comprises three strands, each of which appraises a different aspect of the interaction between Indigenous Australians and the telediabetes service. In later chapters, where each study is presented as individual chapters, these methodologies will be described again where relevant.

The research problem and justification

This study evaluates the usefulness of a novel health service (telehealth) for Indigenous clients living with diabetes in distant communities, which had not been previously studied. Understanding the usefulness of such a service is essential to ensure the quality and effective health service delivery to Indigenous communities and to address the health disparities of Indigenous Australians. The importance of this research is further highlighted, considering that Indigenous Australians are some of the most vulnerable populations in Australia, with the highest health morbidity and mortality ⁴⁰. Furthermore, if disparities between health indices such as poor health outcomes are to be reduced (closing the gap) and opportunities for accessing safe, quality and culturally appropriate health services for Indigenous communities are to be increased, these types of novel services could be extremely important.

The lack of understanding of the usefulness of telehealth (a novel service for Indigenous clients in rural and regional communities) is probably a result of similar services not being implemented, hence not been previously evaluated. This type of study will be able to provide information essential to ensure quality and effective health services to address health disparities and may also assist in providing opportunities to access to safe, quality and culturally appropriate health services.

Study design considerations

This study is an evaluation of a new telediabetes service for Indigenous communities in distant areas of Queensland. As described earlier, the evaluation consists of several aspects - stakeholder perceptions including satisfaction, evaluation of activity data and clinical parameters, and an analysis of costs. All these differing aspects review the service from the perspective of how the new service is being utilised (a ‘utilisation-focused evaluation’) by the local communities. Utilisation-focused evaluations attempt to link the usefulness of the evaluation (and its findings) to its end-users (stakeholders). Furthermore, utilisation-focused evaluations assist in making informed service-related decisions to improve performance. The descriptive methodology used to describe the service-related contexts also helps to understand how the service is utilised by the local communities.

As described above this study is an evaluation of a new telehealth service. The study comprises an extensive research component (e.g. qualitative assessment of stakeholder perceptions) within the evaluation. An evaluation of a new health service (in this instance a telehealth service) generally attempts to ascertain specific knowledge applicable to the service concerned. A research can be loosely defined as being useful to provide theoretical knowledge, useful for academic purposes. Therefore, this study can be outlined as a utilisation-focuses evaluation with an embedded extensive research component. Information derived from both components were assessed holistically when final conclusions regarding the service were made.

As stated in chapter 1 above, this research project comprises several descriptive studies. Scientifically, the findings of descriptive studies have limited usefulness due to the probability of increased bias. However, due to several reasons (small sample sizes, distance, and difficulty in client access - discussed in the section on ‘Limitations’ in chapter 10), other types of higher-quality studies (e.g. randomised controlled trials) could not be conducted. This barrier is further highlighted in the review of literature, where most studies included were of a descriptive nature. However, the use of a descriptive study design allows the researcher to describe initial findings from an intervention (of this type) and could also be useful for future research (planning higher order designs) within the same domain. Furthermore, other researchers have also successfully used descriptive methods for similar studies ^{85, 103}.

Evaluation framework

This study comprises qualitative, quantitative and economic evaluation components. Each of these components were designed to evaluate a different aspect of the interaction of Indigenous people with the new telehealth service. The study draws on an evaluation framework (by Nepal *et al.*) that was designed for evaluating telehealth and telemedicine services in 2014 (during the period in which this study was first initiated). However, this framework was not specific for Indigenous contexts. Therefore, it was reviewed only to understand the different components that needed inclusion when evaluating a new telehealth service.

The comprehensive telemedicine evaluation framework (consisting of six domains) published by Nepal *et al.* mapped evidence from previously published telemedicine studies ¹⁰⁴. This framework evaluated not only technology-related factors of telehealth (moving forward from other studies), but a more developed and holistic approach to telehealth service delivery. Four domains from the prescribed framework by Nepal *et al.* were useful for the purposes of developing this study. The domain ‘health service factors’ was useful in designing the qualitative study (e.g. acceptability and appropriateness) and assessment of uptake and outcomes studies. The ‘environmental setting’ domain informed the enquiry on comfort and satisfaction with the service. The domain on socio-economic aspects informed the inclusion of an economic evaluation (cost-analysis) and the ‘health’ domain informed the inclusion of case studies and review of diabetes-related management changes of clients receiving teleconsultations.

In 2016, Fatehi *et al.* published a comprehensive telehealth evaluation framework, describing all aspects of evaluation of telehealth interventions ¹⁰⁵. Recommendations of this publication were also reviewed in reporting findings of this study (the framework was not available during the planning phase). The framework describes how the aims of an evaluation changes as the intervention matures. The study describes several stages of an intervention where evaluations are required. These include concept development, service design, pre-implementation, implementation, and post-implementation phases. This framework also describes how various strategies (studies) could be useful in the evaluation of an intervention at each stage. As the framework describes, various study methodologies were used (e.g. case studies, cost-modelling) in the evaluation (with already collected data) of this new telehealth service.

Indigenous health services have various ways of interacting with their clients (as described in chapter 2). Hence, the use of all aspects of the prescribed frameworks was unsuitable, or not

possible, for the investigated contexts. Furthermore, constraints such as time, finances and distances to the sites required the selection of research domains that were executable within the given time period.

Other factors considered in research design

From the findings in the review of literature, enablers and barriers to the successful delivery of a telediabetes service was specifically impressed upon in designing this research study. Aspects such as acceptance of the telehealth modality, satisfaction and comfort with using telehealth (videoconsultations), service activity, outcomes, and economics were some of the important aspects identified previously. These were also well-correlated to the selected domains of the framework above.

Acceptance of the service was considerably important in understanding the usefulness of this new service. If Indigenous clients did not accept the telehealth modality, irrespective of how well the telehealth service is delivered (by the local health staff or the central service), clients would simply stay away. Comfort during a videoconsultation and the satisfaction of the health care received during the consultation would also be important for clients to receive (uptake) the service well. Evaluation of activity and outcomes provided a snapshot of the input made by the service, in its early phase (at two years post-implementation). Economic analysis of using the telehealth service was another important aspect in understanding the usefulness of the service.

Conducting research in small Indigenous communities means that grittiness of research, overcoming difficulties, understanding contexts, reflexivity, etc. were also important aspects. Given the small sample sizes (of clients and admissions to health institutions), the focus was placed on demonstrating critical enquiry (e.g. the role of context in using telehealth services, barriers faced and how they were overcome), rather than attempting a comprehensive statistical analysis. Demonstrating an understanding of context in each finding, process, barrier and supportive factor was also important. The systematic review on enablers of, and barriers to, providing telediabetes services in Indigenous communities was also useful in this context (previous evidence). Importantly, it would be imprudent to assume that the new service would ‘fix’ Indigenous diabetes in these communities, from its outset. Therefore, it was important to show what did and did not work and why (described in chapter 5). The issues with high staff

turnover and a mobile population leading to clients failing to attend consultations were some of the reasons highlighted in the findings.

4.2A multi-method study design

This study uses a multi-method study design. The study uses both quantitative and qualitative measures in evaluating the research problem. In health services research, integrated studies where different types of methods are used in understanding a health context (especially for complex interventions such as telehealth) can be more useful than a single-method study ¹⁰⁶. Different types of studies allow for an in-depth understanding of the context under investigation and as data are collected (both qualitative and quantitative) the responses to the research question could be developed more conclusively. The convergence of different types of data allows for the triangulation of findings and reduces the chances of bias (from any singular data point). This would mean that converging findings could be generalised for the communities and divergent findings could be investigated further to understand the reasons for the disparity. Another important aspect affecting the study design was the ethical considerations (discussed below) of conducting research among Indigenous people. This was especially important as client numbers were small and there was a considerable chance of inadvertently identifying persons included in the study ¹⁰⁷.

Considering the above factors, an Indigenous client-centred study was developed where their interactions were understood using the social-ecological model (described below). Furthermore, having the Indigenous client (and interests) in the centre of the research process meant that more invasive methods (such as non-routine blood tests) were unsuitable. Therefore, the study (outcome evaluations) was conducted using routinely available blood tests (HbA1c) or routinely available records at local hospitals and emergency departments. At the time of the research design, the telehealth service was fully funded by The Diamond Jubilee trust (equipment), Commonwealth and state governments (activity). Furthermore, telehealth services had established Medicare claim modalities (claim numbers) and other funding sources based on activity. This meant that funding of the service was not a consideration in study design.

Theoretical framework (qualitative studies)

The research used the social ecological model (SEM) as the theoretical framework for understanding Indigenous contexts and study design, analysis, and reporting of (qualitative) findings. The social interactions Indigenous people have with family, elders and their community have a significant bearing on how they interpret their external world ¹⁰⁸. Indigenous elders would pass down their lived experiences as stories to the younger generation during an informal discussion (a ‘yarn’). These influences have significant weight on how health-related decisions are made by Indigenous people ³⁰. The use of the SEM helps to understand the observed behaviours in regard to general health-seeking behaviours and in relation to the new telehealth service ¹⁰⁹.

Urie Bronfenbrenner first introduced the socioecological model in the 1970s. The model describes several external layers of influence affecting an individual’s behaviour. The microsystem, which lies closest to the person, is the interaction with close family and the immediate physical environment ¹¹⁰. Of relevance to diabetes among remote Indigenous people, the input from the patient’s closest family members – spouse, children, and extended families, such as aunts and uncles, grandparents and even village elders (meso-system) - are all important. For Indigenous people, these external influences and past experiences of older members of the local population (or clan) with diabetes, do play an important role in shaping individual behaviours in relation to nutrition, exercise, and medication ³⁰. The Indigenous understanding of diabetes and how it is intertwined with their history has been described earlier (in chapter 2). The external layers, i.e. the exo-system and the macrosystem, describe the external factors, such as the local politics of the Indigenous community, cultural values, government policies, and legal aspects. The socioecological model has been successfully used previously in qualitative and quantitative Indigenous research work, in assessing uptake of health care among Australian Indigenous people ¹¹¹ and in understanding weight-related issues of aboriginal people in Canada ¹¹².

Ethical considerations in Indigenous research

Ethical and Indigenous cultural values are especially important when conducting research (and developing relationships) among Indigenous population groups. This research project (through its intervention of establishing telehealth services in distant Indigenous communities) allowed Indigenous clients living with diabetes, an opportunity to meet an endocrinologist via

videoconferencing, on some occasions for the first time (benefit). Previously, these types of services were not available to these distant Indigenous communities; hence, this project is an example of increasing the equitable distribution of specialist health resources to Indigenous communities (reciprocity). Respect to the included research group (from the selected Indigenous communities), was shown by cordially accepting those clients who rejected participating in the research, by conducting regular discussions with local Indigenous health staff regarding how to conduct the study with respect, involving local staff members in recruiting clients for the study, scheduling (or re-scheduling) interviews dependent on time availability of the clients and, importantly, accepting the cultural norms and practices of the Indigenous people (e.g. sorry business), even when it impeded data collection efforts on some occasions ¹¹³. Furthermore, local health workers were included as co-researchers for data collection for the satisfaction survey. This meant that clients were able to comfortably accept (or decline) participation in the study.

Respect for the different Indigenous population groups (clans) were shown by appreciating and respecting differences in cultures and traditions of each group (equality). Furthermore, the '*value of people*' was shown to each client through fairness and justice ¹¹³, by being available for clients to question the researcher on the research project or related telehealth issues and by valuing their knowledge or wisdom (of insights related to health services and innovations). This also allowed understanding of the Indigenous contexts related to living with diabetes and how telehealth may affect health-seeking for those clients. Understanding the impact of the responsibility an Indigenous person has to their family and community was also important to developing the research project (conducting interviews) in harmony with each client's individual social contexts. It was important to protect participants from any harm (do no harm), such as providing inadvertent misinformation. The study also required to provide accountability (truthful information) and transparency (accurate and comprehensive) and ensured that trust with the local health service was continued (e.g. issues of data security discussed).

The aspects of survival and protection of the selected Indigenous clients (and their cultures) was ensured through respecting their Indigenous identity ('collective identity') and conducting the research in a non-exploitative manner. The development of diabetes education leaflets, initially planned as a method to increase the interaction between the researcher (need identified by local staff) and the community was also extremely useful in this context, as clients were able to provide insights (ownership) into how changes needed to be made (especially those

staff members who were also living with diabetes). Some of the changes (e.g. requirement for additional clinical subspecialties through the service) were also supported by the information gathered from these discussions ¹¹³.

Considering the ethical and cultural aspects in conducting this research project (in line with the spirit and integrity of Indigenous people and their culture), from beginning to the end was an important aspect for the success of the project. Indigenous people view the past, current, and future of their lives as interconnected, and intertwined with their lands and lifestyle ³⁰. The effect of this research, in establishing a telehealth service and discussing and describing the research to clients (essentially marketing the service to them), could change how health services are delivered (or expected to be delivered) to these communities in future. Therefore, it was important to provide accurate information; what can and cannot be done (e.g. some consultations will still require the client to travel to a metropolitan health centre) were also important considerations.

The overall aim of the research

As described in Chapter 1, the main aim of this research was to appraise the usefulness of telehealth services to provide videoconsultations to Indigenous Australians with diabetes in distant communities of Queensland. (For the purposes of this research, the term ‘distant’ was defined as those indigenous communities from regional areas of Queensland, where usual travel to a metropolitan hospital to access specialist services was not possible or difficult, without impact to the usual daily activities of the Indigenous person.)

The research consists of multiple studies (multi-method study) described in three strands in evaluating the usefulness of the service to the Indigenous client living with diabetes (see Table 5).

The overall research question of this study is to understand the potential usefulness of a new tediabetes service to Indigenous Australians living in distant areas in Queensland.

Strand 1 studies: Stakeholder perception: Acceptability, comfort, and satisfaction

Research question: What are the perceptions of stakeholders regarding the usefulness of the new tediabetes service?

Three studies comprising two qualitative and one quantitative study was planned for this strand.

Qualitative studies: *Stakeholder perceptions*. These two qualitative studies are descriptive in nature, conducted with Indigenous clients, specialist clinicians, and local health workers. The first study evaluates the perceptions of specialist clinicians (who used the service in case management of Indigenous clients), primarily based at the Princess Alexandra Hospital in Brisbane. The study included nine specialists, who were specifically selected due to their extended use of telehealth (across many sites across Queensland health institutions and Indigenous health facilities) during their usual clinical practice with Indigenous people. Semi-structured interviews were conducted, and content was thematically analysed. These interviews provided perceptions of specialist clinicians regarding the potential usefulness of this new telehealth service to the target communities. The second study (methodologically similar to above) included Indigenous clients (23 clients from the two Indigenous communities of Cunnamulla and Charleville) who had used the telehealth service at least once for the care of diabetes, and also perceptions of local health staff regarding these interactions. This study provided perceptions of clients regarding the acceptability, comfort, and satisfaction with the telehealth services and included clients from Cunnamulla and Charleville Indigenous communities (close relationships were built with these sites through informal introductions from other clinicians, and travel was financially supported by bundling with other parallel interventions in the same area). These two studies are included in Chapter 5.

Quantitative study: *Satisfaction survey*. A descriptive study using quantitative methods was conducted to evaluate client satisfaction (clients from Charleville only) upon receiving care via the new telediabetes service (n=18). Findings of this study were used in providing an external data point during the analysis of the qualitative study findings. One limitation of this study was that only a small number of clients completed surveys (n=18). Therefore, though data were expressed in terms of proportions (of individuals who agreed with a certain response or not), it was useful as an external point of validation of the qualitative data during triangulation. The reason for selecting Charleville only for this study was that the initial clinical workload was higher than Cunnamulla, and a local health worker was permanently made available (upon onset) for the telehealth service. This study is described in Chapter 6.

Strand 2 studies: Uptake and outcomes of the service

Research question: How is the uptake and what are the outcomes of the new service, as a measure of the usefulness of the service in delivering specialist care?

The strand includes two studies: one evaluating the short-term uptake and the second evaluating outcomes (as per HbA1c levels and admissions to local hospitals and emergency departments). Both studies used quantitative measures, using simple descriptive statistics (means, proportions, ranges) in describing the findings.

Uptake evaluation: This study was conducted by evaluating medical records of Indigenous clients (n=59) who had at least one videoconsultation using the new service. The study included matched records to the clinical condition (diabetes), Indigenous status (Indigenous clients only) and the period of evaluation (first year of service). In the planning stages of the study, it was decided to include Gladstone in addition to Cunnamulla and Charleville for this component of the study (higher client numbers in Gladstone - described in chapter 7). Client data from these sites were available via the central service. Cunnamulla, Charleville, and Gladstone were among the initial site's teleconsultations were set up. However, at the initial stages of the study, several visits to Cunnamulla and Charleville had been planned (to have close interactions with the communities for data extraction purposes for the qualitative studies). This was not possible for Gladstone due to funding (primary reason) and resultant access (no close association with the Indigenous community and its elders in Gladstone) limitations. The outcome evaluation study (HbA1c and admissions) was also planned to include Cunnamulla and Charleville only.

Outcome evaluation: This study is a quantitative evaluation of clinical outcomes (HbA1c) and admissions to local hospitals and emergency departments (in Cunnamulla – nine clients and in Charleville – 12 clients). HbA1c levels were assessed matched to clients (pre-post analysis) who had used the videoconsultation service at least once. Admissions for diabetes-related conditions to hospitals and emergency departments (in the same two communities) were, however, not matched to the usage of the service, as data were only made available grouped (for each institution). Due to the low number of clients accessing services from these communities, it was not possible to access individual data, which would give the potential to identify clients. Though the term 'admission' has been used throughout this study, usually records are made from the diagnosis made at the discharge of a patient. For the purposes of the

study, it was assumed discharges and admissions meant the same and were numerically equal (i.e. excluding those clients who would be discharged without a diagnosis for any reason). This study is included as Chapter 8.

Strand 3 study: economic evaluation

Research question: What are the costs of the new service and how do they compare to other options?

Economic evaluation. This study includes a cost appraisal of the telehealth service (fixed and variable costs) for Cunnamulla. The study also compares with other options available for clients to access specialist care (outreach) for these communities. The study used cost-minimisation analysis principles (described in chapter 9).

Table 5: Study characteristics

Strand 1: Stakeholder perceptions: acceptability, comfort, and satisfaction			
<i>Research question</i>	<i>Outcome measures</i>	<i>Data collection methods (tools) and references</i>	<i>Objective measured (and similar domains of the framework)</i>
What are the perceptions of stakeholders regarding the usefulness of the new telediabetes service?	1. Clinician perceptions – Qualitative data	Interviews with specialist clinicians (Purpose-built semi-structured interview tool)	Acceptance, comfort, and satisfaction (environmental setting and health domain)
	2. Client and local staff member perceptions – Qualitative data	Interviews with clients and local staff (Purpose-built semi-structured interview tool)	Acceptance, comfort, and satisfaction (environmental setting, health domain, and socio-economic aspects)
	3. Client satisfaction of telehealth interactions – Survey data	Context-specific (purpose-built) satisfaction survey ^{114, 115}	Satisfaction (health domains)
Strand 2: Uptake and outcomes of the service			
<i>Research question</i>	<i>Outcome measures</i>	<i>Data collection methods (tools) and references</i>	<i>Objective measured (and similar domains of the framework)</i>
Uptake and outcomes of the service	1. Service activity – at three sites; Description of case studies	Review of activity data and medical records at three sites – Purpose-built manual data extraction tool Client matched pre-post HbA1c levels;	Uptake (health service factors)

	2. Clinical parameters (HbA1c) and admission numbers to emergency departments and hospitals (for diabetes-related conditions) of two sites	Pre-post admission data (numbers) to two selected emergency and hospitals (Indigenous clients only)	Activity and clinical outcomes (health service factors)
Strand 3: Economic evaluation			
<i>Research question</i>	<i>Outcome measures</i>	<i>Data collection methods (tools) and references</i>	<i>Objective measured (and similar domains of the framework)</i>
What are the costs of the new service and how do they compare to other options?	Actual and estimated costs	Evaluation of telehealth costs and comparison (using cost-minimisation analysis) with outreach services ^{116, 117}	Costs (socio-economic aspects)

4.3 Limitations

One of the main limitations of this research was the difficulty of access to the remote Indigenous communities, primarily due to the distance from Brisbane (also inhibiting the use of more exhaustive research methodologies). Financial and time limitations were also secondary constraints. The evaluation frameworks used was not specific for telehealth services within Indigenous communities. Hence, an assumption was made that the framework by Nepal *et al.* would be suitable (due to its ease of use – adaptability, and feasibility to describe a wide range of telehealth programs) for the selected communities and Indigenous contexts. Other problems that were encountered during each study and how these were overcome are described within each chapter, with key limitations explained further where relevant.

4.4 Conclusion

This chapter provides an overview of the overall research design, theoretical framework used and a description of the selected study methods. A brief description of the research methodology and suitability of each method selected has also been described. This multi-method study, therefore, fits within the selected (telehealth) framework and addresses several specific domains (acceptance, client comfort, satisfaction, etc.) of evaluation, in understanding the potential usefulness of videoconsultations for Indigenous clients with diabetes. In the ensuing chapters, where full methods and results of the studies are presented, references will be made to this chapter as and when required.

Chapter 5: Stakeholder perceptions of the telediabetes service to Indigenous communities

5.1 Overview

This chapter analyses stakeholder perceptions of this new telehealth service. In part one of the chapter, a qualitative study of perceptions of specialist clinicians with regards to the use of telehealth for consultations with regional Indigenous clients is described. The study includes the experiences of nine specialist clinicians from six clinical subspecialties, who had prior experience in using video consultations to consult with regional Indigenous clients.

Part two of the chapter is a qualitative evaluation of perceptions of Indigenous clients and local health workers regarding the new telediabetes services (telehealth for diabetes care). Eighteen interviews with Indigenous clients from Cunnamulla and Charleville Indigenous communities and four local health worker interviews from Cunnamulla were included as primary interviews. From a previous study conducted at the Cunnamulla AMS, 10 interviews (transcripts) were also included. This previous study had evaluated perceptions of local health workers regarding the general usefulness of having a telehealth service for remote AMSs and the community they support.

Part 3 of the chapter is a list of enablers of (supporting factors), and barriers to, the new telehealth service. These were identified either directly through participant perceptions (during interviews) or through interpretation (during analysis).

In part 4 of the chapter, the development of diabetes education leaflets, focused on the Indigenous clients with diabetes from Cunnamulla and Charleville Indigenous communities is described. These leaflets were to be useful for the local health service to advertise their new programs (including videoconsultations) for diabetes clients as well as to provide targeted and new information on diabetes control. Importantly, the leaflet development process aimed to allow increased interaction between the Indigenous communities (health staff and clients) and the researcher (allowing for accurate interpretation of interviews).

5.2 Research design considerations

This study uses a descriptive qualitative research methodology, using principles of qualitative description ¹¹⁸. This method is useful for summarising events identified through interviews (either formal or informal) conducted with participants, in its most factual form. The researcher analyses the data, staying close to the events and words of the participants, describing phenomena identified as directly as possible ¹¹⁸. This method was further suitable for this study as the researcher was from outside the Indigenous communities (risk of misinterpretation and bias); however, they travelled to the communities often (justification).

Qualitative description

In its simplest form, qualitative description methodology minimises the need for the researcher to ‘posture’ (need to hold a theoretical position) by simply describing and theorising content. The inductive approach also allows for problem identification and concept development ¹¹⁹. The method is further suitable when the primary aim of a study is to ‘*describe the informant's perception and experience of the world and its phenomena*’ ¹¹⁸.

Further, this method is different to theory-driven methodologies (such as phenomenology), as it allows for thoughtful linkages of existing knowledge and description of participant experiences as similar to the initial language ¹¹⁸. This was achieved through the inclusion of a significant number of statements and contexts described as similar to the descriptions (without much interpretation). However, during this study, the analysis used the socio-ecological model to describe some findings, by contextualising the phenomenon within the Indigenous frameworks. Though, concept (theory) development was not the main aim of this research study, a phenomenon of ‘segmentation of care’ was identified as a significant concept when providing telehealth to Indigenous clients with diabetes.

Theoretical framework

As described above, this method (qualitative description) uses, prior knowledge, thoughtful linkages, and clinical experience of the researcher ^{120, 121}. However, in describing some of the contexts of Indigenous health-seeking, the socio-ecological model was used as suitable. Furthermore, Indigenous research has consistently used lived experiences of Indigenous clients

in interpreting and understanding behaviours. During the description of findings, a similar method was used, where facts were described as directly (as they are) as possible. Therefore, the study has a pragmatic philosophical research approach with overtones of ethnography (some researcher observations) ¹¹⁸. Furthermore, as the research question for the study was to evaluate the usefulness of the new telehealth service, a qualitative descriptive method was appropriate as informant perceptions could be easily referenced (as direct quotes) to the research question (i.e. the underpinning primary motivation).

Sampling

All stakeholders were identified and included purposefully. As the sample sizes were small, variation in sampling was minimal.

Data collection

The data collection used semi-structured interviews with selected stakeholders. Data were collected specific to the experience with the telehealth consultations for diabetes care (observation of a specific occurrence).

Stakeholders from sites: Data were collected from formal and informal discussions with staff members at two AMSs (Cunnamulla and Charleville). Cunnamulla AMS included the Chief Executive Officer of the AMS, practice manager, a senior reception staff member, a chronic care coordinator and GPs. From Charleville, the practice manager, telehealth coordinator and a GP were included. The endocrinologist from the central telehealth service, diabetes educator and a telehealth service manager at the telehealth centre from the central service were also included. A GP visiting Cunnamulla from Brisbane and a staff member from this team were also included.

The researcher took the opportunity to speak to any local staff member at their convenience, during field visits. Many informal discussions were conducted either in the common room or the corridors of the AMSs.

Field visits: Between 2015 and 2017, the researcher undertook five visits to Cunnamulla Indigenous community (four with the supervisory team and one with a visiting GP). The researcher visited Charleville Indigenous community four times for data collection purposes, all of them with the supervisory staff. Commercial flights are available between Brisbane and Charleville, and from there it is a two-hour drive to Cunnamulla (hired car). The gatekeepers to the communities were the CEOs of the AMSs, who were contacted prior to each visit.

Central service: At the central service, the specialist interviewed and other administrative staff members were vicariously known to the researcher and relationships were formed quickly. All of the specialist clinician interviews were planned and scheduled through informal relationships formed whilst the researcher was at the central service.

Field notes: Field notes describing the telehealth activities observed during field visits were recorded at the end of each day. Field notes included how clients were referred to the telehealth specialist by the local GP, how appointments were scheduled, how clients were informed of the booked appointments, and how reminders were sent the day prior to the appointment. Notes made included random observations about how Indigenous clients and local health workers interacted and how the telehealth service was gradually integrating into the day-to-day activities of the AMS. All notes were made by hand. Pages were serially numbered and reviewed during analysis. These were useful in the analysis of chronologically important events (follow-up or referral of clients).

Observations: Incidental observations were made by the researcher on how closely the telehealth service and Indigenous clients interacted. Observations included interactions between local staff and the telehealth service, how clients interacted with the AMS, and how a videoconsultation was arranged. Observations were only incidental - without any observation protocols. Though these were not directly evaluated during analysis, it is likely the researchers' understanding of the contexts was affected by what was randomly observed during site visits.

Forming relationships: The researcher (during field visits) actively developed relationships with participants by being open to new ideas, actively pursuing what was meant by participants

during interviews. These active listening exercises were attuned to understanding the telehealth service and the interactions of staff and Indigenous clients with the new service. However, because some of these meetings were ad-hoc (and intermittent), developing a strong relationship was difficult. However, no staff members or clients were unwilling to participate in the study (after being identified by local staff), unless they were busy with other activities at that time. In such circumstances, appointments were made to conduct interviews later on, either in person or by telephone. (All clients who were identified by the local health staff were eventually interviewed.)

Analysis

Participant perceptions (content), identified through interviews were analysed thematically (thematic analysis). Therefore, the primary tool for data collection was the interviews with participants. The analysis also included interpretation of relationships (from interview content) and contexts of how Indigenous people interacted with each other and health staff where possible. However, these interpretations are liable to risk as the findings were not direct observations. An ideal method would have been an ethnographic approach where the researcher is a part of the world being observed (a pseudo-member). However, due to the distance between the researcher and the communities, this was not possible (the researcher was based in Brisbane and was only able to meet stakeholders periodically, and through electronic communication only, in the interim).

As all (primary) participant interviews were conducted by the researcher, the anonymity of the identity participants during analysis was not possible. Furthermore, in a small Indigenous community, there were only a limited number of staff members for diabetes services (purposive selection was suitable).

It was important to understand what was ‘normal’ after several videoconsultations had occurred – for clients as well as staff members, as this allowed comparison of events temporally. The social-ecological model was useful in understanding the several layers affecting the interactions (though not advised for qualitative description approaches). Importantly, the researcher had no prior association with the AMSs or the two Indigenous communities before the study. Therefore, the analysis was not prejudiced by any previous interactions.

Positionality – As the researcher was ‘embedded’ in the study (though superficially) working from an implementer’s base, the positionality of the researcher is an important aspect. Usually, qualitative descriptive approaches attempt to describe findings ‘as they are’ by identifying patterns, themes, commonalities and generalisations from content analysis. This deems positionality (how events are reflected and observed from the researcher’s base) less significant. However, on reflection, during this study, the researcher was positioned as an outsider (to the Indigenous clients and health staff from AMSs and to all their interactions) and an insider to the workings of central service. The reason for this is the limitation with distance, leading to intermittent travel to the sites and the difficulty in keeping in touch with clients and staff in the interim. The researcher was vicariously known to the central service, as the researcher was based at the centre (embedded researcher).

Ethical approval

Ethical approval for this study was from the University of Queensland (Number 2015001105). An important aspect of ethics was that health workers were identifiable (small communities and a limited number of health workers for diabetes care) during the description of findings. This fact was explained to the health workers (consent) and details of the health worker in descriptions were minimised.

Part 1

5.3 Specialist clinician perceptions regarding using videoconsultations for Indigenous clients

5.3.1 Aim

This research aims to explore perceptions of specialist clinicians regarding the usefulness of telehealth (TH) to consult with Indigenous clients from distant areas in Queensland. These clinician perceptions aid the understanding of the acceptance of videoconsultations by the Indigenous people and future usefulness of telehealth services in similar Indigenous communities.

5.3.2 Methods

Study setting

The study was conducted at the Centre for Online Health, Princess Alexandra Hospital (PAH). Specialist clinicians who were consulting at the telehealth centre of the PAH during the study period (2015–2017) were approached for the study, during working hours.

Recruitment of participants

Purposive sampling

A purposive sample of nine clinicians from six clinical subspecialties was invited to participate in the study. Suitable clinicians were identified from the PAH and contact details obtained through the PAH telehealth centre. Interviews were conducted following verbal informed consent, either in person or via telephone, by appointment.

The reason for including clinicians from other clinical subspecialties (other than for endocrinology) was to understand the Indigenous client interactions with local health services broadly. Furthermore, once the tele-endocrine service was operational (for diabetes clients), need for comprehensive case management would mean that clients would need to be referred to other clinicians intermittently. At this point, it would be important to know how other services could be delivered via the same telehealth service, as clients would not have any other

option for accessing care, without leaving the community to a metropolitan hospital for specialist care.

Semi-structured interview guide

The interview guide consisted of six domains, expanded during each interview. The domains included acceptability of telehealth by Indigenous clients, appropriateness, clinical quality of the videoconsultation, the presence of local health workers and family during a consultation and pre-consultation work-up required for each consultation. The questions were informed by literature ¹²²⁻¹²⁵ and later refined by input from supervisors. Initial interviews also assisted in forming new questions for later interviews.

Data analysis

Transcription of interviews

Audio recorded interviews were initially stored securely on the University of Queensland S-Drive. These interviews were transcribed verbatim by the primary investigator and imported to an N-vivo -11 database. Each audio record ranged between 15 and 25 minutes in length. Transcriptions were verified by listening to the audio whilst reviewing the text simultaneously.

Coding

The initial coding was conducted by hand, using different colours for each code. Later, these hand codes were used in identifying categories and themes via analysis within N-vivo software. The primary codes used were similar to the domains used in the interview guide.

Content analysis

The thematic content analysis was conducted by developing categories and subcategories from the initial codes. Later, themes were identified through review of the text within the categories. The analysis was informed from methods used by Saldana ¹²⁶. Development of categories and themes from the transcripts were reviewed periodically and aligned with the research aim (i.e. to explore perceptions of clinicians) and to the views of the participants, to avoid misinterpretation of data. Content forming each theme included input from all participants.

Memos were created when themes were assigned describing its extent and reasons for the content.

Validity and internal coherence

Validity and internal coherence of findings were achieved through dynamic review (back and forth) and by the extensive presentation of verbatim evidence (qualitative descriptive approach) for reader interpretation. Concepts were mapped to identify interrelationships, and an overall concept (theory) was developed that explained the relationships. The analysis used social-ecological theory in understanding the participant's perceptions, where relevant. The social-ecological theory was useful when exploring an individual's actions and how they are influenced by external factors, such as family, community relationships and societal factors, linked to the new telehealth service ¹²⁷.

Concept map and word cloud

A content map and word cloud was developed to understand the main concepts of the analysis. The word clouds were especially useful as they allowed identification and analysis of exact terms used by stakeholders (fitting the qualitative descriptive approach).

5.3.3 Results

Participant characteristics

All nine participants included were specialists in their respective clinical subspecialty. The participants included three geriatricians, two endocrinologists, and one specialist each from dermatology, gastroenterology, orthopaedics and general practice. All participants (excluding the GP) were from the PAH and had used the PAH telehealth facility to provide services to Indigenous communities during the previous year.

Participants had used videoconferencing for providing care to Indigenous clients regularly and were actively involved in telehealth-based clinical services. The GP conducted frequent outreach services to one of the regional communities where telehealth was delivered to and was instrumental in setting up of the telehealth service.

Definitions of codes and categories

Tables 6 and 7 show the definitions of the codes and categories used for clustering data during initial analysis and how the themes and overarching theme was developed.

Table 6: Definitions of primary and secondary codes, and categories and subcategories

Primary code and definition	Secondary codes and definitions	Categories, <i>subcategories</i> and definitions
Acceptability - Perceptions of clinicians regarding the acceptability of telehealth by Indigenous people for specialist health needs.	Receptiveness - Factors leading to the increased receptiveness of the specialist service; Reluctance - Factors perceived as barriers to uptake.	Participation - Client willingness to participate with telehealth <i>Disease-specific standards - Delivery of disease-specific standards of care</i>
Appropriateness - The appropriateness and usability of the telehealth service.	Client uptake - Enabling factors for clients to appropriately receive the telehealth service (as perceived by the clinicians); Specialist perceptions - specialist perceptions about the appropriateness of telehealth for the client condition.	Clinical quality - The ability of the videoconsultation to achieve intended endpoints
Consultation quality - The ability of the videoconsultation to manage the presenting condition.	Consultation - The quality of the consultation – ability to communicate, clinically observe, etc. Technology - Technological aspects of the consultation – break in service, difficulties, etc.	

Staff presence- The effect the presence of a staff member has on a consultation.	Support consultation - Support provided by the staff member for the continuance of a targeted consultation; Support client - Support extended towards the client during the consultation	Continuity of care - Evidence for telehealth supporting continuity of care <i>Rapport - Evidence for client and health service personnel working together with telehealth</i>
Family support - Effect the presence of family has on the consultation	-	Family as a stakeholder - Usefulness of the family during the consultation
Pre-consultation work-up - Usefulness of the pre-consultation work-up for a videoconsultation	-	Logistics - Logistical requirements for a videoconsultation <i>Care coordination - Interactions of staff from the central service and the AMS</i>

Table 7: Development of themes and overarching theme

Categories and subcategories	Themes (and meanings)	Overarching theme
Participation <i>Disease-specific standards</i>	Receptiveness - Receipt of telehealth services	Segmented care delivery – The need to include external agents in an Indigenous client’s videoconsultation as a prerequisite for its success
Clinical quality	Technology integration – How technology helps a videoconsultation to take place from an Indigenous community	
Logistics <i>Care coordination</i>		
Family as a stakeholder	‘Tailored’ teleconsulting – The need to ‘tailor’ videoconsultations, depending on the availability of local resources	
Continuity of care <i>Rapport</i>		

Themes

The analysis of interviews identified one overarching theme and three subthemes. The overarching theme was ‘segmentation in care delivery’ – how an Indigenous client’s clinical consultation via telehealth included external agents such as local health workers and GPs. The three subthemes identified under the overarching theme were receptiveness, technology integration, and ‘tailored’ teleconsulting. Further analysis of these clinician perceptions (and Indigenous client perceptions in part 2 of the study) led to the development of a concept (of segmented therapeutic relationships) to describe the overall interaction.

Overarching theme - Segmentation in care delivery

This overarching theme describes how different agents (local health workers, GP, etc.) interact with the client and the clinician in providing telehealth services. During a traditional clinical consultation with an Indigenous client, a working alliance is usually built with the clinician and/or the immediate family members. During these generally in-person consultations, the function of both the local health worker and the local GP is limited to a support role of referral and follow up. When a telehealth consultation for an Indigenous client is conducted, the local staff members are more closely involved – an extension to the traditional health services setup. The local staff member becomes a critical link in the telehealth care process, with responsibilities in introducing, informing, supporting, comforting during a consultation and follow-up – an extended involvement. The extension in care delivery also includes services from the GP assisting with the clinical examination as per advice from the specialist, helping Indigenous clients to become comfortable and accepting the telehealth modality of care.

Support by local health workers - The local health workers are also extensively involved with the client care process, informing and following-up of planned follow-up measures, and organising allied health referrals. The clinicians perceived that the presence of a local health worker, a nurse or the GP allowed them to quickly develop trust with the client. Training of local health workers further improved these exchanges.

‘Establishing a relationship with the health service, and knowing the limitations within which they work, having a better understanding of the social situation, and what resources they have to assist in the managing.’

'It is easier for them (AMS staff) to talk to them, than to us. If they don't understand a question they always turn to the liaison worker, and the worker relays it to us. The Indigenous liaison helps them to open up and helps with the consultation.'

Support by family members - Family member support to clients was integral during videoconsultations, providing context to the clinical symptoms and morbidity. Although family members are usually involved in the clinical care of a client, if these Indigenous clients were to travel to a metropolitan centre, it is unlikely their family would be easily accessible for the clinician. With telehealth, family support was easily available, and the care process was much swifter.

"Initially they feel a bit anxious; as time goes they become comfortable, I have no recollection of any client having major problems; they are well supported; had a big support group of family."

Presence of the local general practitioner - The presence of a local GP during a consultation was also perceived as extremely useful as it allowed clinicians to develop a client management plan to suit the local needs and availability of resources (e.g. allied health services). The extended interaction with the GP in a videoconsultation is also an example of the segmented care delivery when telehealth for Indigenous clients is considered.

Theme 1: Receptiveness

Receptiveness (how telehealth services are received) of Indigenous clients to telehealth services depended on two factors. These were cultural aspects and availability of local health staff to assist during a videoconsultation.

Cultural aspects

Clinicians identified 'cultural' aspects, such as poor eye contact with the clinician during the videoconsultation, reaction to the video when it is first turned on, and not looking at the screen during a conversation, important to be considered. However, none of the clinicians referenced

these as impediments to achieving intended clinical endpoints, but only as factors requiring extra effort during a clinical consultation.

“Very occasionally cultural issues are there; not looking at the screen; sometimes clients and family members both; if the mismatch is great we’ll abandon the consult and arrange for a face-to-face.”

Cultural aspects of Indigenous communication for the provision of health services are well-described in Australia ¹²⁸. Successful interpersonal communication with Indigenous clients requires rapport-building, simple language (avoiding technical jargon), flexible time allocations, respecting personal space and non-verbal communication ¹²⁸. The specialist clinicians observed that, sometimes, it was not as easy to build a rapport with clients as they were uncomfortable with the technology. *‘It needed a bit more work,’* several clinicians stated, highlighting the extra effort needed. But once communication was established (especially subsequent to the first consultation), it was easy to conduct an appointment.

Difficulty in interactions - Some of the other limitations when using videoconsultations, highlighted by the specialists, were the difficulty of showing empathy and respecting personal space. In the virtual environment, as the client and the clinician were both face-to-face, essentially throughout the whole consultation, it was not possible to allow for space, as if during an in-person consultation. Traditionally, Indigenous clients are said to have minimal eye contact during a clinical consultation ¹²⁸. Similarly, clinicians stated that some clients they’ve had videoconsultations with tended to avoid looking at the screen during video-consultations. However, clinicians also highlighted that this was not an impediment to a successful clinical consultation.

“It’s hard to get them to always look at you, but that is not only in telehealth but in general. They are restrained in their speech. I need to be persistent to get the information”.

The dermatologist stated:

“I have had at times some issues with clients not willing to have photographs taken for their consultation due to cultural reasons. This can make it difficult for me to offer an

adequate assessment as the imaging through the TV screen is often pixelated and not clear.”

If a dermatology videoconsultation were to be unsuccessful, as when a client disapproves photographs being taken or allowing for visualisation of the skin disorder through the camera, it would be extremely difficult for the clinician to make an informed (and accurate) clinical decision. This difficulty is further aggravated if the internet connectivity is poor, where clear images could not be transferred over the video quickly. For most videoconsultations with Indigenous clients, the dermatologist had requested images to be sent prior. In those instances, the consultations had simply been for a description of the disorder and its clinical management. Due to these reasons for dermatology videoconsultations to be successful, Indigenous clients must be willing to accept (and receive) technology-driven (store-and-forward of images) solutions. If they do not prefer a telehealth solution, a specialist will have to depend on the local GP for an accurate description of the skin condition or else will have to ask the client to visit a metropolitan hospital for care. Due to the distance, it is most unlikely that a client would visit a metropolitan hospital, even when asked to do so.

Availability of local health staff

The involvement of local staff member was identified by clinicians as crucial in the uptake of the telehealth service by Indigenous clients. Local staff often assisted the videoconsultation by setting up the video equipment, by introducing the clinician to the client at the start of the consultation, and by assisting the clinician-client interaction throughout each consultation. If a client was from a background where they had not been exposed to telehealth-based consultations before, building a therapeutic relationship through telehealth was more difficult. In this instance, the local staff members' input was extremely useful in connecting the tele-clinician with the client.

“You appreciate that they don't like to make eye contact all the time, and it (telehealth) is new for them. I think that is why it is important for someone to be with them to support them in the process on the other end. If it was an Indigenous health worker or a (local health) worker that they know, then they open up more and quickly.”

“Indigenous people are very reluctant to come to consultations - both telehealth and face-to-face. It's very hard to understand whether they have understood what you have

told them. But they would ask their indigenous health worker afterwards. Even in the people who do turn up, the uptake of what we do say is probably a bit low.”

“They probably have more of a relationship with the staff there (AMS). My feeling is that they are not comfortable at a general clinic. They get some priority at the AMS. They are in a facility that they are comfortable with.”

The clinicians stated clients felt comfortable at the AMS premises (in comparison to the local hospital) when they presented for a videoconsultation. Clients felt as if they were given priority when local staff received them cordially (and on most occasions by a person known to them). Clients also felt the AMS as a culturally appropriate institution to receive health services, with artwork depicting culture, understanding their ways of interpersonal communication and staffed by local health workers from the community. It is likely that knowing the local staff personally made the wait for an appointment less stressful as well. Furthermore, availability of pre-trained local staff (on the processes for teleconsulting) at the AMS assisted to streamline the clinical examination and case preparation processes.

Client privacy- When AMS staff were sitting in during a videoconsultation, privacy of a client was not perceived as a concern by the specialists. It is likely the clinicians observed privacy of a sensitive clinical discussion more closely only if warranted. Feedback from local staff members post-consultation, were also positive, highlighting only the need to work through the initial anxiety of clients (with support from family and AMS staff). Furthermore, associated anxiety with a videoconsultation for a client was less as they were mostly from the surrounding community, hence waiting times were shorter due to reduced travel. Older clients were more concerned about travelling as they had to depend on the AMS or family for transport.

Comparison with in-person consultations - Clinicians observed that reluctance in the uptake of telehealth was ‘*somewhat*’ similar to what was seen for in-person consultation among Indigenous clients. Urban and younger Indigenous clients seemed more willing to access videoconsultations. However, they too preferred their Indigenous medical centre for the consultation, as they felt more comfortable with the care given at the local centre.

“From the few interactions that I have had, I think it is acceptable to them. Otherwise, they wouldn't be turning up for their appointments - and the failure-to-attend rates are similar in face-to-face consults as well.”

Failure-to-attend rates - High failure-to-attend rates (for clinical appointments) are well-documented for Indigenous clients. Some of the reasons being: poor understanding of the severity of the condition, lowered expectations and lack of trust in traditional western health systems, and difficulty in access to culturally accepted care in the community, especially for screening clinics ^{129, 130}. The specialists interviewed for this study stated that among the Indigenous clients they've had videoconsultations with, to date, an excess in 'failure to attend appointments' was not seen. The likely reasons were that institutionalised adults (for geriatric and gastroenterology appointments) were brought in by the institution (i.e. either the aged care facility or the correctional facility), and for orthopaedics appointments, the clients perceived the appointment as very important as they could see the fracture on their x-ray.

Extended scope

Interviews identified several instances where clinical conditions outside a specialist's usual clinical scope were managed. One such instance involved a young hypertensive client who was investigated and provided with a care plan (normally managed by a general physician) by the endocrinologist.

"If I didn't do what was needed, there would be no one to do it. It is unlikely this one (client) would travel even if an appointment was given (at a metropolitan centre). I always try to do that (solve all the medical problems I can)."

On another occasion, the endocrinologist described a client who was admitted to the local hospital for further care, immediately following a routine review through telehealth. The client had extremely elevated triglyceride levels warranting admission prior to a probable pancreatic event.

These interactions with the endocrinologists from the telehealth service show that the new service has provided remote Indigenous clients with access to care that was previously unavailable to them. Given the difficulty in attracting the same specialist to do regular outreach clinics, telehealth provides a better option, as clients can get used to the same specialist and develop a stronger working alliance in the process.

Theme 2: ‘Tailored’ teleconsulting

Each videoconsultation with an Indigenous client was perceived to be different, each needing to suit the clinical need, the technology available on-site and dependent on the personnel available to assist during a consultation. If a GP was available during a videoconsultation, the specialists were able to utilise their clinical judgement (and clinical explanations) for general physical examination, skin examination, etc.

“If there is another medical person, they can follow your instructions; and examine in front of the video-link; telehealth requires preparation and support for physical examination; for some people we can do without; for an older frail, cognitively impaired person, if preliminary workup is there, all the questionnaires that we use for cognitive assessment are done before-hand and sent, it will be very useful.”

“If I know that the GP is not going to be there, I usually ask the GP to do a preliminary physical examination, with the client’s problem in mind, and ask the GP to do the needful, during or after the consultation; and that’s how we usually overcome barriers; I’ve never had issues.”

Personnel at the remote end - The type of personnel available at the remote end was key in successfully conducting a consultation. The dermatologist found it essential to pre-train local health workers to examine and photograph skin rashes, take skin biopsies and conduct allergy testing.

“Having photographs prior, a good history on referral letter is also helpful, e.g. if drug rash suspected, I can request drug list from chemist pre-appointment which makes the process a lot smoother.”

The local staff members were able to closely follow up on clients as they had a good rapport with most clients. The geriatricians highlighted the need for collateral clinical history and, in some instances, they had to depend on the local GP, local Indigenous health staff or family members, especially if the client was incapacitated (e.g. dementia). Hence, setup, flow and follow-up for each consultation were situation and personnel-dependent.

“Having family, relatives, and (local) staff is critical because they can clarify some things in the historical setting, so you get a better idea of what you are doing.”

The specialists emphasised the limitations of frequent changes in staff due to poor scheduling or turnover. The specialists had to be flexible to accept that each consultation, even across the same clinic, would be different, dependent on the input to clinical history and clinical skills of the local staff member. Availability of the local GP was dependent on their workload, hence was not routinely available.

For specialists who had previously used telehealth for consultations, using this new service had simply been a novel way of interacting with Indigenous clients outside the norm of standard in-person care. The good quality video, availability of all relevant information in the central computer system and being seated in a comfortable environment in the central facility were all positive factors from the clinician perspective. Even though slow uptake (and '*laboured*' or '*reluctant*' responses by clients) had been an initial limitation, the consultation provided access to health services otherwise not available within the standard care process for Indigenous clients. However, in other instances of using video-conferencing, as for contacting family members being treated in a metropolitan hospital (or an incarcerated family member in the correctional system), immediate engagement via video-link was noted.

Theme 3: Technology integration

Telehealth-based consultations require Indigenous clients to communicate through a video-link with specialists based at a metropolitan hospital. On most occasions, this would be the first time the client is involved in telehealth-based consultations. Furthermore, for most first appointment clients, it would be the first time they meet the (new) tele-clinician. Each videoconsultation includes interactions with specialists via videoconference, answering questions and even allowing clinical examinations (conducted for by the attending GP) across it. Furthermore, a pre-consultation work-up requires the transfer of pathology records, radiology images, etc. via the electronic system. In some instances, older records had to be shown to the specialist by holding them near to the camera. Hence, a videoconsultation for Indigenous clients required extensive involvement with technology.

Videoconsultations with the dermatologist seemed to be most affected by technology, as it depended on good-quality images or video for an accurate diagnosis.

“I need to look at a skin rash, sometimes it is not possible unless it is grossly evident; I would ask the nursing staff to take images and send them.”

“For Acne, some might send me a video clip, but that is for acne only and GP can help (if available) for things like an examination.”

“In person is preferable; clinical quality is less than preferable, but for the first consult; but it is ok, under the circumstances.”

“Most of the time the problem is the client won’t interact via telehealth; then have to depend on collateral history.”

Correctional health services - The gastroenterologist, who had extensive experience in providing services to correctional facilities, perceived that telehealth was an extremely important tool for consulting with incarcerated Indigenous clients at short notice (without having to visit the site) and for the review of urgent pathology reports. Any face-to-face consultation at a correctional facility required the clinician to travel from the PAH, and whilst inside a correctional facility, a concern for personal safety. The clinician felt more comfortable and at ease during a videoconsultation, delivered from the PAH rather than when conducting it face-to-face at a correctional facility, in person. If relevant records were available prior to the consultation, outcomes of these consultations were perceived to be similar to in-person care. Furthermore, clinician travelling costs and the logistics of transporting prisoners across correctional facilities were reduced.

Store and forward telehealth - The orthopaedic surgeon often used ‘store and forward’ methods for transfer of images (e.g. fractures) prior to each consultation. This allowed the relay of timely advice to the remote site, for clinical action to be taken. The advice was delivered in real time via either a video-link or by telephone. If the specialist wanted to review a client (e.g. for observation of wounds of a compound fracture or physical limitations post-correction), a videoconsultation was organised.

Geriatric telehealth services - For the geriatricians, high-quality video was very important as they wanted to observe clients during a consultation – for mood, mannerisms, etc. Videoconferencing with family and local health workers was also helpful in planning care. During initial case preparation, cognitive assessments could be conducted and uploaded to the central system, if a trained staff member was available locally. The clinicians stressed there would be problems with a clinical consultation if the video quality was to be poor, as it would impede observation of the client.

For the geriatricians, though they had expected a poor response from elderly clients when using videoconsultations, the response was positive; clients engaged immediately. The specialists stated that it is likely the elderly clients were willing to accept the telehealth modality of care, as they wanted to avoid travel to a metropolitan hospital.

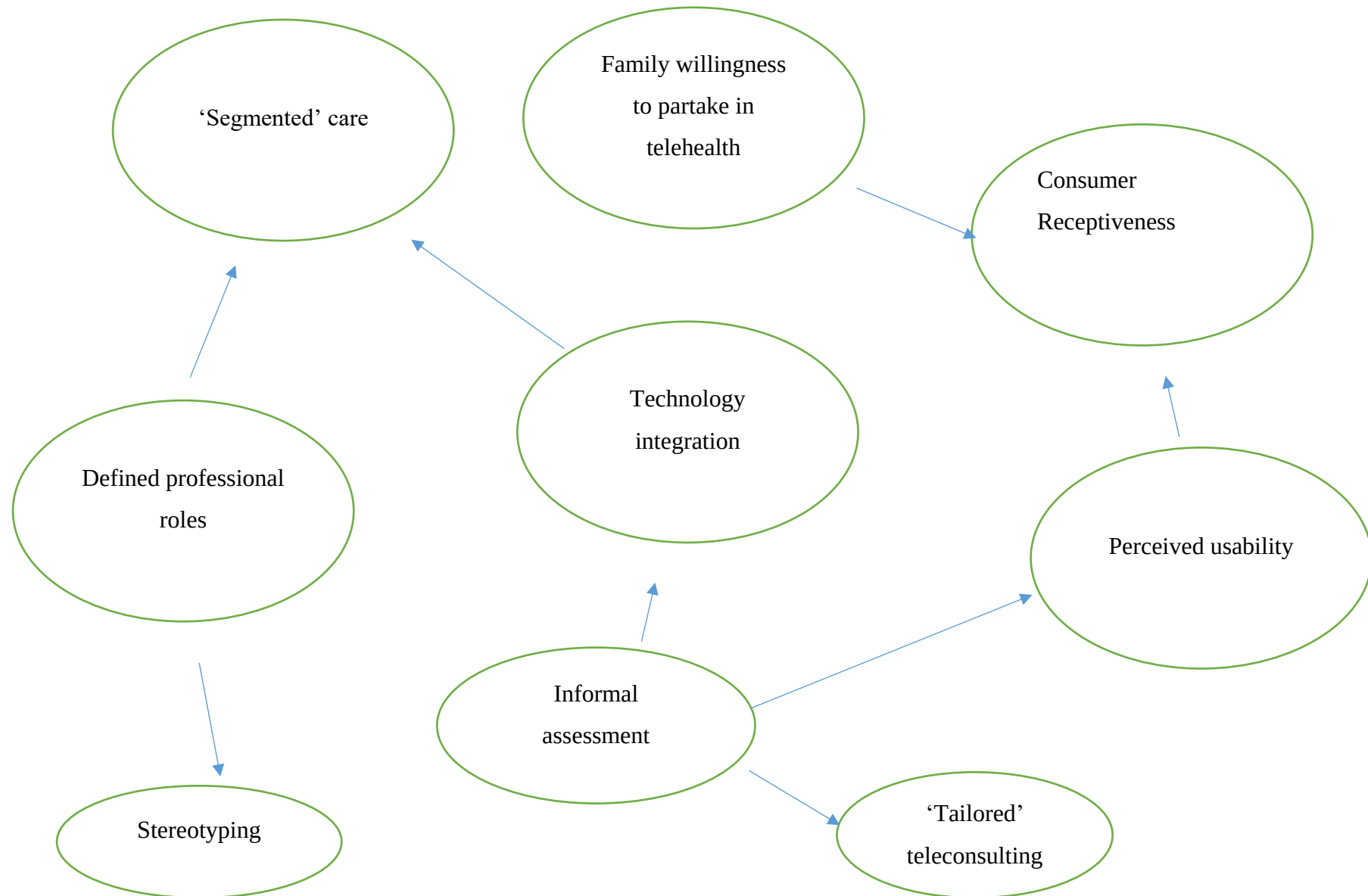
“In the absence of residual pathology, use of video was appropriate for clinical decision-making. If collateral information on the client was available through preliminary case preparation, a geriatric consultation, and cognitive assessment of an Indigenous client is similar to in person.”

Tele-endocrine services - For the endocrinologists, the quality of the video was not as important since they depended heavily on the timely availability of pre-planned pathology reports for clinical decision-making. In some instances, when the telehealth connection could not be established, some review consultations were conducted via telephone. Reports were made available to the specialist either via the computer system, fax or email, prior to each consultation. Downloads from blood glucose readers were also uploaded for review. The video-link was more important when meeting a new client, as it helped to develop rapport.

Concept map

Concepts identified during analysis of the interviews have been mapped (Figure 7) to identify inter-relationships. The concept of segmented care (where an extended clinical relationship is built with the Indigenous client and other participating agents, e.g. staff, family) is influenced by clinician expectations of how the consultation will eventuate (stereotyping), previous experiences with professional roles, and problems with integrating technology. The receptiveness of telehealth from the client perspective is influenced by family, perceptions formed by lived experiences, and AMS staff involvement during case preparation. The effect

of different layers of an Indigenous person's life – family, local community, health staff and specialist in a metropolitan hospital, as described by the socio-ecological model – is clearly identifiable. Furthermore, legislation such as Medicare reimbursement of telehealth (exo-system in the socio-ecological model), also affects the form of these interactions.

Figure 7: Concept map

5.3.4 Discussion

This study aimed to understand the initial impressions of specialist clinicians in using telehealth services for clinical consultations with Indigenous clients. These perceptions were to help understand the usefulness of the service once other clinical subspecialties (other than for endocrine services) were to be required, for the comprehensive clinical care of cases. The data collection of the study was through open-ended and semi-structured interviews. This method assisted to comprehend impressions of specialists about the service, which were clinical subspecialty and site-dependent. The study found that specialists perceived the service to be successfully delivered and would be an essential service for Indigenous clients in accessing care without leaving the community. However, each clinical subspecialty had its own set of barriers, and different strategies needed to be employed to overcome them.

External parties

The use of the Social ecological theory to understand and interpret findings showed that the family members were extremely important for the client to take up the service initially. The prior know-how of the local health workers (and in some instances the local GPs) was also helpful for the Indigenous client for a productive interaction with the new service. The external layers of the interaction included the tele-clinician and the allied health and support staff at the central service. Though interactions of the Indigenous client with these external layers were minimal and dependent on the support of the local health workers, the clinicians perceived them to be positive.

Local health workers

All specialists identified the local health worker to be extremely important for a clinical subspecialty to be delivered successfully. The usefulness of the local health worker in the remote Indigenous health setting is well-identified ^{69, 131}. At the remote end, the Indigenous health worker is the bridge between the traditional western health service and the remote Indigenous community ¹³². Local health workers, through their community services involvement ¹³³ and through extended personal and family relationships, are able to attract and retain the local Indigenous clients to the AMS. Clients find comfort and familiarity with the presence of the local health worker. This comfort factor, where clients feel shielded from any unfamiliar health service experience is probably one of the key reasons why clients feel they

receive better services at the AMS. This know-how is also vital in attracting and retaining clients with the telehealth-based services as well. When telehealth was previously implemented in remote Indigenous communities across Australia, the local health worker was found to be similarly important. An example of which is, when oncology services ^{134, 135} were delivered using videoconferencing into remote Indigenous communities, uptake and satisfaction had been significantly dependent on the trust between the local health workers and clients.

Delivering new telehealth services

When initiating a telehealth service in a distant Indigenous community, the location at which the service is set up has significant weight on how the community receives it. Despite the usefulness of having telehealth at the local hospital as a clinical decision tool, helping refine or upscale care ^{136, 137}, the interaction clients have with the telehealth at the hospital is minimal. Furthermore, when clients are in a hospital they are likely to heed the requests and advice as they assume the patient role ¹³⁸ in agreement with the care provided. However, when the client is back in the community, with the option of choosing to present to a planned telehealth consultation, they may very well forego an appointment if they feel uncomfortable. Non-attendance would be further accentuated if it was a medical condition not outwardly felt such as hypertension or diabetes. By setting up the telehealth service in the AMS, the cultural appropriateness, the relative feeling of ease at the AMS and the presence of local health workers ¹³⁹ can be used as a buffer for clients to access care. Therefore, the ideal model for telehealth services in a remote Indigenous community is to see ambulant clients at the AMS for routine specialist follow-up and, when a client is admitted to the hospital, provide clinical care supported by telehealth. A similar model has been prescribed previously by Caffery *et al.*, where the AMS was used as the base for housing telehealth services and the local hospital and emergency units used as needed ⁶⁹.

Geriatric telehealth services

Geriatric care delivered through telehealth usually involves extended parties, such as family or social services personnel, within a consultation. Such involvement supplements the need for collateral information often poorly provided by clients with cognitive and memory impairments ¹⁴⁰. In the case of elderly Indigenous clients from remote regions, the usefulness of extended care providers is accentuated, as there is no other way of verifying the diagnosis

or the receipt of planned care. For endocrine, gastroenterology and orthopaedic videoconsultations the process of delivering a successful consultation depends more on preliminary case-preparation than on the quality of the actual videoconsultation itself ¹⁴¹. However, for Indigenous clients, uptake of advice provided is dependent on how well the videoconsultation proceeds. For dermatology, the cultural aspects of Indigenous clients are a limitation, especially when they refrain from communicating with the clinician or dislike having photographs taken. In such circumstances, the specialist will have to depend on the local GP or a health worker for an accurate description of the condition or will have to ask the client to make the journey for an in-person consultation. Though the accuracy and efficacy of providing telehealth-based dermatology care are well-established ^{142, 143}, these limitations in Indigenous health behaviour can increase the potential of a misdiagnosis.

Strengths and limitations

The inclusion of specialists from multiple clinical subspecialties, each with significant experience and interest in Indigenous health, and also focusing on clinical subspecialties which accrue a large number of videoconsultations annually (endocrine and geriatrics) across the PAH Indigenous telehealth service, are strengths of the study. The clinicians selected in this study had a vested interest in telehealth; hence, findings are most likely to be positively skewed towards the usefulness of telehealth. However, the inclusion of clinicians with a limited interest in either telehealth or Indigenous health is unlikely to have provided any insight into the usefulness of telehealth for remote Indigenous communities. The use of a non-validated interview guide was a limitation, but it was simply used as an aid to the conversation and was also advised by previous literature and experienced Indigenous health researchers. The analysis was conducted by the principal investigator only, opening it to significant bias. This was exemplified as the principal investigator had an interest in the establishment of the service and its eventual success. A close review of the interim findings and finalised themes by the supervisory staff would have minimised the effects of this limitation. The findings of this study component was mainly informed by the data collected from the interviews with specialists (with limited input from other parts of the evaluation). These specialists were well-informed sources with first-hand experience in working with Indigenous communities using telehealth. Therefore, their perceptions were well-correlated (to the new telehealth service) and valid to the contexts studied even when assessed without input from other sources.

5.3.5 Conclusion

The specialist clinicians described the telehealth service as a useful tool to access care for remote Indigenous clients. The clinicians perceived the service to be acceptable to clients, local health workers (including the local GP) and the client's family when included. Limitations identified by clinicians included cultural barriers, staff turnover, lack of trained staff during consultations, technological barriers, and the extensive need for preliminary case preparation. The receptiveness of clients to the telehealth service was variable, despite most clients integrating quickly, with local health staff assisting to mitigate their initial angst. The rapid nature of changes to the local circumstances (for example, the turnover of trained staff, non-interacting clients, poor pre-consultation work-up, and barriers to technology integration) have led to clinicians becoming more adaptive, tailoring each consultation to match the unmet need. The involvement of extended agents in the videoconsultation has led to segmentation in the care delivery process, with components complementing for the productive delivery of a videoconsultation. In conclusion, from the perspective of the clinicians interviewed, this telehealth service seems to be a successful health service tool to increase access to specialists for these distant Indigenous communities.

5.3.6 Key findings

- For the Indigenous client receipt of care by telehealth meant the therapeutic relationship was built with local health workers, local GPs and the specialist clinician (on video).
- The telehealth service was useful in managing remote Indigenous clients, with intended clinical objectives achieved on most occasions.
- The client and their family members were receptive to the service, accepting the service despite initial anxiety.
- The local health worker (including the GP) was integral to a successful videoconsultation, assisting at overcoming bottlenecks to the smooth delivery of the service.
- Limitations of the service included staffing, training, cultural and technological barriers.

Part 2

5.4 Client and local health worker perceptions regarding the specialist telehealth service for diabetes

Overview

This part of the chapter describes findings from a qualitative study exploring perceptions of Indigenous clients and local Indigenous health workers from two AMSs in distant (remote) Western Queensland. Clients were provided access to an endocrinologist and a diabetes educator via the telehealth service. In the analysis section of the study, quantitative results from chapter 7 have been included in triangulation, where relevant.

5.4.1 Aim

This study aimed to explore perceptions of Indigenous clients and local health workers from distant Indigenous communities regarding the potential usefulness of the telehealth-based specialist consultation service for diabetes care.

5.4.2 Methods

A descriptive qualitative study design (described above) was used for this study.

Ethical clearance

The study protocol obtained ethical clearance from the School of Medicine, University of Queensland (2015001105, amendments 1 and 2), which includes Cunnamulla and Charleville AMSs. Letters of support were received from the Chief Executive Officers of both AMSs (see annexure 1).

Study setting

The study was conducted at the Cunnamulla and Charleville AMSs in Western Queensland. Clients with diabetes, with previous exposure to videoconsultations, were included in the study.

Local health workers, including the local General Practitioners (GPs) from the two AMSs were also interviewed during the study period (2016-2017).

Participant recruitment

Participants were purposively recruited through the assistance of the local health workers at both Cunnamulla and Charleville AMSs. At both AMSs, staff members perused previous videoconsultation lists and identified diabetes clients who had a least one telehealth consultation (for diabetes) and would potentially be willing to participate in the study. Once suitable clients were selected (by local staff) they were contacted by telephone and invited to participate in the study. The initial contact was made by a local staff member, where the researcher was introduced and consent for contacting over the phone was requested. For those clients who wanted to be included, the researcher made calls and had an initial discussion about the client's clinical condition and willingness to participate in the study. Once participation was confirmed a suitable time for a more extensive discussion was made. For most clients, the discussion was also on the same day following the initial discussion. If a participant was available in town (at the AMS) when the researcher was on field visits, interviews were scheduled in person. This was the case for almost all interviews conducted in Cunnamulla AMS.

Consent

For clients who were contacted by telephone only, consent was verbal and audio-recorded. For some clients wanting explanations on the research, a brief description of the research aims were provided. For those clients who were met in person, consent was in written form, following explanations (of what the research was about and what telehealth meant). An information sheet was provided (and time allowed) for the client to review, prior to obtaining consent.

Ethical considerations

The research was conducted with respect to the cultural values of the Indigenous communities and with respect to their ongoing connections to the past and lands (spirit and integrity) ¹⁴⁴. Respect to kinship networks (reciprocity) meant that, during interviews, family members' views had to be respected. The survival and protection of the Indigenous peoples are dependent

on their shared values. If the community was in mourning ('Sorry Business'), interviews had to be rescheduled. When interviews were conducted, especially face to face, different (to how a western society perceives) views regarding health, kinship, family and community were respected and understood (equality). Some interviews had been pre-scheduled (during field visits) but clients failed to turn up for appointments, citing responsibilities of a sick relative or community gathering. In these instances, repeat appointments were scheduled, either during the next field visit or via telephone. The recruitment of participants was strictly based on the willingness of clients to participate in the study and there was no coercion of clients either through local health workers or financial incentives at any time ¹⁴⁴.

Diabetes educational leaflets

During the initial part of the study, as a response to lack of up-to-date and site-specific diabetes education material (as requested by local staff and specialists), diabetes educational leaflets were developed. The leaflets also provided an opportunity for the researcher to closely interact with AMS staff, strengthening the professional relationship. The process of leaflet development and interactions with local staff members are described in part 4 of this chapter.

Study sites

Cunnamulla

During field visits to Cunnamulla, both the local GP and a visiting GP provided access to diabetes clients. In-person interviews were conducted after the client had been seen by the GP in a private room at the AMS. Informed written consent was obtained after providing information about the study verbally and also by using an information sheet with pictures of telehealth consultations. If the clients were unable to spend time after the consultation with the GP, telephone interviews were arranged. The local health worker coordinating diabetes services for the Indigenous clients in Cunnamulla assisted by providing contact details of clients and by informing clients to come into the AMS when the PI was on site.

Charleville

At Charleville AMS, client contact details were obtained through the local practice manager and the telehealth coordinator. Some contact details of clients were also obtained from the

telehealth centre at the PAH. The telehealth coordinator informed clients via telephone or when they visited the AMS regarding the study and introduced the PI prior to the interviews. All interviews in Charleville were conducted as telephone interviews with recorded verbal consent. All clients were provided information about the study at the beginning of each interview.

Data collection

Local health worker interviews

Informal discussions with local health staff were conducted during field visits, in person. At the Cunnamulla AMS, the practice manager, the telehealth coordinator and the chronic care coordinator were interviewed. At the Charleville AMS, discussions with the practice manager and the telehealth coordinator were conducted either in person or via telephone. Any follow-up questions for staff members were delivered via telephone, by prior appointment or by email. Informal discussions with the local GPs were conducted either in person during field visits, or by telephone by appointment. All field notes made during informal discussions were included in the study.

Semi-structured interview guide

Client interviews were conducted using a semi-structured interview guide developed by review of the literature ¹⁴⁵⁻¹⁴⁷ and through discussions with senior academics who had previous experience in Indigenous research. The guide was comprised of three domains: client satisfaction, comfort with telehealth, and acceptability of telehealth for diabetes care (Table 8). The informal discussions with local health staff were general discussions exploring client uptake, satisfaction, comfort and barriers to telehealth. Client interviews were conducted uniformly for all clients but discussions with local health staff were informed by previous discussions, with additional, more specific questions added during subsequent discussions.

Table 8: Semi-structured guide for client interviews

Primary domain	Secondary questions
Satisfaction with telehealth	Tell me about your experience? Did you feel like there was a benefit for you by having this appointment? What did you like about the telehealth appointment? Was there anything you didn't like about the telehealth appointment? How could your experience be made better next time?
Comfort with telehealth	Were you comfortable having a telehealth appointment? Why? Why not? If you had a choice, would you prefer to have an appointment in person with the doctor or via videoconference? Why? Any differences - GP versus specialist? Do you feel it is necessary to see a specialist as well as the GP or Indigenous health worker (IHW)? Why? Where would you prefer to have your appointment (the AMS, local hospital or specialist hospital)? Why is that? Have you had to travel to see a specialist? What does this travel involve? Would travelling away from the community be inconvenient for you? What would this mean for you? Family, work? Have you been provided with any information about diabetes or other health conditions? Yes/No; If 'No', is this something you would like to have?
Acceptability of telehealth	Do you normally see a doctor for your diabetes? If yes, how often? Do you also see a specialist? If yes, how often? Would you be happy to see your doctor by telehealth (videoconference) - GP and/or specialists? How do you think this would compare to the way you normally see your doctor? What might be some of the benefits of a telehealth appointment? Do you think there could be any disadvantages?

Primary data

Primary data included in the study comprised interviews with clients and informal discussions with local health staff. A secondary dataset was included from a parallel study assessing the readiness for telehealth inclusion at the Cunnamulla AMS. Interviews had been conducted with all local staff at Cunnamulla, with transcribed interviews available through a professional transcription service. The PI was involved in the data collection for this study, hence was privy to its scope.

Analysis

Interviews with clients during field visits were audio-recorded and saved in the personal computer of the PI during transport. Later, these were exported to the S drive of the University of Queensland (UQ) server for storage. Telephone interviews were recorded and exported to the UQ server on the same day. Field notes made by hand during informal discussions were saved separately with the PI and included in the analysis later.

Audio records of primary interviews were transcribed verbatim by the PI and included in an N-Vivo database for analysis. These were 15-20 minutes in length on average, with field notes ranging from a few lines to half a page. The transcriptions of the interviews were imported to the same database. The audio recordings of these secondary interviews were an average of 25-35 minutes in length. The transcriptions of primary interviews (only) were reviewed a second time by listening to the audio whilst simultaneously reading through the text. As interviews were pre-planned and organised by the local health workers, all interviews were completed without observing for a data saturation point.

Content analysis

Open and axial coding of all transcriptions was conducted using N-vivo -11 software (as all primary interviews were conducted, transcribed and analysed by the PI, they were not de-identified). Primary codes were reviewed, and categories were identified prior to deciding on themes. Content analysis, by back-and-forth review of included text segments within the categories, was conducted before identifying themes. The thematic analysis was informed by the previous literature ¹²⁶. Identification of emergent themes was periodically reviewed and

aligned with the aim of the study. General rules of N-vivo analysis, where memos and notes were made during the analysis process, were observed.

The analysis used social-ecological theory to understand how the client relates with telehealth. However, when findings were described, they were presented as close to actual form (as they were). How these interactions are augmented or altered with input from family, local health workers and local GPs was observed through the theory^{108, 148}.

Concept map and word cloud

Concepts identified during analysis were included in a concept map, and relationships were identified and described. A concept, identified during the analysis of all interviews (inclusive of interviews in Part 1 above), describing the relationship Indigenous clients have with telehealth, was described using findings from the study.

5.4.3 Results

Participant characteristics

Cunnamulla

Thirteen interviews with diabetes clients, comprising two telephone interviews and 11 face-to-face interviews, were included in the study. All clients lived in the local area of Cunnamulla. At the time of the initial field visit, three clients interviewed were yet to have a telehealth consultation for diabetes. However, these outspoken clients had some previous experience with telehealth (e.g. within correctional services).

Handwritten notes from informal discussions with two GPs and three local health workers were also included in the analysis. The two local GPs were employed on a contract basis, providing locum general practice services to Cunnamulla for two to four weeks at a time, alternating between the hospital at Cunnamulla, the non-Indigenous health service (east-wing) and the Indigenous medical service (west-wing) in Cunnamulla. During the night they were on call to the local hospital. The local health workers interviewed were the practice manager, the chronic care coordinator and the telehealth coordinator. Field notes made during informal interviews with these health workers were also included in the analysis.

Charleville

Nine clients were interviewed from Charleville AMS. Seven patients were from the local area of Charleville, with two clients residing 40 km outside the town, living on a farm. All the clients interviewed in Charleville had previously had at least one videoconsultation through the service. The local practice manager and the telehealth coordinator were interviewed in person for the study during field visits. The GP, who usually sits in with the client during the videoconsultations with the endocrinologist, was interviewed informally by telephone. All handwritten notes made during interviews were included in the N-vivo database for analysis.

Definitions of codes and categories

Table 9 shows the definitions of the codes and categories used in the initial ordering of data. Table 10 shows the process of development of themes from primary nodes and categories. All interview transcripts and handwritten notes were coded similarly at the primary analysis stage.

Table 9: Definitions of codes and categories

Primary code	Definition
Acceptability	Perceptions of clients and local health workers regarding the acceptability of the telediabetes service for specialist health care
Willingness to use	Willingness to use telehealth (VC) for future consultations with the endocrinologist
Usefulness	Client perspective regarding the telediabetes service's ability to help manage their diabetes
Tailoring care needs	How care delivery was tailored to individual circumstances, client needs, availability of resources, etc.
Satisfaction	Satisfaction of care received, modality of care and the way care was delivered
Reduced travel	Reduced need to travel to meet the endocrinologist
Comfort	Level of comfort during each VC
Categories & <i>Subcategories</i>	
Anxiety	Anxieties in using telehealth for diabetes care
<i>Local support</i>	<i>Support received from local health staff during telediabetes consultations</i>
Impact on disease	The ability of the videoconsultation to achieve a positive impact on the disease
Convenience	The convenience of using telehealth
<i>Reduced costs</i>	<i>Client perceptions of cost reduction due to telehealth</i>
Perceived ease of use	Indigenous client perceptions on ease of use
<i>Using telehealth for other diseases</i>	<i>Using telehealth-based consultations for other diseases.</i>

Table 10: Development of themes and categories from primary nodes

Primary node	Category	Theme
Willingness to use in future	Perceived ease of use;	Intention to use
Satisfaction	Subcategory – using telehealth for other diseases	
Acceptability	Telehealth anxiety;	Resistance to uptake
	Subcategory – Local support	
Comfort	Convenience;	
Reduce travel	Subcategory – reduced costs	
Tailoring care needs	Impact on disease	Health service experience
Usefulness		

Themes

Three main themes were identified from the analysis of transcriptions. These were: intention to use telehealth, resistance to uptake and overall health service experience of clients.

Theme 1: Intention to use telehealth

‘Willing to try’

Client perceptions about the nature of telehealth were varied, contingent on the age of the client and previous exposure to videoconsultations or social media. Older Indigenous clients (who had not had any telehealth exposure) did not have a clear idea of what telehealth meant, sometimes inquiring whether it was some *‘telephone thing’*. But when explanations were provided on how telehealth worked, they thought it could be useful, highlighting benefits from saved travel. When older clients had no experience with telehealth, they felt anxious, and worried about how the consultation will eventuate, prior to the event; however, the savings made through not having to travel made them try it, regardless - *“Willing to try this since it saves me travelling”*. It is likely that initial hesitation among Indigenous diabetes clients about

using telehealth is an amalgam of inexperience with technology, lack of exposure to social media and/or their non-willingness to try technology (telehealth). Most importantly, clients who were willing to try telehealth may have perceived diabetes as an important disease, with significant morbidity, if not properly managed.

‘Nothing to change’

Clients who had received at least one videoconsultation prior to the interview were satisfied with their initial experience. However, these included clients with previous exposure to social media who thought it was similar to most video-chat platforms. Clients with previous telehealth exposure found ‘*nothing to change*’ in the new telehealth service interaction, highlighting the ‘*clear picture*’ – video quality, and how well the consultation proceeded, exceeding their expectations. After some time into the consultation, some clients felt that it was as if the specialist was present in the room. They understood that, for diabetes, they would have to meet the specialist regularly, and were happy to use videoconsultations ‘as long as’ they were needed.

“The message from the doctor was clear, everything was perfect. I liked having our doctor (local GP) there. I wouldn’t be gaining anything from a face-to-face, just meeting him. No problem about seeing him on TV. I am doing all right this way.”

However, some clients, even after their initial experiences, were still not fully convinced, - *“It just feels funny talking to the TV; it’s stupid, but after some time, I got on to it”*. It is possible, that after a few interactions, some clients became comfortable with the setup, and learnt to accept it. However, for those clients who were uncomfortable, focused support by local health workers was needed, to prevent the possibility of their dropping out of the program.

Preference of the AMS

All clients preferred the AMS over the local hospital for the videoconsultations. They felt comfortable at the AMS, most likely as they knew local Indigenous health workers personally. They found the AMS culturally acceptable for them to receive care and placed a personal attachment towards the establishment over the local hospital.

Technological barriers

Staff members had sometimes experienced poor picture and audio quality during a few consultations. Those staff members who had previous experience in working with tele-linkups (for family meetings whilst working in correctional facilities), stressed the need for good picture quality so that clients and their clients' families did not get disheartened. Sometimes, when picture quality of the videoconsultation was intermittent, the telephone, email and facsimile were more useful to complete the consultation. Some clients, who had had previous exposure to either good quality videoconsultations or to social media, also found the poor picture quality a major drawback. In Cunnamulla, frequent power outages were also a problem. It is imperative that technological aspects of the service are well-organised prior to the start of a videoconsultation, to ensure that clients who are already sceptical do not give up on the new service.

Saved travel to the city

Local health workers stated that clients wanted to avoid travel to the cities, primarily as they were not comfortable away from their community. Travel was also costly, as all expenses were not reimbursed by the PTSS (part reimbursement only) and they had to forego income while they were out of work, travelling for care. Mostly, clients simply found navigating the 'big' cities difficult so, if possible, they avoided travel. Due to these reasons, it is likely that clients who eventually accessed videoconsultations would not have met an endocrinologist for their care if not for the new telehealth service, as they would not endure the long travel required.

Other clinical services

Some of the Indigenous diabetes clients even requested further specialties to be delivered, as and when required. One client stated:

'All is okay with the diabetes thing (service)... My child needs to meet an oncologist for a six-monthly review, can you organise that like this meeting with the diabetes doc. (endocrinologist)?' – from handwritten notes.

The possible reason for this interest may be the lack of specialist services in these remote communities and the difficulty of travelling to metropolitan hospitals. The ease of access to specialist services through telehealth meant that clients were able to meet an endocrinologist:

for many, for the first time. Furthermore, early uptake may have been a result of clients considering that the easy access to an endocrinologist was an opportunity that they feared may halt after some time.

Scheduling

Some clients were impatient when they had to wait for a consultation via telehealth, especially when the specialist was running late, either due to double bookings or technology issues. The local staff were essential during these times, to mitigate client anxieties. Furthermore, since the telehealth service was set up at the AMS, clients were comfortable waiting for the consultation to eventuate, as opposed to the local hospital managed by the Queensland Health Department. Hence, setting up the service at the AMS was most likely a significant enabler for the eventual accomplishments attained by the service.

Theme 2: Resistance to the uptake of telehealth

Concerns about using telehealth

Poor competence with the technology used in telehealth was a concern for clients early in the videoconsultation process. Clients who had no previous exposure were the most concerned - *“I don’t even know how to use a computer, I have no idea”*. However, even those who previously had a telehealth consultation for other health needs were still hesitant at the beginning. This may simply be due to the lack of consistent exposure and, as it was the first time, they were experiencing telehealth outside a hospital environment.

Younger clients - Some younger clients described their previous exposures with tele-links within the justice system, through court proceedings and family reunions for those who were serving prison sentences within correctional facilities. Younger Indigenous children were exposed to online education at schools. This exposure meant it was easier for the younger Indigenous members of the community (who were related to clients with diabetes) to support parents and older relatives easily during a videoconsultation if they were with them. The local health workers found that Indigenous clients were *‘a bit shy speaking to the TV, they say it is a bit scary. It is probably because they can see themselves, it is the whole camera thing’*.

A client with previous telehealth experience stated...

“I had one telehealth with a doctor in Toowoomba because I have bad kidneys; he did telehealth, I felt a little bit funny about it. It’s strange but it’s okay. I have a basic idea of what telehealth is. It’s like talking with you now but on the TV.”

“It would be okay to meet the doctor (endocrinologist) via tele, but still feel a little funny about it. He can ask you questions and all that, I guess it would be ok. I just feel strange, I am not used to that sort of thing, talking to the screen; is this thing gonna answer me back or what!”

“I don’t think they get the full picture on tele; how you are feeling and all that; there is something missing, personally I like to talk to people face to face; tele is different but I will talk through tele if I have to; to get your message across.”

It is clear that previous exposure allayed some of the initial anxieties of clients. Clients who had some understanding of videoconsultations were probably a bit less hesitant to accept the modality when compared to those who had none. For those who had some exposure, one of the key factors that reduced anxiety with videoconsultations was eventual repeated exposure. Clients who were into their second or third videoconsultation expressed feelings of comfort and reduced anxiety, and no one enunciated any problems due to their lack of competency in technology thereafter. Furthermore, it is unlikely that all the clients who had previously accessed videoconsultations were competent in technology at the time they had their first videoconsultation. It seems some clients with poor technology literacy were using that as a defence to mitigate the anxiety of facing their first videoconsultation.

Initial support - essential

The support provided by local health workers in making clients comfortable with the videoconsultation was an essential element in recruiting them for videoconsultations.

One staff member stated...

“Because we get them in early and they’re just sitting there, so initially they’re saying ‘what’s going to happen’ we’re telling them their photo will come up on the big screen and we are just in the little box.... Just to make them a little bit more comfortable with the technology before they are actually having to talk with people.”

When local health workers were actively involved in managing the videoconsultation, clients expressed that they were less anxious.

Intermittent face-to-face consultations

Clients described a preference towards a mix of telehealth and in-person consultations as the ideal solution for them. They felt they needed “*to put a person to the face on TV*” – to personally get to know the specialist. It is likely that Indigenous people find a need to speak to the clinician in-presence, at least periodically. It is most likely that, once they get to know the specialist personally, they would be able to transpose the personality to the person seen on the screen. Indigenous people are known to be ‘visual’ - needing to meet people face-to-face, which aids in understanding body language when forming relationships.

Cultural acceptance

Some staff members stated that clients were worried about the cultural aspects of telehealth, especially the elderly. Staff also stated that if these clients were exposed to telehealth regularly, the significance laid on cultural aspects would most likely recede with time. It is likely that cultural aspects, such as being at the AMS for health care, being cared for by Indigenous health workers and respecting personal thoughts and beliefs about their illness when discussing care, were important for Indigenous clients. Despite these cultural aspects being a bottleneck to the uptake of telehealth services for the elderly, once the initial barriers of fear and anxiety were overcome, clients quickly became comfortable. It is also likely that the increased initial anxiety of facing videoconsultations and feelings of the relative cultural inappropriateness of telehealth was impeding them from turning up for appointments. Therefore, any cultural inhibition related to telehealth is actually only significant until clients (who were not previously exposed to the technology) receive the service for the first time only. Once they understand that a service is a simple act of meeting the specialist (on TV), they quickly get used to it and become comfortable. It is during this initial period that the Indigenous health workers are most needed, to overcome the initial barriers created by anxiety.

Theme 3: Overall health service experience

Having a local health worker sit in

Most clients interviewed were happy to have a local health worker sit in with them during the videoconsultation. They found the health workers' presence during the consultation useful as they made them comfortable with the technology, setting up the video-link and troubleshooting if needed. The health workers also introduced the specialist to the client, relayed information to the clinician (clinical information was simplified) and explained what was said by the clinician in simple language, afterwards. Since health workers were aware of the care plan, they were able to follow up referrals and investigations of the client later on (enhanced continuity of care). However, two clients (9%) were not keen on having any local health workers sit in during their consultations, highlighting privacy concerns. However, the presence of the local GP during a videoconsultation was welcomed by *all* clients. However, the GPs were not able to sit in often, due to scheduling difficulties, as they were busy with daily clinic duties (Cunnamulla).

One local health worker stated...

“She’s (client) like saying - What are they saying? She really just couldn’t hear. She is just like, talking to me rather than connecting with the professional.”

Staff members also stated that when they sat in during a videoconsultation, clients were more outspoken about the challenging aspects of the service and also helped them learn more about factors impeding the uptake of the service.

‘Having not met an endocrinologist previously’

Almost all clients interviewed had not met an endocrinologist previous to the telehealth service by travelling to a metropolitan centre; however, they may have seen an endocrinologist if one had visited the community during an outreach program. Clients had been consulting with the local GP only, for their diabetes care. When they had travelled to a metropolitan hospital to meet a specialist (for reasons other than for diabetes), it was only if they felt it was ‘*absolutely essential*’.

Setting

One client highlighted the need for a dedicated space for videoconsultations to be conducted with privacy.

“I don’t like sitting in the middle of the room, trying to write something on my knee. A table (is needed), put your stuff down, fortunately, the good Lord gifted me with a reasonable brain, get his (endocrinologists’) instructions and to forward. For me, it is quite clear, but it is not so for everybody.”

Some local health workers also highlighted the need for a private room for videoconsultations. A private consultation room, specifically for videoconsultations, would allow a client to consult with their specialist in privacy. This was especially true for Cunnamulla, where the videoconsultations took place in the common room, adjacent to the kitchen area. Some clients also stated that since it was a small town, they would have to interact with local health staff outside health service circumstances, hence increased privacy during videoconsultations was important.

One client stated...

“Generally, I think it should have a permanent type room, with the good quality picture, not juggling the TV.”

However, one of the staff members stated that only a very few clients wanted to be alone during a videoconsultation. Most clients had requested a staff member to be present. The staff member also added that this may be because of the prevalent nature of diabetes in the community - if it had been a disorder with the stigma attached, such as mental health (e.g. depression), this would have been different.

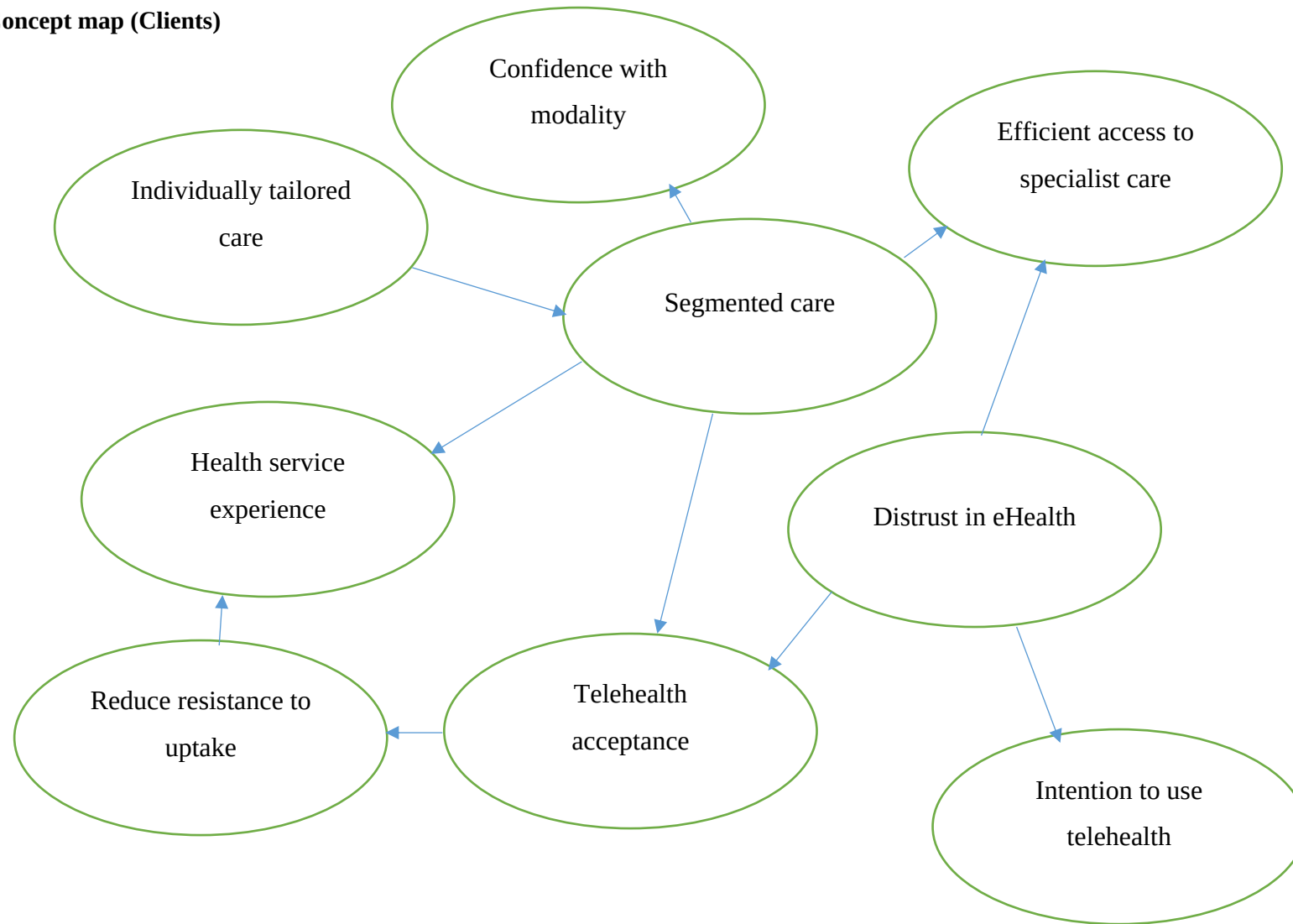
Guidelines for videoconsultations

One staff member stated that guidelines on how to conduct a videoconsultation with an Indigenous client were required, as there were none currently available. This would also help tele-clinicians, who were new to managing Indigenous clients through telehealth, to understand them (and their behaviours) during a videoconsultation. Furthermore, guidelines would be helpful for those staff members who were from a non-Indigenous heritage and were new to videoconsultations. Such guidelines could also ensure that health workers with no previous experience working in remote communities understand how to work with Indigenous clients

(to develop cultural competence) for videoconsultations. Review of literature on guidelines developed on how to conduct a videoconsultation safely shows that some work has been already done by professional medical bodies, such as the Royal Australian College of Physicians ¹⁴⁹. However, none of these seems to be aimed at Indigenous health contexts. Therefore, it is imperative that in future such guidelines are prepared for videoconsultations to be conducted in a more culturally safe manner.

Concept map

A concept map (Figure 9) was used to identify inter-relationships of the key concepts identified from the analysis.

Figure 9: Concept map (Clients)

Development of theory (concept generation)

In relation to the interaction remote Indigenous people have with this telehealth service (for diabetes care), three key concepts are clearly identifiable:

- Early acceptance of the telehealth modality is dependent on the *active participation of the local health workers*, especially of Indigenous origin (Aboriginal health worker), in the consultation process.
- *Client dependence on the local health worker (or AHW) diminishes* as they get used to the telehealth technology and setup, the clinician and the consultation process (scheduling, pre-consultation work-up, the involvement of the GP and the diabetes educator).
- *Clinicians continued to depend on local staff* (local health workers and the GP) for the consultation to proceed efficiently, even if the client was comfortable without a local health worker being present during a videoconsultation.

Active participation of the local health worker in the consultation

Interviews with both clients and local health staff showed that active participation of local health workers was an essential element for the videoconsultations to proceed efficiently. For some clients, the presence of the local health worker during the videoconsultation was the norm. Several clients, especially the elderly, depended on the local health workers to make the transition to receiving specialist clinical advice via videoconsultations easier for them. Clients wanted the health worker to help them become comfortable with the technology, to initially introduce them to the clinician (on TV) and, later on, to help them comprehend the clinical discussion.

It seems that the active participation of the local health worker is a vital constituent of this interaction, especially early in the process. In fact, in the absence of the local health worker, it is most likely clients would have easily turned away from videoconsultation, as it was a novel method of receiving care, not previously experienced by this community. There is evidence to show that, traditionally, Indigenous people are slow to take up novel health services, including traditional western healthcare^{150, 151}. Therefore, acceptability, comfort and satisfaction with the service, all of which most likely lead to better uptake of the service, were dependent on the active participation of the local health worker.

The participation of the local health worker in the videoconsultation process, and the client dependence on the health worker during the consultation, means that the traditional therapeutic alliance (as described by Higgins and others)¹⁵² developed between a clinician and a client has to be extended to include a third party – the local health worker. This may be a consequence of the way the consultation occurs – i.e. via telehealth with minimal in-person interaction with the specialist. Since the clinician is not physically present, the clients tend to depend on the local health workers for emotional and moral support during the consultation. Such support would traditionally be extended by the clinician if the consultation was to happen in person. Therefore, the therapeutic alliance that is developed traditionally between the client and clinician is somewhat weaker for these interactions. The extension to involve the local staff may, in fact, be the basis for the emergent therapeutic alliance between the clinician and the client.

During the videoconsultation, the endocrinologist depended on the GP for physical examinations to be performed for an accurate clinical assessment of the client. In this circumstance, the traditional therapeutic alliance developed with the client and the specialist clinician extends to include the GP as well (as similar to the local health worker). These extensions lead to a segmented therapeutic relationship forming between the specialist, local health worker, local GP and the Indigenous client. In a traditional in-person consultation the therapeutic alliance between the clinician and client does not necessarily involve third parties, unless for an extensively involved family member.

There is no evidence to show that the weaker therapeutic alliance between the specialist clinician and the client leads to, or has led to, poor management of the disease or to lower uptake of the service. In fact, the extended therapeutic alliances seem to be significant supportive factors towards the client's uptake of the service, especially in the initial period.

Diminishing need for local health workers to be included in a videoconsultation once clients become comfortable with videoconsultations

It is also notable that when client exposure to videoconsultations increases, as with repeat appointments, they become comfortable with the process, the tele-clinician and the format of the consultation. This means that their dependence on the local health worker usually included in the videoconsultation diminishes with time. However, there is as yet no clear evidence to show that the therapeutic alliance between the specialist and the client increases as exposure is increased (as time passes). It may simply be that clients are getting comfortable with the

consultation process. The knowledge that local health workers or the GP is available at short notice, if required, may be a supportive factor, driving acceptance and comfort. The segmented therapeutic relationship, therefore, continues to exist, even when client exposure increases to videoconsultations over time.

Continued clinician dependence on the support of local health workers

As time passes, clients get used to the service and become less dependent on the local staff. However, the clinicians continue to depend on local staff for the efficient conduct of a consultation. The pre-consultation work-up, appropriate scheduling and logistics (ensuring clients arrive on time for consultations), including transport of clients and supporting clients to be set up for the consultation, all seem to be important to the specialist, even when the client is fairly comfortable with the consultation process. In fact, even when the client does not expect the local health worker to sit in whilst a consultation is in the process (after several consultations), the clinicians continued to require the support of local staff, for tracing records and reports and technological aspects. Therefore, the segmented therapeutic relationship continues to exist even when the client is constantly exposed to videoconsultations and the clinician and is becoming comfortable with the process. This continued inclusion of local staff is, most likely, a factor that supports the relationship, as the clinical conversation and the client management protocol is further enhanced by the local health worker's presence. However, some clients were outspoken about not including the local health worker from the outset, due to privacy concerns. For some of these clients, who had previous experience with videoconsultations, the therapeutic relationship was extended to the GP only.

Segmented therapeutic relationships of remote Indigenous clients when consulting through telehealth

The concept of 'segmented therapeutic relationships of remote Indigenous clients when consulting through telehealth' is a phenomenon resulting as a consequence of the distance (remoteness) of the client's community. It is most likely that the client will not meet the endocrinologist in person (often), as there are no plans for the clinician to travel to these areas, and the only therapeutic relationship they will have with the specialist is through the video-link. Therefore, clients may be substituting their need to develop a therapeutic relationship to include the extended parties for these videoconsultations. This is a likely phenomenon of all

videoconsultations of this nature for remote clients, as they have minimal interaction with the clinical specialist in person, throughout. Furthermore, for this group of clients who must manage a chronic disease, this extension is extremely important as, during their disease management process, they can rely on local staff when they have an acute need.

5.4.4 Discussion

This research is one of the first studies to assess the usefulness of telehealth for diabetes care for Indigenous Australians living in remote areas. Though several previous studies have identified that Indigenous clients are receptive to telehealth services for healthcare, these have been primarily for acute ¹⁵³ (e.g. mental health) or severe ^{103, 154} (e.g. oncology services) clinical conditions. Diabetes is a chronic condition for which continued monitoring and care is needed over a long duration. Importantly, diabetes is not a visible (‘seen’) disease externally, such as a skin condition or a limb deformity. This means that Indigenous clients are likely to neglect the self-management required ³⁰, as opposed to a more acute morbidity, such as a carcinoma. Added to this is the burden with older clients attributing diabetes with the ‘white settlers’ and their ‘oppression’, where their traditional ways of living have been altered by foreign inclusions ³⁰. This means that for some clients (especially for the older), there is an internal dilemma of accepting ‘western health’ advice, for a disease brought on by the same people and their unfamiliar culture.

Strengths of the new service

The study incorporates views of local health workers from two remote Indigenous AMSs – Charleville and Cunnamulla. Since the delivery of telehealth services seems to be exceedingly interlaced and dependent on the local health staff, it is important to assess their perceptions about the new intervention. Such an assessment would likely provide direction to the usefulness of the service and its sustainability into the future. The local staff were actively supportive and seemed satisfied with the telehealth intervention from its outset. It provided them with an easy way to upscale client care if warranted, at short notice, without waiting for an outreach program or having to send clients to metropolitan hospitals via road transport. Previously, local staff would have had to advise clients requiring an endocrinologist’s review to travel to the closest metropolitan hospital (in Toowoomba), which usually requires around three days, given the

distance. Several staff members (who were living with diabetes themselves) expressed that, even personally, it was a great relief that they did not have to travel now.

Usefulness of the new service

Prior to the telehealth service, a client requiring a specialist endocrine review would have had to travel to Toowoomba for care. Most likely, clients would have opted not to travel, thus the responsibility of care for diabetes rested with the local primary care services alone. This is further evidenced by the fact that for several of the clients who received videoconsultations for endocrine (diabetes) care, it was for the first time, even though they had lived with the disease for many years. With the advent of the new telehealth service in the community, staff were able to schedule a videoconsultation quickly for a client. This option of easy accessibility may lead to increased client compliance, as clients may be more inclined to heed advice and care provided locally, as they know that the specialist is available at short notice.

Acceptance of telehealth

One of the important facts regarding the new telehealth service (identified through this research) is the high level of acceptability of the telehealth modality by Indigenous clients living with diabetes. Though there was some previous evidence to say that Indigenous people were receptive to videoconsultations^{90, 103, 155, 156}, there was minimal (or no) evidence to show that clients would be interested in receiving specialist endocrine consultations for diabetes over a long period of time. The acceptability (receptiveness) of videoconsultations by Indigenous clients has also been previously identified by several authors^{90, 103}. However, acceptance of new technology by Indigenous clients depends on several factors. These include support from the local health workers, the infrastructure available (such as internet connectivity) and the community connections (mostly informal) local staff members have within the local community. The interviews show that the recruitment of clients for a videoconsultation was sometimes dependent on the local health staff being able to convince them to try it out. This scenario was especially true for older clients.

Diabetes and the Indigenous person

Previous research has highlighted that Indigenous people tend to identify diabetes as an episodic disease³⁰ where, when one gets sick, they have to be treated at the hospital and then get better. This mistaken understanding had led to poor diabetes care for Indigenous clients. However, this research finds that (from the clients interviewed) the two Indigenous communities have moved forward from this point of understanding. All clients who were interviewed understood that diabetes was a chronic disease that needed care for a longer time and that it was not an episodic illness. In diabetes management, it is imperative that clients continue to heed advice provided by the endocrinologist and the various allied health professionals, such as the podiatrist, nutritionist and others. The clients who were interviewed during this research understood the importance of this advice and were determined to be mindful of the advice provided.

Comfortable with telehealth

Another of the key findings of this research was that Indigenous clients who accessed the endocrinologist for diabetes through this service were comfortable during the tele-interaction. Since most Indigenous clients from these two communities had not accessed videoconsultations previously if they were not comfortable at the consultation (due to cultural, technological or fear-of-change reasons) it is most likely they would have turned away from repeat appointments. However, with the local health staff continuously being attentive to their needs and being supportive, clients turned up for appointments. Furthermore, if clients were unable to attend, they would inform the local health staff early so that the appointment could be rescheduled, without wasting clinic time through a 'no-show'. It is possible that increased awareness of client availability in the community and support of the local staff to communicate any unavailability also made client no-shows lower. Staff may also have come to know of a client's unavailability in the community through informal channels.

'Satisfied with telehealth services'

Satisfaction with a new health service is an important aspect to any Indigenous client for uptake and continued use. This is more important to Indigenous people, as they historically mistrust traditional western health services^{157, 158}. The satisfaction survey conducted with Indigenous clients from Charleville also showed that those who accessed the telehealth service were

satisfied with the services received. Some of the reasons for clients to be satisfied with the service were the helpful nature of the local staff (as described by several participants) and that the service was placed at the AMS premises. Clients found the AMS culturally appropriate and comfortable to access routinely. Clients need not make an appointment and may simply walk in and have a chat to a health worker if the latter was not busy. It is likely that satisfaction with the new telehealth service was closely related to the above factors. Another reason for Indigenous clients to be satisfied with this new service was that they did not have to leave their traditional (or semi-traditional) Indigenous life, family and the community and travel to a metropolitan hospital for care. Care was available locally at the AMS through the telehealth service. Several clients expressed that not having to travel was one of the main reasons they were satisfied with the videoconsultations and that they were able to save money from not having to pay for fuel and accommodation. Similar to these findings, there is some evidence to show that Indigenous clients are satisfied with telehealth services ^{143, 159}. However, research in this domain is minimal. Furthermore, whether the AMS is the most appropriate place to set up telehealth services (given that the hospital can provide pathology or admittance support) is also yet to be definitively identified.

Increased access to specialists

Increased access to specialist services can lead to better outcomes for Indigenous clients with diabetes living in remote areas ^{160, 161}. When remote indigenous communities are connected with metropolitan-based health services for diabetes care (endocrinologist, diabetes educator, insulin stabilisation service), they are able to manage their disease better, as they can access specialist services more easily. As clients get to use the new telehealth system more often, they may request that more services and other clinical subspecialties be delivered in a similar manner, as was the case for some clients from Cunnamulla. With the rolling out of the National Broadband Network (NBN) across all areas of Australia, clients will be able to connect with services much more efficiently, without technical limitations such as bandwidth-related video and audio problems, as was the case in Cunnamulla.

Contrary to previous evidence

Previous evidence by Thomson *et al.* (published in 2000) showed that remote Indigenous clients had a poor understanding of diabetes and that they viewed it as an episodic or acute process. This (current) work finds that this may be an invalid perspective ¹⁶², or it is also possible that disease-specific knowledge of Indigenous clients has changed over time. Indigenous clients more willing to attend repeat appointments via the telehealth service, adhering to advice provided by specialists (e.g. on lifestyle changes). These actions by clients could also be a proxy of the changing level of understanding about the disease, with corrective actions directed by changing attitudes or knowledge. The archetypal perspective regarding diabetes by Indigenous clients (as described by some elderly clients of this study) was the history of trauma and oppression of the white settlers ¹⁶³, with some (older) clients identifying diabetes as a disease deliberately inflicted on them by the settlers. It is likely these perceptions do lead to poor uptake and adherence to western medication ('white man's medicine') and could be a reason that clinical improvements have lagged behind over time.

Strengths and limitations of the study methods

One of the key strengths of this study was the inclusion of more than half the clients who had at least one videoconsultation for diabetes from both communities. This meant that clients who were interviewed were able to relate to the service closely, and the strengths and limitations of the service were first-hand experiences if they decided to describe them truthfully. Since the clients were selected by the local health workers, it is most likely that those who were selected were outspoken clients, hence would have described matters pertaining to the service aptly. Although the researcher was not always able to meet clients face to face, the telephone conversations were friendly and open. This meant that the actual usefulness of the service was most likely ascertained during the study.

Purposive selection

One of the main limitations of this study is the selective nature of how clients were selected for the study. However, the selections were made by the local health worker, without any prior input from the researcher, somewhat minimising the biases of selection from the investigator's end. The local health workers (the diabetes coordinator and the practice manager) chose clients after excluding those who were not interested in participating in the research. It is not known

how many clients refused to participate (participant selection was purposive). However, this number is likely to be very low as the total number of clients suitable to be included was also small (it had to be an Indigenous client who has had some teleconsultation experience for diabetes care with a specialist within the given time period).

It is possible that those clients who were dissatisfied with the telehealth service were not willing to speak with the researcher (however, this was not a fact highlighted by staff members impeding the recruitment of clients at any stage of the research). Furthermore, some clients may have answered the questions about the telehealth service to appease the researcher, without actually highlighting its shortcomings. However, the descriptive qualitative approach of the study allows for purposive selection of clients and used for identifying linkages.

Biases in analysis

The analysis of the study was conducted by the researcher alone and is another significant limitation. However, the supervisors reviewed the analysis and the findings of the study thoroughly. Furthermore, there were several discussions with the supervisory team during the analysis phase. When data collection and analysis of a qualitative study is conducted by one investigator, it allows significant bias in the findings, as the investigator's personal views and ideas about the study are not negated by other researchers' inputs. Furthermore, in this study, the extensive involvement of the researcher with the intervention meant that there were most likely preconceived notions about the direction of the analysis. Furthermore, the Social ecological model, which was the theoretical basis for this study, meant that client behaviour was influenced by close family and the community. This analysis lacks input from the family members of clients, and also from community leaders and elders. However, several clients who were interviewed were elders of the community living with diabetes, and it is most likely their input regarding the telehealth service was captured inadvertently.

5.4.5 Conclusion

Videoconsultations seem to be a useful method to provide access to an endocrinologist for Indigenous clients from distant communities. The new telehealth service allowed clients who had never met an endocrinologist for diabetes to meet an endocrinologist without leaving their remote community. With the assistance of the local primary care service, the endocrinologist was able to provide continuity of care for these diabetes clients. Once a client's

care was optimised, the specialist referred the client back to the local primary care service with a comprehensive management plan. This meant that the local GP was able to manage the client in the interim, and also had the option of referring back to the specialist, via the telehealth service, at short notice.

The interviews with clients showed that they accepted the telehealth service as the most convenient option for them to receive specialist care without having to travel to a metropolitan centre. Several other important aspects, relating to how the service should ideally be delivered to remote Indigenous communities, were identified in the interviews. The inclusion of local health workers at all stages of a videoconsultation and establishing the service at the local Aboriginal health centre were essential elements identified. However, the usefulness of the service was somewhat limited due to lack of trained staff at the local health centre to operate and troubleshoot technological problems, technological barriers such as poor video-quality, and scheduling difficulties to include the local GP. It is also possible that some clients may have refused to participate in the study (exact details not known). In such case, it is likely these views were only of clients who were willing to participate (biased) in the study.

It is vital that local health workers and clinicians continue to work together to deliver the service continuously, as clients find the service extremely useful and have started to demand that other clinical specialities be delivered using the same platform. Furthermore, this is likely to create a significant shift in how specialist clinical services are delivered to remote Indigenous communities.

5.4.6 Key findings

- Indigenous clients with diabetes found the telediabetes service an acceptable method to access specialist care. Furthermore, when established at the local AMS, they found the service culturally acceptable.
- Once clients had experienced at least one videoconsultation, they were comfortable with the service and were satisfied with the care received. They were also willing to access the service for diabetes as long as it required.
- The local health worker was essential to the success of the service, as clients and the clinicians depended on them for operational aspects of a videoconsultation.
- The extensive involvement of local health staff with the care process meant that the clinician-client interaction was extended to include the local health worker. However, with

increased exposure, clients were increasingly comfortable in using the telehealth service without their support.

Part 3: A description of enablers and barriers to the telediabetes service

5.5 Enablers and barriers to telediabetes services

Overview

This part of the chapter lists and describes enablers and barriers identified either directly from comments or were interpreted from the analysis of interviews.

5.5.1 Aim

This study aimed to list (and describe) enablers of, and barriers to, the new telehealth service.

5.5.2 Methods

Enablers of, and barriers to, the new telehealth service were recognised during the analysis of the interviews. Enablers were identified as factors assisting the service. A barrier was identified as an event that impeded the usual activities of the service. These were identified during content analysis of interviews, during the first two studies. Explicit data (direct quotes) were connected to interpretations of the analysis where relevant. Observations by the researcher during field visits were further useful in contextualising and understanding these findings from a practical aspect. In describing the enablers and barriers, examples (direct quotes) from the content analysis (where relevant) has also been used.

Justification

The reason for identifying of enablers (and barriers) of this telediabetes service was to assist in the setting up and operating of this new service (or an analogous service elsewhere). Identification of barriers can guide to any potential complications that need to be recognised and corrected promptly. The effectiveness of telehealth for diabetes care (mostly of non-Indigenous populations) is well-established (discussed elsewhere) ^{164, 165}. However, enablers of, and barriers to, constituting and operating these services in distant and remote Indigenous communities of Australia, are yet to be sufficiently investigated. Implementation of a new health service involves interactions across various agencies, leading to conflicts and friction, especially if the process is not planned and managed properly ¹⁶⁶⁻¹⁶⁸.

5.5.3 Results

Enablers

- *Active participation of local health workers*

The active participation of local health workers was an essential requirement in the success of this telediabetes service. If local health workers had not been interested (or not convinced about the usefulness of the service at its outset), it would have been difficult to make the intervention operational.

As both Cunnamulla and Charleville populations were small (less than 1,000), clients were known to the local health workers personally, either through community gatherings or family or clan relationships. The local health workers were often able to call on these casual networks, in scheduling an appointment for telehealth or arranging investigations or referrals. Informal connections also helped clients better communicate their needs, such as an inability to attend a planned appointment. Repeat appointments, if arranged, were also in consultation with clients.

Leads to lower 'no-show' rates

The reason for the lower no-show rates (through re-scheduling or cancelling appointments) was most likely to be a result of the client availability received through informal connections of the local health workers. In chapter 7, the analysis of service activity shows a high number of rescheduled appointments and cancellations with a relatively low number of no-shows. The reduced no-show rates mean less of the endocrinologist's time was wasted.

Transporting elderly clients to appointments

Local health workers sometimes assisted elderly clients who lived nearby to AMSs by transporting them for videoconsultations. Sometimes, if the AMS vehicle was unavailable, they used their personal vehicle for this purpose. Clients were also reminded about telehealth appointments by phone calls or texts, by local health workers on the day before.

Feeling welcome

Parts 1 and 2 (of chapter 5) above describes how clients felt more comfortable at the AMS than at the local hospital. They felt they were treated well and that they belonged at the AMS. They felt they were not treated as ‘just another patient’, but as someone who was known, or a friend who had come for a visit. Because the AMS staff knew the clients personally, it is likely that they engaged in a casual chat – (or a ‘yarn’) with clients before the scheduled consultation, and this made the wait for an appointment less stressful. Such emotional support is essential for elderly, non-tech-savvy clients to feel comfortable enough to navigate through the first few telehealth consultations. Clients perceived that, at the AMS, they were not treated as clients but as ‘welcome guests’, welcome to stay as long as they wanted, in contrast with the treatment they received at the local hospital (managed by Queensland Health department staff), where they had to ‘*get treated and leave*’.

Supporting clients during videoconsultations

The local health workers supported clients initially during videoconsultations by familiarising them with the equipment and the technology, describing how and what would happen during the videoconference, and then introducing the specialist when the videoconferencing started. Furthermore, local staff would act as a buffer for clients to lean on during the videoconsultation, by relaying or paraphrasing questions and advice from the endocrinologist to clients in a language and dialect they would understand. Sometimes they were needed to provide information about future referrals if the client was unaware.

Supporting clinicians

The local health workers also supported each videoconsultation in the initial stages by providing a brief clinical overview of the client. They described the client’s condition and the clinical complaints in technical language, for the clinician to easily make sense of. As some of the interviews with local health workers have shown (in part 2 above), staff members were able to provide additional clinical information about clients. This allowed the clinician to make informed decisions about the client’s condition. When clients became used to the telehealth format and were comfortable interacting alone with the clinician across the screen, such close assistance was not required.

- ***Use of Indigenous cultural elements***

Previous studies have shown that the use of cultural and spiritual elements help Indigenous clients to be comfortable with telehealth programs ⁸⁵. The only significant cultural aspect identifiable within this service was the setting up of the service in the AMS premises, where clients felt most comfortable to receive health services. However, setting up telehealth facilities in the AMS premises was possibly the most important enabler for the telehealth service as well. The reason for this is that clients were able to access known local health workers and be guided in a friendly manner, increasing their level of comfort. Clients were often called by name or referred through family relationships, (e.g. uncle, aunty, etc.) without referring to records. Clients were also provided with refreshments often and invited to make tea/coffee at the AMS's kitchen.

Indigenous artwork

For clients, it was important that the walls of the AMSs were decorated with Indigenous artwork and painted with colours and images depicting Indigenous heritage. Indigenous flags at the AMS premises were also culturally significant to clients. Flags would be lowered to half-mast when an Indigenous client died, and clients were informed of the mourning period (referred to as 'sorry business'). The community was also informed of the event through this, so they could gather and participate in the bereavement process.

- ***Convenience***

The telediabetes service provided clients with the opportunity to meet with a specialist physician without leaving their community. Part 2 above describes how reluctant clients are to leave their community for health care needs, avoiding travel at all costs if possible. Although cost was the main reason to avoid travelling for clients, being a part of the community, engaged and at 'home' in the community were other important aspects for Indigenous people ¹⁶⁹. The significant importance of 'homeland' to Australian Indigenous people has been identified by previous researchers ^{169, 170}. If the telediabetes service was unavailable to these communities, clients would invariably have to travel to the nearest tertiary centre or wait for an outreach program. With telehealth, clients have the significant convenience of specialist consultations in their own community, at a suitable time.

- ***Continuity of care***

The central service recruited an endocrinologist on a permanent basis for the Indigenous telehealth service, during the initial phase of the service to conduct consultations. Therefore, clients had the opportunity to meet the same specialist every time they had a videoconsultation. This reduced the need to explain their clinical history every time they had a consultation. Repeat consultations with the same clinician also helped to develop a better working alliance between the client and the clinician, which is important for managing a chronic disease such as diabetes ¹⁷¹ among Indigenous clients ³³. With the improved clinical relationship, the specialist was able to devise care plans according to the client's personal, family and social circumstances, setting realistic goals and coordinating with the local health staff.

- ***Ability to bring others into the care process***

A videoconsultation conducted at the local AMS allowed clients to bring family members or close friends into the clinical consultation if they desired. This helped the specialist and the local health staff to develop a better impression of the client's clinical and social circumstances. Family members were also a source of additional information about diabetes care relating to food intake, alcohol consumption and physical activity.

If the client were to travel to a metropolitan health centre, it is unlikely that a family member would be able to accompany the patient. Even if a family member were to travel with the patient, it would not be always possible for the family member with most insight about the client's condition to travel with the patient. When clients travel to an appointment at a tertiary centre, important information known to the spouse, children, friends and local health staff members is not available to the specialist during the consultation.

Although the telediabetes service was conducted only once a month at the two communities, the diabetes educator at PAH was available via telehealth three days each week. A patient (or a staff member on behalf of a patient) could contact the telehealth centre at PAH for advice or additional information at short notice. The diabetes educator could discuss the issue with the specialist and communicate any changes if warranted. Importantly, these factors have a direct positive effect on the quality of life of clients in these communities.

Extended services to family members

The telehealth service can also provide clients and family members with access to extended services, such as smoking cessation programs ¹⁰³. Furthermore, external agents (those affecting individual patient behaviours) such as the community elders can also be made part of the care process.

- ***Economic benefits***

If a client had to travel for a specialist appointment, even if costs were partially reimbursed by the Patient Travel Subsidy Scheme, they would have to bear the additional costs of meals and other incidental expenses ¹⁷². However, interviews with clients showed that only a few clients wished to travel to meet an endocrinologist, and few actually did so for diabetes. Therefore, in reality, the actual number of clients who would eventually travel for care would be quite low. If an endocrinologist had to be consulted at short notice for an urgent issue, the client might have to travel and pay for a private consultation. Most clients would most likely visit the local GP rather than pay for a metropolitan-based private consultation.

- ***Funding for telehealth***

Staff members described several funding mechanisms available for telehealth consultations in these communities. These are mainly delivered through Commonwealth Government initiatives and through collaborative projects between the states. Early project funding, Medicare Benefits Scheme (MBS) and non-MBS funding schemes, and activity-based funding payments through the Commonwealth and states are examples of these ¹⁷³.

Importance of funding availability

As described by staff members, availability of funding for telehealth activity helps increase similar initiatives in distant Indigenous communities and may also drive specialist clinicians to use telehealth more frequently, for routine consultations. For clients with endocrine diseases, who are geographically eligible (>15km from a tertiary centre), telehealth can be an easy alternative to face-to-face care ¹⁷⁴. The service is funded by reimbursements from the MBS scheme for telehealth activity-based funding. If state and Commonwealth government-funded activity-based funding schemes were to cease, telehealth services will only be able to access

funds from the MBS scheme. In such an event, scaling-up of activity will be needed for telehealth to be financially viable in these communities.

- ***Opportunity for learning***

The telehealth service provided an opportunity for specialists to train and inform local health workers and local GPs during or after a videoconsultation. Specific training meant that local staff were able to assist the specialist as required, and GPs were able to more confidently manage complicated conditions at the local level. When local staff are well-trained to identify clinical signs and symptoms, the telehealth specialist can also rely on them with confidence.

Barriers

- ***Local operator knowledge***

Staff members from the AMS did not know how to operate the telehealth equipment at the time it was set up (new technology). As this was expected by staff from the central service, several training programs were conducted during each outreach visit. Training included how to upgrade software and simple troubleshooting for any technical issues. During the first two years of service operation, staff turnover at Charleville and Cunnamulla AMSs was high. This meant that more frequent training programs had to be conducted to keep staff up to date.

- ***The distance needed to transport equipment***

Setting up (maintenance and upgrade) of the telehealth equipment required transport of hardware from PAH in Brisbane. For safety purposes, this was done by Centre for Online Health technical staff by road. It would have been costly to transport the equipment by air, as Cunnamulla is not connected by domestic air transport and would have required a chartered flight. However, road transport also incurs expenses for fuel, meals and accommodation for staff. In chapter 9, these costs are discussed more extensively and have been included in the costing.

- ***Lack of knowledge among Indigenous clients about the availability of telehealth at the AMS***

When telehealth was first set up in the AMS, clients from the Indigenous community did not know that such a service was available. Therefore, local staff members had to inform clients about the new service whenever an opportunity arose, such as when they came in to consult the GP. However, to increase uptake among the Indigenous clients, other measures were employed by local staff (contacting by telephone, text messages, and explanations during community programs).

- ***Lack of health education reading material for Indigenous clients***

During the initial discussions with the specialist endocrinologist and staff at the local AMSs, lack of appropriate and up-to-date reading material for Indigenous diabetes clients was highlighted. This was because the few information brochures available at the AMS were generic in nature, primarily related to nutritional and general health information (alcohol, smoking, etc.), and had not been updated for several years.

Discussions with the local health staff also confirmed the lack of any targeted reading material for Indigenous diabetes clients. Informal discussions with the endocrinologist of the telehealth service also acknowledged the lack of, and the need for, targeted information material. The clinician stated that it would be useful if clients were able to pick up the reading material on their way out after a consultation. Once they reviewed the brochures leisurely at home, what was learnt during the consultation would be reinforced. The diabetes educator could also use the reading material as a tool during education sessions. If these materials were also made available at the reception area of the AMS, clients could also review the material while awaiting an appointment.

- ***Lack of understanding among Indigenous clients of what ‘telehealth’ meant***

Using videoconsultations to meet with an endocrinologist was new to Indigenous clients, especially to the elderly. Interviews showed that some did not know what was meant by a ‘telehealth consultation’. The local health staff had to explain what telehealth was, almost every time an elderly client presented for a videoconsultation and often had to use pictures and drawings. Furthermore, they had to allay their fears of using the service before scheduling a

consultation. These initial reservations of elderly clients may have been due to their fear of using technology in general, not knowing about the endocrinologist or a possible lack of trust in the videoconsultation process. Similar reservations about telehealth have been described in Indigenous communities starting to use telehealth ^{26, 76}. The support provided by the local health workers to allay these initial reservations was vital in the uptake of the service.

- ***The high rate of absence from scheduled appointments in Cunnamulla***

The AMS in Cunnamulla recorded high rates of ‘did not attend’ (DNA) to scheduled telehealth appointments, especially when compared with Charleville and Gladstone AMSs (chapter 7). The possible reason for this was the availability of a routine outreach program during this period in Cunnamulla. Clients had the option of meeting a specialist face-to-face through an outreach program and may have informed the AMS of their inability to attend a scheduled appointment just before the scheduled time when cancellation was not an option. Cunnamulla AMS also recorded a high number of cancelled or rescheduled appointments. It is likely that changes to these scheduled consultations were possible because staff members contacted clients the day before to confirm their attendance. The no-show rates of Charleville and Gladstone AMSs were lower than for Cunnamulla. Clients from these two communities had no other option for accessing a specialist, apart from travelling.

- ***The high rate of staff turnover***

Local staff members described that there was a high rate of staff turnover at Cunnamulla and Charleville AMSs (remote locations). The AMS in Cunnamulla had two different telehealth coordinators during the first two years. These new staff members had to be trained by the PAH Telehealth Centre each time, and clients also had to get used to the new staff member. Furthermore, the new staff member had to learn the software (firmware), how to operate the equipment, and how to schedule a videoconsultation.

- ***Difficulty in meeting AMS staff during site visits***

Staff members described that they were often short-staffed, and a single staff member was responsible for multiple programs. When staff members spent time with the researcher (to discuss issues with service), they were foregoing or postponing an appointment with a client.

5.5.4 Key findings

- Active participation of the local health worker is an essential enabler if a telehealth service for remote Indigenous communities is to be successful.
- If a remote community has a secondary option of accessing specialist health services, such as a regular outreach program, uptake of the telehealth service may be slower and missed appointments will be more frequent.
- Other important aspects to a telehealth service are the close consultation with the local Indigenous community, informing the local Indigenous community about the availability of the new service and continuous operational and technical support from the service provider.

Part 4

5.6 Development and distribution of diabetes education leaflets

Overview

This part of the chapter describes the development of diabetes education leaflets for the remote Indigenous communities (see annexure 3). The reasons that led to developing the leaflets, the process of development, how changes were made to the leaflets (after consulting stakeholders) and how the distribution was carried out are described in this part of the chapter.

5.6.1 Aim

The study aimed to develop diabetes education leaflets suitable for the Indigenous diabetes clients from the two remote communities of Cunnamulla and Charleville.

5.6.2 Methods

Identification of need (planning)

During early field visits (in late 2014), local staff from the Indigenous communities revealed the lack of up-to-date targeted diabetes reading material for Indigenous clients. Local staff further informed that, if available, clients could read them whilst they were sitting at the AMS's reception, awaiting an appointment (or at leisure by taking home). Furthermore, what was learnt during a consultation could be re-enforced if clients had easily comprehensible reading material to review later. This was identified as an opportunity to support the Indigenous health service and the community. Furthermore, by including local staff members and clients in the development process, a close relationship could be developed with the community and interactions and interviews (on the usefulness of telehealth) would be an actual representation of the true state of events (not just appeasing the researcher).

Literacy (of English) of clients at the sites was not measured (no exact data). It was assumed that clients would be able to read and understand simple English text. The content of the leaflets was discussed often with staff members and elders (some were clients of the telehealth service

as well), during the development stage - a proxy measure of the literacy abilities of the intended clients.

Developmental process

This developmental process included all stakeholders (clinicians, local staff and clients), where contents were reviewed often, and changes made. Feedback and advice by local staff and clients were often obtained (inclusive design). All stakeholder opinions were valued with respect and equality (respectful and participative). Once changes were made to a draft, these were presented to stakeholders for review (iterative). The process was aimed at developing locally-suitable diabetes-education material (outcome-focused). This co-design methodology allowed for developing and evaluating locally-suitable and culturally appropriate diabetes education material for the community.

Previous evidence

Previous evidence shows education resources strengthening clinical consultations and improving outcomes^{175, 176}. Targeted reading material on diabetes could supplement a clinical consultation with the endocrinologist or a diabetes educator. Khan *et al.* shows how multimedia-based education, in the waiting room setting, helps clients increase their knowledge about diabetes¹⁷⁵.

Discussions with clinical staff

The plan to develop leaflets about diabetes was presented to the endocrinologist who conducts the routine telehealth clinic to the Indigenous communities. The endocrinologist was supportive and stated that, if available, it would be a useful tool for clients to improve their knowledge. Evidence also shows that diabetes education resources help clients increase their knowledge¹⁷⁷.

Review of available material

A search of Indigenous health information websites identified several leaflets for diabetes. However, none of these were specific to the communities, nor did they have any information

on the availability of telehealth services. They also included information unsuitable for the two communities included in this study (e.g. non-specific community programs). A peer-reviewed (or well-accepted) guideline on how to develop diabetes education resources for Indigenous clients (of Australia), was also unavailable.

Discussions with community leaders

The plan to develop diabetes education material was presented to community leaders in mid-2015, during a field visit. The CEO and senior members of the AMS also participated in the discussion. They were very interested and supportive of the plan. The AMS officials were informed that they would be consulted throughout the process of education material development, and any changes requested would be accommodated. Evidence shows consultations with Indigenous communities, prior to implementing health interventions, helps increase uptake and support for health initiatives ^{76, 178}. Community consultations may also assist initiatives to be developed suitable to the local circumstances, and may also increase buy-in.

5.6.3 Results

Developing initial drafts of the leaflets

Primary drafts of leaflets were developed by late 2015. Three leaflets were developed, each addressing a different aspect of diabetes management. The assistance of the endocrinologist from the telehealth service was also sought at all stages. Technical and educational information was accessed from the Diabetes Australia website and was acknowledged on the leaflets as the source of the technical information.

The three domains of diabetes care addressed by the leaflets were:

- How to identify the disease in an undiagnosed client;
- Identifying symptoms of acute hypoglycaemia and hyperglycaemia; and
- Information on taking medications for diabetes accurately.

Checking for accuracy of information

Once the primary drafts of the leaflets were developed, they were presented to the department of endocrinology at the PAH for review. The director of the diabetes and endocrinology department reviewed the final drafts. Subsequently, several changes to the leaflets were made. These changes included: corrections made to the educational information and targeted messages, removal or reduction of technical terms, and simplifying sentences so that the Indigenous clients will be able to easily read, review, and understand meanings. Some of the changes made to terminology were: ‘videoconsultation’ changed to ‘meeting your specialist on TV’, and ‘alcohol’ being changed to ‘grog’.

Changes to the format of the brochure

Initial drafts were developed in a foldable brochure format with information flowing according to how clients opened the brochure. In early 2016, with the PAH and the Metro South Hospital and Health Service (MSHHS) converting to an A4 format for client reading material (to accommodate for ease of converting to online content), the educational leaflets had to be adjusted. The A4 format helped reduce reader errors by not reviewing information in the correct order. The new format and flow of information were reviewed by the endocrinologist of the telehealth service.

Telehealth advertorial

Each leaflet was included with information on how a telehealth appointment can be requested from the local AMS. This information was to be useful for the clients or their family members if they were to decide to use the local telehealth service for a specialist consultation. Once clients use the service (or get to know about it through the leaflets) they may inform others during a community or family gathering.

Graphics and layout

A graphics designer at the PAH assisted in developing the primary drafts and in creating a layout according to the PAH protocols for education material. Several rounds of design changes took place during early 2016. The leaflets were finally developed as per the MSHHS

guidelines; there were no design costs to the researcher as the design costs (graphics) were funded by the PAH.

Colour schemes

During a subsequent field visit (in mid-2016), a discussion was conducted with AMS staff members for a suitable colour scheme to be used in the primary drafts. From this discussion and review of leaflets used for other communities, it was evident that a colour scheme used in Indigenous art was required to make the leaflets more appealing to Indigenous clients. As there were no guidelines on appropriate colour schemes for Cunnamulla and Charleville, Diabetes Australia was contacted, to ask their advice for a suitable colour scheme. They had previous experience (evidenced through previous publications) in developing Indigenous information materials for remote communities. They informed that colours from the Indigenous flag of Diabetes Australia (DA) could be used. The graphics designer was asked to select suitable colours for the primary drafts. Shades of brown and red were selected.

Further discussions with the Indigenous team at Diabetes Australia informed that each Indigenous community had slightly different artwork and colour schemes amongst them. This meant that it was incorrect to use the artwork of one community for a different community. The DA-Indigenous team confirmed that using earthy brown (darker shades) colours and reddish shades should be appropriate to the target communities of Cunnamulla and Charleville. They informed that if the clients had been from a Northern Queensland area where many Torres Strait Islanders reside, the colour scheme could be more of shades of yellow.

Further changes - artwork

A visiting GP to Cunnamulla, a person with Indigenous heritage, was asked to review the leaflets after final drafts were completed. This GP informed that the leaflets could be made more appealing if an artwork specific to the remote area was included in the leaflet. Though it was considered, funding limitations meant that such an artwork could not be commissioned separately for each community. Therefore, the graphics designer had to use a generic artwork previously used on MSHHS Indigenous education material, with appropriate permissions from the copyright owner. These generic artworks had been previously used in leaflets developed for other clinical specialities at the MSHHS.

Second review by AMS staff

Once the final drafts were completed, with their generic artwork added, they were sent to the AMSs by email for review. Ensuing telephone conversations with diabetes coordinators at the AMSs confirmed that they were satisfied and that the leaflets had met requirements. The diabetes coordinator from Cunnamulla advised the need to add information on the local diabetes programs, Sugar shakers (for females), and Broom (for males). These were included for Cunnamulla only.

Acknowledgements

The funding organisations and information sources were acknowledged on the leaflets. Logos of the funding bodies, Diabetes Australia, Centre for Online Health of The University of Queensland and the Centre for Research Excellence in Telehealth were included. The AMSs were also acknowledged by using their logos, with appropriate permissions. Since the leaflet development was assisted by specialists from the MSHHS (and PAH), the logos of both institutions were also included.

Final reviews -

Review by PAH Indigenous liaison staff

Indigenous liaison officers of the PAH were presented with primary drafts of the brochures for review. Indigenous liaison officers of the PAH generally use several types of information brochures for providing information to Indigenous clients who visit the PAH out-patient department on a daily basis. Hence, they were experienced in what Indigenous clients perceived as useful and easy to read. With their advice, further changes were made to technical terms, with general English terms being changed to commonly used Indigenous terms. They provided two clients to review the leaflets. These clients provided a positive review on the layout of the content.

Perceptions of community elders

Initial drafts were shared with the CEO (and staff) of the Cunnamulla AMS during a later site visit. The leaflets were well received by the CEO and senior staff members. Several staff

members, who were also clients with diabetes, requested the primary drafts for their personal use.

Evaluation

Evaluation of reading-ease

The Flesch Reading Ease (FRE), and Flesch–Kincaid Grade-Level (FK-GL) were calculated for the leaflets using Microsoft Word. Findings of the calculations are below (Table 11).

Flesch Reading Ease (FRE)

The FRE measures reading ease of a document. It is based on school texts from Grades 3 to 12. The scores vary from 0 (hard) to 100 (easy), with a target level from 60 to 70 for standard documents.

FK-GL scores

FK-GL scores are also developed from school texts. A value of 8.0 on the test means an eighth-grader can read the leaflets. A standard patient information document should read between FK-GL 7.0 and 8.0 ¹⁷⁹. The presence of words of greater length (high number of letters per word) used in leaflet 1 may have reduced its reading-ease.

Extrapolating from available evidence

The standard of reading ability for the Indigenous communities wherein the leaflets were distributed (measured through FRE or FK-GL) was not available. However, the standard reading ability of Indigenous children in *remote areas* is considered low when compared to non-Indigenous children ¹⁸⁰. Extrapolating from these findings in children, it is likely that the adult Indigenous people who received these leaflets will also require lower reading-ease scales, to comprehend the health information.

Table 11: FRE and FK-GL rating of the leaflets

Measurement	Brochure 1 (Undiagnosed patient)	Brochure 2 (Identifying acute hypo and hyperglycaemic events)	Brochure 3 Taking medications accurately
Number of words	188	361	345
Number of sentences	14	24	21
Words/sentence	7	10.4	10.1
Characters/word	5.7	4.3	5
FRE	39.1	80.8*	60.3
FK-GL	9.5	4.5	7.3
Passive sentences	0	0	0

Distribution of leaflets

Both active and passive measures were taken to distribute the leaflets amongst Indigenous diabetes clients. Once the leaflets were completed (in late 2016), prints were delivered to the AMSs, to be kept at the reception desk. If clients were interested, they could pick them up and review, either whilst awaiting an appointment or later, by taking leaflets home. The local staff were asked to observe uptake and to inform if reprints were required. With clients taking leaflets home, as intended, reprints were necessary later on.

In early 2017, printed, high-quality copies were delivered to the AMSs with A4-sized leaflet holders. The leaflets were kept in the reception area and also with the local GPs. The GPs and the endocrinologist from the telehealth service were asked to actively distribute the leaflets among suitable clients. It was anticipated that, when clients took leaflets home, others in their family would get to know about diabetes and about the telehealth service (through the telehealth advertorial).

The process of developing and distributing leaflets is depicted below in Figure 11.

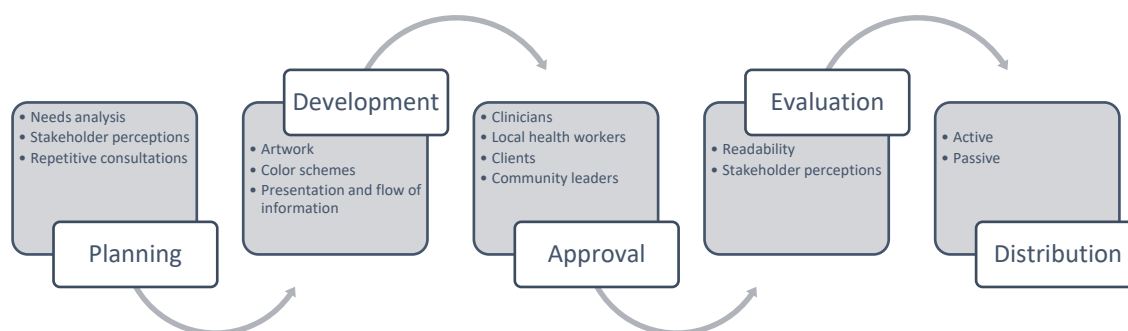


Figure 11: Pictorial depiction of the leaflet development process

5.6.4 Discussion

The aim of this part of the study was to develop and distribute diabetes education leaflets for the Indigenous communities where telehealth services were set up. It was hoped that the leaflets would supplement the lack of targeted diabetes-specific reading material. Furthermore, it was hoped that the researcher would be able to develop a closer relationship with the communities (as was the case) during the process of leaflet development.

Previous evidence

Though there is strong evidence to show that health education can supplement and improve diabetes-self management^{181, 182}, evidence for the usefulness of diabetes education resources amongst Indigenous communities is minimal. Inconsistency among various health information¹⁸³ sources has been previously identified, to limit the usefulness of patient-directed educational resources. However, appropriate education resources may help remote health staff practice more efficiently, especially when staff shortages curtail in-person time spent with clients.

Evidence shows that client education materials need to be assessed for readability, appearance and organisation of data, before delivery to Indigenous communities¹⁸⁴. Though it may not be as effective as previously thought, tailoring information to the target population can increase uptake and usefulness, especially if perceived as culturally appropriate¹⁸⁵. Community involvement in the leaflet development process can also increase eventual uptake and rigour for Indigenous education programs¹⁸⁶, as was the case observed for this intervention.

Limitations in leaflet development and evaluation

Since remote clients were difficult to contact, further testing of the usefulness of the leaflets could not be conducted. Therefore, cultural appropriateness from the client's perspective, suitability of the layout and colour schemes and comprehension of the information within the leaflets could not be measured. Poor readability scores in health information material is a limitation previously identified among health educational programs^{187, 188}, similar to the leaflets developed here. Over-representation of input from a few local health workers, due to practical difficulties in accessing clients throughout the development process, could be another reason for this.

Ideally, a pre-post intervention type of study could have been conducted to measure the usefulness of the leaflets, as a method of increasing the disease-specific knowledge among its readers. However, time and access limitations to clients restricted such a review. Changes to the leaflets will need to be made as time passes, both to the technical content, and to accommodate requests made by the local health staff. A continuous quality improvement (CQI) process, through periodic review, should be made part of similar efforts to keep the content up to date.

5.6.5 Conclusion

The leaflet development process was useful to increase the interaction between the researcher and the Indigenous communities (both health staff and clients). Furthermore, leaflets were useful for local staff members to distribute among diabetes clients. However, the process of development was protracted, as there was no accepted guideline on how to develop them accurately.

5.6.6 Key findings

- Indigenous cultural aspects, such as local artwork, colour schemes and language elements need to be observed in developing diabetes-related reading material for clients from Indigenous communities.
- Community consultation and inclusion of local health staff in the development process helps develop content that is suitable for the local circumstances and the health literacy of clients and to include information on specific local health programs.
- Embedding telehealth advertorials within health information material could be a useful method to promote the availability of telehealth throughout the remote Indigenous community.

Chapter 6: Measuring the satisfaction of Indigenous clients receiving the telediabetes service

6.1 Overview

This chapter describes the development and implementation of a client survey that measured satisfaction among Indigenous clients after using the telediabetes service. The survey was administered to clients with diabetes, after each videoconsultation with the endocrinologist. The survey was administered at the Charleville AMS only.

6.2 Aim

The study aimed to develop and test a survey to assess satisfaction among Indigenous clients who had accessed the telediabetes service.

6.3 Methods

Study planning

The study was planned as a collaborative research study between the Charleville AMS and the telehealth provider, the telehealth centre at the PAH. The survey was to be a quantitative measurement of Indigenous client satisfaction upon using the telehealth service for specialist consultations. Results were primarily, quantitative measures of client satisfaction upon using the service and were also used to corroborate findings from client interviews in the qualitative studies.

The reason for including Charleville (alone) for this study component was that it had the telehealth service for endocrine services (only). This meant that clients interviewed would not be confused with other in-person services received (e.g. outreach services in Cunnamulla). Therefore, an accurate account of the satisfaction among clients who accessed the teleconsultation service could be made.

Ethical clearance

The survey tool was reviewed by the Human Research Ethical Committee of the University of Queensland, and approval was obtained at the first approval stage at the beginning of the study (UQ HREC Number - 2015001105). Ethical aspects of Indigenous research (involving Indigenous staff as co-researchers and research governance processes of AMSs) are described in Chapter 4 above. The administration of the survey, after a videoconsultation (by the attending Indigenous health worker), was discussed with the AMS, prior to applying for ethical clearance.

Review of available satisfaction tools

Several satisfaction tools had previously been developed to measure a patient's perspective upon receiving care for diabetes; however, telehealth was not involved in the treatment process. Therefore, there were no appropriate satisfaction tools to assess an Indigenous patient's perspective after using the telediabetes service. Some of the previously developed tools (reviewed) include the Diabetes Treatment Satisfaction Survey (DTSSs), Diabetes Distress Scale (DDS), and Diabetes Medication Satisfaction Tool (DMSAT) ¹⁸⁹⁻¹⁹².

Previous evidence

Several studies describe satisfaction measures for non-Indigenous populations whilst using telehealth for diabetes care. Bener *et al.* used the Diabetes Treatment Satisfaction Questionnaire (DTSQ) to show an overall satisfaction of 3.91 (scale range 0-6) amongst 2,582 hospital clients admitted for in-person care for diabetes ^{189, 193}. Videoconferencing for diabetes consultations for non-Indigenous clients shows a satisfaction rate of 100% for video quality (using a satisfaction tool), but a low satisfaction rate of 21% for clinical assessment ⁶⁸.

However, the DTSQ is not validated for use in Indigenous communities. Furthermore, the questions included in the tools were not specific to assess satisfaction when using telehealth for Indigenous clients. Therefore, survey questions were newly designed (the process described below) to fit the domains of both telehealth and Indigenous people.

Development of the satisfaction survey

The development of the survey was mainly informed by the design of the DTSQ – status version ¹⁹². Domains suitable for telehealth and Indigenous communities were identified and

nine new survey questions were developed. Questions for personal details (Q1-3) and HbA1c levels at the point of care (Q10) were later added.

Description of the survey questions

The survey consisted of 13 questions in total. Questions 1 to 3 were for the client's personal details and were useful for client identification when changes are measured over time. Question 4 reviewed whether the client has learned new ways to manage the disease – a measurement of client education received. Question 5 assesses whether the client was comfortable (physical and psychologically) during the consultation (with or without the presence of an Indigenous staff member). Comfort is an important consideration for Indigenous clients (cultural safety) when accessing mainstream health services, especially through a novel communication method⁹³.

Question 6 evaluates whether the client considers that a videoconsultation can help prevent health problems in the future. Question 7 probes whether participation of a client's family at a videoconsultation is helpful. Question 8 assesses whether the client is willing to use telehealth again for the next appointment. Question 9 reviews whether the client is willing to recommend telehealth to others, such as family members.

Question 10 ascertains the client's HbA1c level at the point of care (either self-reported or from available records – if the client grants access). Clinical parameters are useful in measuring improvement over time, and to correlate whether continued telehealth consultations help control HbA1c levels¹⁹⁴. Question 11 is a direct question of satisfaction of the care received via telehealth. Questions 12 and 13 measure hypoglycemic and hyperglycemic events in the month preceding the consultation. This question was a proxy measure of how well clients were able to identify and manage acute events and assesses whether acute events reduce with regular specialist care. The survey tool is attached as annexure 2.

Validation

In the initial stages of survey development, discussions were conducted within the primary research team (primary investigator and supervisors) to ascertain the main aims of the survey. Since a qualitative study had already been planned to investigate the research questions of client experience and perceptions of the telediabetes services, this survey was designed as a

quantitative measure of the interaction. Validation of both qualitative and quantitative data through the technique of triangulation, which allows cross-verification from two or more sources, would then be conducted through further analyses.

Expert panel

Face validity of the tool was established by involving a technical group of academics; an expert panel from the Centre for Online Health, School of Medicine of The University of Queensland. These academics were familiar with telehealth research and how telehealth is received by Indigenous communities.

There were several changes made after the expert panel review. The survey questions were streamlined and nine of the questionnaire responses were converted to Likert scales. The wording of the questions was reviewed to match the Likert scale responses. The questions in the survey tool were designed in simple language, to make it easy for the local health worker to gain information from the client. The local health worker would simply need to read out the question without trying to convert it to a simpler form for the client to understand. This would help in standardisation of the inquiry process.

Review by second expert panel

Once the survey development was completed it was administered to 10 academics from the Center for Online Health (COH). This group included the specialist endocrinologist who conducts the teliabetes clinics for several AMSs in remote Queensland. Individual discussions were conducted with each academic and changes were made to the survey tool.

The second expert panel changed the wording of the survey questions to minimise technical terms, enhancing the flow so that it would be easy for the clients to understand. Discussions regarding the survey were held via telephone with the telehealth coordinator at Charleville AMS; the coordinator was also asked to review the questions. No changes were requested by the telehealth coordinator or the practice manager at Charleville AMS. Inclusion of local staff in the review process meant that survey questions were relevant to the local contexts and could be easily understood by clients. However, there was no opportunity to meet with a local client and review the survey questions and terminology, after all changes had been made.

Data collection

Data collection began in May 2016. The surveys were administered by the telehealth coordinator for the diabetes clinic at the Charleville AMS. After each videoconsultation with the endocrinologist, clients with diabetes were asked whether they could spend some extra time to complete the survey. The telehealth coordinator is of Indigenous origin and is an Indigenous Health worker (IHW) who is well-acquainted with local clients. Discussions with the telehealth coordinator informed that it takes about 10 minutes for the survey to be completed. Clients had been receptive to the requests made by her to spend extra time after each videoconsultation.

The surveys were collected by the Indigenous health workers, then scanned and emailed to the primary investigator at the end of each day. The scanned copies were stored in a secure database on a drive at The University of Queensland. The data were then entered into a Microsoft Excel sheet by a research assistant (MT) and later analysed using descriptive statistical methods (proportions and ranges). Since there were only a small number of surveys completed, the further statistical analysis was not undertaken.

Feedback to the AMS

Initial findings were communicated to the practice manager at the Charleville AMS. The study was concluded in August 2017. Cleaning of collected data was carried out by the researcher, who reviewed the data entered by a research assistant and checked for errors ¹⁹⁵.

An audio recorded data collection session with a client was planned, to review whether the accurate process was adhered to, but could not be carried out as clients (i.e. the clients who were contacted by the local health worker administering the survey) declined to consent to record. As the primary investigator could not be present during such an interview, other methods such as note-taking was also not relevant.

6.4 Results

Description of sample characteristics

Between May 2015 and August 2017, only 18 surveys were collected in total. In Chapter 7, the total number of consultations for the first year of service for Charleville AMS are discussed. A clinic is held once a month at the Charleville AMS, on a Wednesday. During the first year, the

Charleville AMS had recorded 54 videoconsultations, averaging at 4.5 consultations per clinic. The surveys were first delivered to the AMS in February 2016; however, data collection began in May 2016. If the average number of consultations from May 2016 to August 2017 were used, a total of 72 surveys could have been conducted during that time; however, only 25% (18 surveys from 72 consultations) of consultations have concluded with the survey being administered. However, it is likely this calculated number (i.e. 72) could be much lower – end of year (December) clinics sometimes not conducted, if client numbers are low clinics are combined, follow-up clients not wanting to participate again, absences, etc. Importantly, clients who received services could have also been for other endocrine disorders.

In total, 18 survey responses were collected. The total number of clients interviewed was 16 (for 2 clients the survey was administered twice). It is important to note that the low number of survey responses also increases bias. The high level of unwillingness/inability to participate, an indication of a strong positive bias – *i.e.* participated in the study as the service was satisfactory. Four clients had responded to question 11 (Are you satisfied with your diabetes care?), as ‘unknown’. The reasons for not responding could be - did not understand the question, unsatisfied with the consultation, or non-diabetes morbidity. In the latter instance, if the client had diabetes (as a co-morbidity), its status may have been briefly reviewed with the specialist. Therefore, these four surveys were also included in the study. The low number of completed surveys also meant that these (partially completed) surveys could not be excluded.

Description of survey responses

Questions 1 and 2 were for client identification and question 3 was for the date of the telehealth appointment.

- Question 4: During the telehealth appointment did you learn new ways to manage your health?

Fifteen clients (83%) responded as ‘learned’ new ways to manage their disease (learned a lot or learned a bit). Two clients indicated that nothing new was learned during the consultation and one had an ‘unsure’ response.

- Question 5: Was comfortable (very comfortable or somewhat comfortable) with videoconferencing?

All clients responded as comfortable with the process.

- Question 6 - Do you think telehealth will help prevent problems with your health?

Seventeen clients responded with positive responses (94%). One client was 'unsure' whether telehealth consultations will be able to prevent problems with health in future.

- Question 7 - Do you feel that it is important to have your family with you during your telehealth appointment?

Ten clients (56%) responded as positively (very important or somewhat important). Eight clients responded that family member participation during a videoconsultation was not important. From this group, two clients have had two videoconsultations each and both these clients responded that family participation is either 'not really important' or 'definitely not important'. The other four negative responses were from four clients, and all of them responded that family presence was not important during a consultation.

- Question 8 – Are you happy to use telehealth again for the next appointment – all responses positive.
- Question 9 - Will recommend telehealth to family members (definitely or probably) – all responses positive.
- Q10 - Range of HbA1c level of each client at the consultation was between 7.2 – 15.0 units.
- Question 11 - Are you *satisfied* with your diabetes care?

Fourteen clients (78%) were satisfied with the consultation process. Four clients had responded as 'unknown', suggesting the possibility that those consultations were not diabetes-related (at least on that occasion).

- Question 12 - In the last month, how often have you felt that your blood sugars have been too high (hyperglycaemia)?

Ten clients had responded as blood sugars were too high (most of the time or some of the times), during the month preceding the survey. Two clients had 'unsure' as responses, whilst six responses were 'unknown'.

- Question 13 - In the last month, how often have you felt that your blood sugars have been too low (hypoglycaemia)?

Five clients (28%) responded as blood sugars were too low (most of the time or some of the time), during the month preceding the survey. Six responses were left blank. One response was 'unsure'.

Repeat surveys

Two clients responded to the survey twice: one client, five months after the first survey, and the second three months after. Table 12 below shows the number of surveys completed during each month, the number of surveys responded by clients without diabetes and the number of repeat surveys. Though an analysis that considered repeated measures was planned, it was not possible since only two clients had responded more than once.

Table 12: Number of surveys completed for each month (February 2016 to August 2017)

Month and year clinic was held	Number of surveys completed	Number of non-diabetes clients	Number of repeat surveys
May, 2016	3	0	0
August, 2016	5	1	0
October, 2016	2	1	1
December, 2016	4	0	0
March, 2017	4	2	1
Total	18	4	2

Interpretation of findings

Hypoglycaemia and the importance of family within a videoconsultation

Out of the eight client-consultations reporting the presence of family as not important, two had reported they had *not had* a recent hypoglycaemic episode. One client reported a hypoglycaemic event and also did not want a family member within the videoconsultation. The other five consultations did not provide a response to the question on recent hypoglycaemic events. For clients having frequent hypoglycaemic episodes, it would be advisable to have the family in the clinical conversation as they can be educated on how to identify and care for the client in such a circumstance. Though the low number of responses inhibits extrapolating findings, the results may be interpreted as clients with poorly controlled diabetes not wanting their family to be overly concerned about their clinical status. One client (DD) reported that family members were not important during the consultations on both occasions interviewed. On both occasions, the client had very high HbA1c levels – 14.1 and 15, respectively, at the point of care testing.

Reasons for the low number of completed surveys

One of the reasons for this low number could be that clients may be presenting for non-diabetes-related co-morbidities. Yet, interviews with the specialist (chapter 5 above) revealed that up to 80% of clients present for diabetes-related problems on any given day. Furthermore, four (29%) of the surveys included have been from clients who had not presented for diabetes or a diabetes-related complication. Even though a client has diabetes, the specialist consultation could be for another morbidity such as a thyroid disorder. The possible reasons for low survey penetration (timing of offer of survey, etc.) have been explored further below.

6.5 Discussion

The study aimed to develop and use a survey, to measure Indigenous client satisfaction after using telehealth for specialist consultations for diabetes. Client satisfaction is an important part of any new care delivery model, as it ensures continued client participation and adherence to care plans, and is especially important for Indigenous clients with chronic diseases⁹⁰. Furthermore, findings of this study were used as a secondary data point for analysis of the qualitative study into client perceptions.

Usefulness of this study

Findings can be used in the comparison of satisfaction rates between similar sites in the future, providing a benchmark for the measurement of future performance. Furthermore, survey findings have, in this context, helped in strengthening the findings (in chapter 5). The wide scope of survey items will help in recognising Indigenous client preferences regarding the telediabetes service. As described earlier, there are no client satisfaction tools to measure Indigenous clients' interaction with telehealth for diabetes care. Future research, focusing on Indigenous communities, could use this survey as groundwork in designing quantitative studies. However, one of the major limitations (as with other tools), was that the survey was not validated with Indigenous clients (logistical difficulties made it impossible for the researcher to be present immediately after a videoconsultation for a client who had consented to the study). Therefore, though other tools were overlooked due to lack of testing in Indigenous communities, the same limitations still do continue for this survey as well.

Client satisfaction with telediabetes services

Results show that all clients were satisfied ('Somewhat' or 'Very') with the care they have received for diabetes via telehealth. Previous evidence from research studies conducted among non-Indigenous communities have shown high client satisfaction for telehealth-based health care ^{196, 197} and increased satisfaction for telehealth-based diabetes care ¹⁹⁸. However, it's important to note the low sample size of this study when interpreting the findings.

Client comfort with telehealth

All clients reported that they were comfortable – 'Definitely' or 'Most of the time'. The qualitative study described in Chapter 5 notes that clients were comfortable with the setup, the technology used, and the fact that local staff at the AMS were available to help if they had problems. Though the qualitative study above found clients reporting that they were somewhat uncomfortable at the first videoconsultation, repeat videoconsultations had been relaxed. The learning effect from previous experiences may have increased client comfort at subsequent videoconsultations. It is likely that most clients were in their repeat appointments (i.e. had at least one teleconsultation) when they were administered the survey, as data indicates the first recorded survey was in May 2016, which is one year after the service started.

Presence of family at the videoconsultation

Only 10 surveys had positive responses to having a family member during a videoconsultation. Contrary to previous research findings describing the presence of family members within the telecare process as a helpful factor for Indigenous clients ⁹⁰, this relatively low preference suggests that this cohort of clients (most likely) preferred privacy over family member involvement. The reasons for this may be because of a lack of any family members close by, clients not wanting to burden family, lack of understanding the importance of the disease, or importantly, wanting to hide the extent of the disease from immediate family.

The health belief model (HBM) shows how a client's perception of the severity of the disease translates to actions taken in self-management. Clients choosing not to involve the family in the care process may perceive diabetes as insignificant or may perceive its effects as insignificant, both leading to poor long-term outcomes. Some clients with good insight into diabetes, but with poor self-management, may wish to hide actual social circumstances from

the clinician, fearing it might lead to the clinician escalating treatment. This context fits well with concepts of the HBM model, where a limited perception of severity leading to a poor care-seeking response with negative long-term consequences, is described ¹⁹⁹.

Inaccurate interpretation of survey questions

The survey was developed to measure client satisfaction of the teliabetes service. There is the possibility that clients might interpret these questions as satisfaction measures of the immediate videoconsultation, or how they interpret their individual life course with diabetes ²⁰⁰. This highlights the need for co-design - inclusion of all stakeholders in the development process of the survey (difficulties in accessing clients meant that this was not possible). However, the inclusion of local health staff in the survey development (sometimes themselves living with diabetes) and the regular visits to the community to discuss the project and monitor progress mitigated this shortcoming to some extent. The survey was administered by a local health worker who was conversant with the survey tool and the research aims, and it is hoped that the exact nature of the study was described to the client, each time it was administered. The client would need to understand the reason for the study and how it will help improve the service in the future and would need to hear a similar description of the aims each time.

Inclusion of the local health worker as a co-researcher

Administration of the survey was mainly performed by one local health worker (the telehealth coordinator at Charleville AMS) throughout the survey period. The reason a local health worker was asked to administer the survey was that the researcher was based in Brisbane, and it would have been difficult to be present during an adequate number of videoconsultations due to distance. Furthermore, clients knew the local health worker personally, so it would be easy for them to communicate their preferences to a known person, rather than to an 'outsider'. This would mean that a more actual representation of the interaction would be made available. Furthermore, once it was explained to the client that the research is a part of a (collaborative) service improvement process at the AMS, it is likely they would provide accurate feedback, as it would help improve the local service. If the primary investigator were to administer the survey, it is possible that clients may describe the service as 'good' to appease the investigator.

Limitations

Several limitations (affecting the utility and validity of the survey) and problems in conducting the research were encountered during this study. These are described below.

Lack of pilot testing of survey among eventual Indigenous participants

Pilot testing of the survey in a subset of indigenous participants, i.e. clients from the community, was *not* conducted at the development stage. The distance from Brisbane to Charleville, and the difficulty in contacting Indigenous clients with diabetes, inhibited this process. This was a significant limitation in survey development and meant that a test-retest or a pilot test in the community could not be conducted.

Low number of repeat surveys

Only two clients have had repeat surveys, and there had been no changes to their preferences in the interim. This suggests that clients were comfortable and satisfied with the service at the first and second instances the survey was administered. If the survey is conducted at a future date, it may identify clients who have become dissatisfied with certain aspects of the service. From the qualitative interviews, it was noted the specialist endocrinologist was friendly and well-conversant with the telehealth equipment. It would be interesting to observe the findings if the specialist were to change at a future time.

Problems with data collection

Staff shortfall

During the latter part of 2016 and the early part of 2017, the Charleville AMS had to provide staff members to mitigate a *staff shortfall* in surrounding smaller health facilities. The neighbouring Indigenous health facilities of Quilpie and Mitchell were frequently provided with staff members from Charleville to maintain services. This meant that the telehealth coordinator at Charleville had to serve away on several clinic days from the Charleville telediabetes clinic, leaving another staff member to support clients. More than one staff member had previously been trained on how to operate the telehealth equipment at the Charleville AMS, hence it was possible to conduct telehealth clinics without difficulty.

Possible lack of interest

Though the study was planned to be a joint research project between the Charleville AMS and the COH, to evaluate the service from the perspective of the client, new staff members who administered the survey may not have known this. It is possible that some staff members also lacked interest. Even though frequent reminders were sent (emails sent and reminder telephone calls before each clinic) the data collection was infrequent and failed to improve over time. Several discussions were held to attempt to improve the data collection during site visits. The practice manager agreed to administer the surveys as part of discussions during site visits; however, survey numbers failed to improve throughout the time allocated for data collection. Since the clinic was held only once a month, the opportunity to administer the survey was also low.

Lack of awareness about the survey

The other staff members who assisted with the telehealth clinics were required to attend to their usual work as well, which led to surveys not being administered. Another reason for the low survey completion rate was that those (staff members of the AMS) who were supporting the service in the absence of the regular staff member *did not know* about the survey. On occasion, the specialist endocrinologist had to remind local staff to complete the survey. The specialist endocrinologist who conducts the regular telediabetes clinic was involved in the survey development and was aware that the survey had to be conducted after each videoconsultation. The researcher also periodically reminded the endocrinologist and the practice manager at the Charleville AMS that surveys had to be completed after each videoconsultation for diabetes clients.

High staff turnover

During the period that data were collected for the survey, there was a high turnover of staff at Charleville AMS. This meant that new staff members starting work at the AMS did not know about the survey. To overcome this barrier, the practice manager was informed to notify all staff members about the survey during staff meetings. If the permanent telehealth coordinator was absent on the clinic day, other staff members would help clients during videoconsultations. The telehealth coordinator, who routinely manages the telehealth clinic, had a good rapport with the clients, which may have been lacking with new staff members. As participation was voluntary, a few clients (exact number unknown) had declined the invitation to participate.

Busy clinic days

As staff members were covering for staff shortfalls at neighbouring Indigenous health centres, Charleville was also operating with low staff numbers. Routinely, the telehealth coordinator had to attend to other duties and did not have adequate time to sit with the clients after each videoconsultation. During site visits, the primary investigator had observed several times that the Charleville AMS was short-staffed on clinic days, due to multiple clinical activities occurring at the same time.

6.6 Conclusion

The survey showed all survey respondents (who participated in this survey) were comfortable and satisfied with using telehealth for diabetes care. Positive responses were also noted for ‘learned new ways to manage diabetes’ (83%), ‘will use telehealth again’ (100%), and ‘telehealth will prevent health complications’ (94%).

Due to limitations in survey development, this will (most likely) not be suitable to be used in other Indigenous communities as it is; however, it will be a useful guide to understand interactions between telehealth and Indigenous clients. Due to the low number of surveys (and repeat surveys), findings are likely to be biased, less reliable to interpret and poorly generalisable. Furthermore, reported satisfaction and usefulness could be overestimates of the true satisfaction and usefulness from the client’s perspective. Despite these limitations, the survey generated useful data to compare with, and reinforce, findings of the qualitative research component described in Chapter 5.

6.7 Key findings

- Indigenous client satisfaction and comfort rates with telehealth for diabetes care are both 100%.
- >80% of patient-consultations have responded as videoconsultations being useful to learn new ways to manage diabetes, will help prevent complications, and a willingness to use the telehealth service in future.
- Data collection at a remote Indigenous health centre for an interviewer-administered survey is difficult. The reasons for this include busy clinics (workload priorities), low staff number

at the AMSs, telediabetes clinic only held once a month, patients declining to participate, and possible lack of research literacy.

Chapter 7: Measuring the uptake of a telediabetes service for Indigenous Australians: 12-month review

7.1 Overview

This chapter reviews the uptake of the service after twelve months of operation. Data were collated from the medical records of clients from two databases at the Princess Alexandra Hospital (PAH). Activity data of the telediabetes service and changes made to client management were evaluated.

7.2 Aim

The study aimed to explore service uptake and describe changes in the management of diabetes over a 12-month period.

7.3 Methods

Type of study

The study is descriptive in nature. It reviews service utilisation at the completion of one year of operation. Service evaluations conducted at the short or medium term helps us understand how well a new health service is achieving its intended objectives ²⁰¹. Case studies of clients who had used the new service are also presented.

Study sites

The PAH-based Indigenous telediabetes service commenced operation in May 2015, extending diabetes services to AMSs of Cunnamulla, Charleville, and later on to Gladstone. These three sites are included in this study as they were among the earliest available for data extraction. Since initiation, telediabetes clinics have been held regularly for each of these sites. Cunnamulla and Charleville were the first two sites services were initiated with services starting in Gladstone later on. Gladstone recorded higher client numbers since services began compared to Cunnamulla (probably due to the higher population of Indigenous people in the site). Data from the Gladstone site was extracted from the central PAH databases after appropriate clearances.

Target population

All clients who had at least one videoconsultation for diabetes (from the three sites) were included in the study.

Ethics Approvals

Ethical clearance for the study was obtained from The University of Queensland ethics review committee - HREC reference number 2015001105, with first and second amendments. As medical records at the PAH were accessed, ethical clearance was also obtained from the PAH ethics committee. The study was approved as a low-risk research - reference HREC/16/QPAH/324 and SSA/16/QPAH/325. Public Health Act approval to access client data without consent was also obtained (RD006373).

Record selection

Multiple databases were accessed to obtain the data required to address the research question (described in Chapter 4 above). Access codes for the QH and PAH finance department records were provided by the data custodian. Relevant information needed to be manually extracted, as copying data electronically was not permitted. Records were searched according to the client's Medical Record number.

1. The telehealth database at the Centre for Online Health (COH), PAH, provided client record numbers from May 2015 to April 2016 for clients who had received at least one videoconsultation for diabetes management at the study sites.
2. The Practix database at the PAH stores medical records for all videoconsultations for endocrine disorders (including diabetes). The relevant records from the Practix database were identified from the record numbers received from the COH.
3. The database at the PAH finance department was accessed by the researcher, and data extracted manually for each episode.

Inclusion criteria

To be included, clients needed to reside in Cunnamulla, Charleville, or Gladstone and receive medical care from the associated AMSs. Clients had to identify as Indigenous and be aged over 18 years (no upper limit). Clients also needed have been diagnosed with diabetes - type 1 or 2, and/or variants of type 2 - and must have had at least one videoconsultation via the telediabetes service during the study period, i.e. its first year of operation.

Exclusion criteria

Clients who had videoconsultations with the endocrinologist for reasons other than for diabetes care, e.g. thyroid disease, were excluded.

Data extraction

Since Indigenous client information, extracted from accessing the client records were sensitive, several measures were taken to secure the privacy and confidentiality of the information. Client details, such as full names, were not used at any time in record extraction. All records were extracted based only on the medical record number and initials of the client. The record number was identified from the COH database and printed on a paper (hard copy only) and kept at the COH in an undisclosed location; the record numbers were not shared with any other parties, including the Practix database administrators.

Discussions with the specialist

An initial discussion was conducted with an endocrinologist, who provides regular videoconsultation clinics, to develop the scope of data collection. A data extraction sheet was then developed. This ensured the extraction items were closely matched to the clinical information recorded in medical records. Data items were extracted by reading through the referral letters, notes made by the endocrinologist, and management plans sent to the local GPs. Pre-defined data items were extracted by hand to a data collection form. Data collection began in January 2017 and was completed by the end of February 2017.

On the advice of clinicians (of the telehealth service), information was extracted by reviewing the comprehensive management plans sent back to the local GPs. However, there was no way to positively identify (cross-check or match) whether the consultation had occurred or not, as scheduling data and records were stored on two independent systems. Furthermore, the AMS

is also used by non-Indigenous clients, and diabetes clients presenting for other endocrine problems. Some clinical notes were also inaccessible upon client request.

Data extraction was conducted by reading and sifting through the specialists' clinical notes. There were notes made by two endocrinologists and one registrar from the PAH endocrine department. The letters sent by local GPs when referring clients to videoconsultation, and documented management plans sent back to them by the endocrinologists, were also retrieved and reviewed.

Data extraction items:

Data were extracted according to three main themes.

- Demographic and presenting clinical complaint:
 - age of client
 - gender
 - type of diabetes
 - HbA1c level or RBG level at the point of care
- Client care changes:
 - treatment changes to insulin or medications (see note 1 below)
 - types of investigations ordered
 - hospitalisation (acute or planned)
 - education provided
- Follow up:
 - planned follow-up
 - referral to another specialist
 - referred to allied health services

Clinically important factors outside these pre-defined items were also extracted if deemed relevant.

Note 1:

Medications pertaining to renal and cardio-protection were selectively extracted. Diabetes is a known cause of renal injury and cardiac morbidity; hence, by including newer medications or optimising dosages of protective medications, damage to these vital organs may be reduced. It

was assumed that the clinician would optimise each client's medication regime during the videoconsultation. The lists for renal-protective and cardioprotective medications were identified from the *Oxford Textbook of Medicine* ²⁰² and *The ESC Text Book of Preventive Cardiology* ²⁰³, respectively. The list of cardioprotective medications includes Angiotensin-converting enzyme inhibitors (ACEI), Angiotensin receptor blockers (ARB), Calcium channel blockers (CCB), statins, anti-hypertensive medications such as beta blockers, and aspirin. Renal-protective medications include different types of ACEI and SGLT2 inhibitors.

Scheduling data

Scheduling data for the three sites were obtained from the PAH outpatients department. The data request included: the number of consultations scheduled for each site during the year; the number of Indigenous clients scheduled; the number of consultations completed, number of cancellations, reschedules and no-shows.

Data storage

Handwritten notes were kept by the primary investigator and will not be shared with third parties. After the study is completed these notes will be destroyed by shredding. The hand notes were scanned, and a PDF version was sent to the supervisors via email and stored in the S drive of the UQ database. These emails and records will also be deleted at the end of the study. The data worksheet in MS Excel is also stored in the S drive of the UQ database and will be deleted seven years after the study is completed, as per UQ policy. This data storage is to allow for the publication of findings and reworking of calculations if required.

Analysis

Retrieved data are entered into an MS Excel datasheet, analysed and presented using descriptive statistics (proportions). Clinical notes in each relevant medical record were included in the study.

7.4 Results

Service utilisation

Fifty-nine client consultation records were identified as meeting inclusion criteria, and data from all records were extracted. There were additional consultations identified from the scheduling data; however, no notes had been made in medical records. It is possible these were brief consultations for a short review (e.g. discuss investigation reports) and notes were not required. An overview of the consultations is depicted in table 13 below. There were 23 clients accessing services for a total of 59 consultations (12-month period), 37 consultations of which were by male clients. Charleville recorded the highest number of relevant teleconsultations (n=35) during the review period.

Table 13: Characteristics of clients from *included* records

Description	Cunnamulla	Charleville	Gladstone	Total
Gender ratio of client consultations who presented at clinics (each site) M:F	24:11	5:3	8:8	37:22
Number of <i>clients</i> who had a videoconsultation during the first year of service	4	13	6	23
Number of <i>consultations</i> included for data extraction	8	35	16	59

Other findings from review of medical records

Number of clients -

There were 19 individual clients with type 2 diabetes among the 23 clients included in the study. The remaining four clients had type 1 diabetes (for ten consultations). These four clients had 2-3 consultations during the first year.

Disease-specific details -

The 18 - 40 age group (n =14) included clients with type 1 diabetes, type 2 diabetes, and the MODY subtype of type 2 diabetes. There were 19 clients between the ages 61 to 80 years. Amongst the clients from the age group 41 -50, there was one client with post-renal transplant diabetes. The client was having complications with anti-rejection medications and uncontrolled diabetes, at presentation. There was a higher number of consultations with male clients (n=24, 69%) compared to female clients (n=11, 31%), which probably indicates that either most clients with complicated stages of diabetes were males (for this selected client group) or that there are more clients with diabetes among males from these communities (resulting in a higher proportion of referrals). Of the 59 consultations, 49 (83%) were for type 2 diabetes, of which three (6%) consultations were for the maturity-onset diabetes of the young (MODY) subtype. The rest (n=10, 17%) were for type 1; there were no clients with any other forms of diabetes.

Consultation type (new/review) -

Of the 59 consultations during the first year of service at the three sites, 11 consultations were for new appointments (had never met an endocrinologist). The number of clients who received care within the first year was 23; this means 12 clients would have had at least one consultation with an endocrinologist, before telehealth. Therefore, the unmet needs of 11 clients for specialist consultations were met by this new service, in the first year.

Referrals –

On average, letters to the local GP had been documented in medical records one to four weeks post-consultation. When the reasons for referral were evaluated by reviewing GP referral letters, only seven referrals had a specific problem mentioned that needed the attention of the specialist. These included referrals for review of an existing care plan for diabetes, a post-renal transplant client for review, and diabetes clients with increasingly difficult-to-control blood glucose levels (BGL). Some referral letters were non-committal on the reason for referral, stating the need for a review or requesting an opinion for further management of the client. The reason for many non-specific referral letters by GPs might be due to the need to optimise care, even though there were no urgent problems to treat. For complicated or specific problems, it is likely that GPs wanted a second opinion before progressing.

Care changes made during videoconsultations

Different types of care improvements made during the consultations are depicted in Table 14 below.

Table 14: Care changes made during videoconsultations

Description of care changes	Number of consultations (n=59)
Decisions made regarding drug regimen	57 (97%)
Insulin-related changes (start, stop, increase/decrease, change of type)	26 (44%)
Renal-protective medications (start, stop, increase/decrease, change of type)	12 (20%)
Cardio-protective medications (start, stop, increase/decrease, change of type)	18 (31%)

HbA1c levels and referrals

Eleven videoconsultations did not have a recent HbA1c level at the time of the consultation. For the other 48 consultations, HbA1c levels were available via a pre-ordered investigation, through point-of-care testing, or by a recent routine HbA1c level available from the AMS. The HbA1c levels of clients (latest recorded at consultation) ranged from 6.3 to 13.1. Only seven (15%) of the 48 readings at the point of care (videoconsultation) were below seven units – i.e. the ideal level of control for diabetes clients ²⁰⁴.

Hospital admissions, referrals, follow-ups, and discharged clients after videoconsultations

During the first year, only one client was advised to be admitted to hospital immediately after a videoconsultation. Two clients were discharged from the clinic as they had gained good HbA1c control. The local GP was provided with a care plan and advice to refer back if any new complications arose for these two clients. Table 15 shows data on follow-ups and referrals.

Table 15: Follow-ups and referrals

Description of follow-up or referral	Number of consultations (n=59)
Number of consultations ending with a plan for further follow-up with the same endocrinologist via videoconsultation	45 (76%)
Number of consultations ending with a plan for the client to be followed up by other specialists (e.g. neurologist, cardiologist, etc.)	16 (27%)
Number of consultations ending with a plan for the client to be followed up with allied health services	20 (34%)
Number of consultations ending with a plan to refer the client to the Insulin Stabilisation Service	13 (22%)
Number of consultations ending with a plan for the client to be discharged to the primary care service from the clinic	2 (3%)
Number of consultations where the client was admitted to hospital for further care	1 (2%)

Reviews and referrals

Reviews were planned after each consultation either with the same specialist, the local GP, the Insulin Stabilisation Service, the PAH diabetes educator, or other specialists or allied health services. Clients requiring allied health services were referred to podiatrists, nutritionist, optometrists, exercise physiologists, and dieticians.

The time gap for reviews with the same endocrinologist ranged between one month and six months. On average, clients were reviewed at three months by the same endocrinologist after a videoconsultation, similar to prescribed guidelines of the Medicare Benefits Schedule²⁰⁵. Clients with high HbA1c levels were reviewed sooner than stable and well-controlled clients. In the case of two clients, who were reviewed after a month, HbA1c levels were higher than

10%. Even when there was a longer time span between an endocrinologist's reviews, blood glucose level chart reviews and reviews with the Insulin Stabilisation Service were planned beforehand. Therefore, the client would have been monitored closely throughout, until the next review by the specialist.

Clients were also referred to other specialists: cardiologists (2 clients), a nephrologist (1 client), gastroenterologist (1 client), ophthalmologists (5 clients), and mental health specialists (3 clients).

Interpretation of findings

These findings demonstrate the positive difference specialist videoconsultations make to these communities (easy access to a specialist). Furthermore, the early uptake by GPs (as evidenced by the number of referrals in the first year) also shows that the service has been useful for local primary care services to optimise clients. However, most importantly, 11 clients who had never accessed a specialist previously were able to have a consultation via the new service. If not for this service, these clients would not have had the opportunity to easily consult a specialist. Furthermore, the low number of clients (n=7; 15%) with ideal HbA1c levels may suggest that the current standard of diabetes care in the community is poor. However, it is important to note that these clients were specifically identified by the GPs as requiring escalation of care, hence had a videoconsultation with a specialist early. It is possible that there were other clients with good control, hence not included in this study.

In Cunnamulla, due to the high workload, GPs were not able to routinely attend videoconsultations (unlike in Charleville). This meant that the potential educative function of teleconferencing to improve local primary care services was not in use. If a GP was present during each videoconsultation, the specialist would have been able to provide technical information regarding disease management, possibly improving client care in future.

Scheduling data

The total number of appointments scheduled for the three sites during the first year of service was 222. However, these appointments included both Indigenous and non-Indigenous clients who use the AMS health facility for care. Of these 222 scheduled appointments, 116 appointments were for Indigenous clients only. These 116 appointments included Aboriginal

and Torres Strait Islander (TSI) clients, Aboriginal but not TSI clients, clients who had declined to identify themselves as Indigenous or clients classified as Indigenous status unknown. Client locations for the Charleville area also included clients from Quilpie and Mitchell.

Consultations conducted or rescheduled also include cancelled appointments. The reason for calculations to be based on consultations conducted and rescheduled or cancelled (a small number) is to include all the planned consultations within the period of evaluation. In the event of a reschedule, the client will be provided another time (sometimes as an extra client on another full clinic-day). Furthermore, when rescheduling is done, the specialist (and staff) at both ends will know beforehand. This means that other clients will be called up or new clients added for those time-slots newly available. Hence there is no (or minimal) time-wasting with rescheduling. Only those who did not show up for the consultation (Did Not Attend - DNA) caused inefficiency - clients who had a scheduled appointment but failed to arrive without informing the AMS.

Total number of potential annual consultation load has been calculated by multiplying the number of days clinics are available, per site, per year (12) by the total number of appointments usually scheduled per day (8). This means 96 consultations can be conducted per annum for a site. A 70% target efficiency is used by the PAH to measure usage efficiency for clinic activity. Therefore, at 70% efficiency, each clinic could conduct 67 appointments annually.

Service usage data received from the outpatient database of the PAH are presented below, in Table 16.

Table 16: Activity statistics (from scheduled consultations) for the telediabetes service from May 2015 to April 2016

Description	Cunnamulla AMS	Charleville AMS	Gladstone AMS
Total scheduled Indigenous client consultations (n=116)	21	54	41
Indigenous client consultations as a percentage of total scheduled (n=222)	9%	24%	18%
Consultations conducted or rescheduled (n=101)	17	46	38
At 70% efficiency (n=67)	31% (21)	81% (54)	62% (41)
Did not attend (DNA) rate	19% (4/21)	15% (8/54)	7% (3/41)

More than eight appointments have been booked on three occasions for Charleville and Gladstone in January 2016 and March 2016. Since appointments include cancellations, rescheduled appointments and DNAs, the workload would have been manageable on those days. The graph below (Figure 12) shows an increasing trend in uptake during the initial part of 2015 (trend line for Charleville and Gladstone). It would be interesting to see whether this increasing trend has continued or waned over subsequent years.

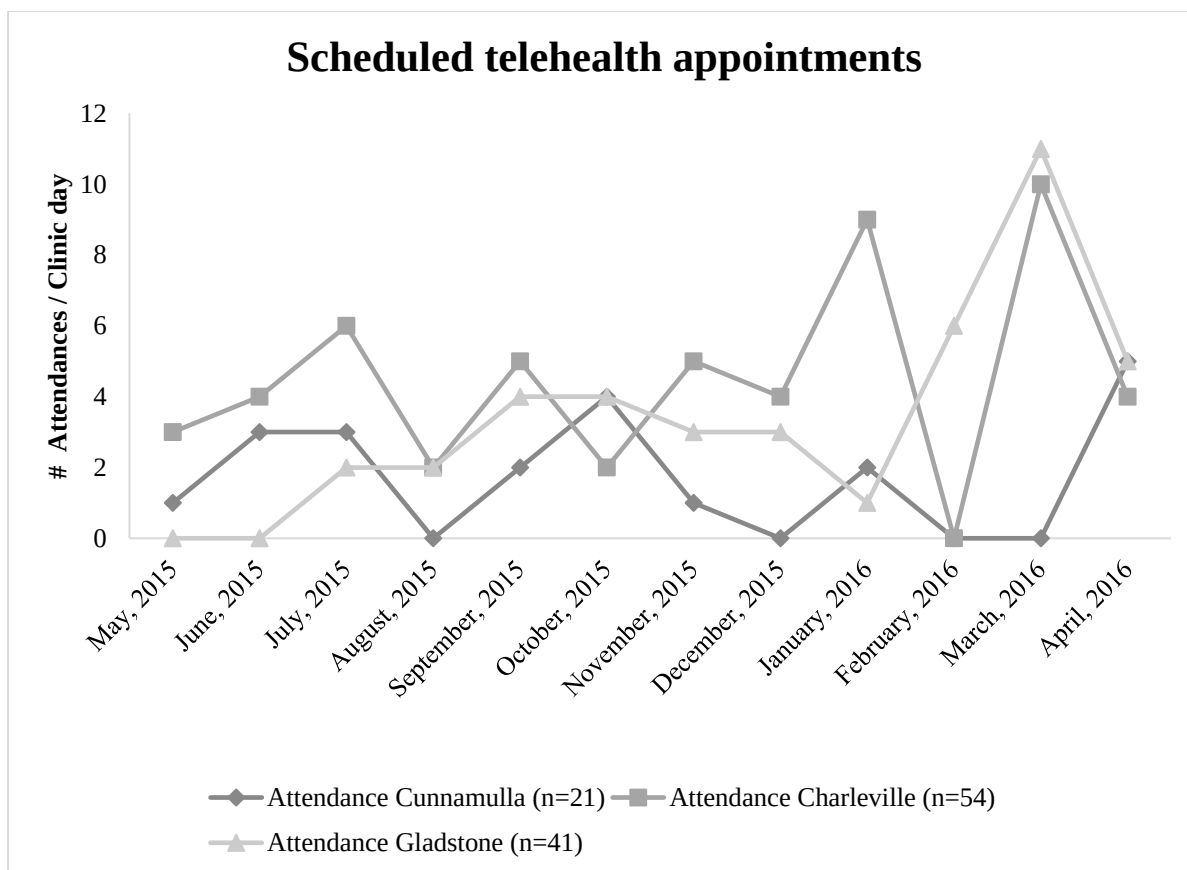


Figure 12: Telehealth appointments for Cunnamulla, Charleville, and Gladstone AMSs (May 2015 to April 2016)

(Note – attendance and appointments assumed similar)

Case studies

Two client case studies are presented below to highlight outcomes for individuals who had significant improvement to their clinical status, probably directly attributable to the contact with the health professionals (endocrinologist, diabetes educator, nursing professionals and staff at the insulin stabilisation service) via the teliabetes service. If not for this service, it is unlikely these clients would have access to any of these specialist services.

In order to protect privacy and confidentiality and the potential to inadvertently identify the client, only minimal details of the client's background are presented. Data for the case studies were extracted during the review of medical records.

Case study 1

The first client, 'M', is an Indigenous client with type 1 diabetes, living in a remote Indigenous community in regional Queensland. The client was responsible for both self-administration of the regular insulin dosage and to adhering to a prescribed nutrition and exercise plan but did not follow the medication and lifestyle plan correctly. Infrequent administration of insulin, improper dosage and, on occasion, not injecting insulin at all, was reported. The client was hospitalised frequently, due to episodes of hyperglycaemic ketoacidosis, with admissions made to the local hospital. Furthermore, when the client injected insulin, it led to frequent hypoglycaemic events (probably due to incorrect dosage), including hypoglycaemic fits.

Telehealth consultations

The client was referred to the specialist endocrinologist during the first available telehealth clinic by the local GP. The GP requested the specialist to review the client's insulin regime with a view to attempting better control of the blood glucose levels. Furthermore, the GP informed that the client has previously had very poor control and had not attended several endocrine appointments that had been planned at the nearest tertiary hospital in Toowoomba.

On first presentation to the specialist via telehealth, the HbA1c level of the client was 13.1. The client revealed that BGL values at random home blood glucose testing had ranged between 12-14 mmol/L. Upon discussions with the specialist, the client disclosed a history of frequent hypoglycaemic episodes and hypoglycaemic fits.

Management

The specialist ordered several investigations to assess the client's diabetes status, renal and liver functions, and also ordered several referrals. Referrals were made to a podiatrist, a nutritionist, an ophthalmologist, an exercise physiologist, and to a neurological testing facility to assess for peripheral neuropathy.

The insulin dosages were reviewed and titrated to meals with advice on carbohydrate counting and fine-tuning of insulin dosages, depending on meal content. Frequent contact with the diabetes educator at the PAH was also planned. The specialist explained to the client, in detail, the negative consequences of not managing diabetes appropriately. Furthermore, the specialist advised the client on being hypoglycaemic aware for two-second and three-second events, a precursor of an impending significant event. The specialist prescribed a glucagon kit for the

client for managing any hypoglycaemic episodes and advised the client on how to use it. The client was initially asked to communicate weekly with the Insulin Stabilisation Service (ISS), and later, fortnightly.

Altogether, the client had four videoconsultations during the first year, one of which was during an unplanned hospital admission. At the end of the first year, the client had taken a substantial interest in the disease and care process. With each videoconsultation, and after several rounds of education by the diabetes educator, the client had started adhering to the Insulin regime and the nutrition plan as recommended. As a result, there had been no hospitalisations for hypoglycaemic or hyperglycaemic events during the early part of 2015 and onwards.

If not for the telehealth service, this client would not have had the opportunity to meet with a specialist so often, during a critical period of the disease and care process. The client would not have travelled to a tertiary centre (as indicated by previous no-shows) in either Toowoomba or Brisbane.

Case study 2

‘S’ was a client who had been diagnosed with a suspected tick-borne disease (unconfirmed diagnosis) for several years, living in a remote Indigenous community. As a probable effect of the disease, the client was complaining of features of chronic fatigue and had recently begun part-time work as a result. Furthermore, the client often felt tired; even minor exercise was not possible. The client had gained weight recently and was having regular high blood sugar readings.

The client was referred to the endocrinologist during the first available telehealth consultation by the local GP. The GP requested the specialist to provide a management plan to achieve improved control of blood sugar levels.

Management

The endocrinologist ordered several urgent investigations to assess glycaemic status. The client was advised to increase light exercise gradually, and to titrate the exercise schedule to blood glucose readings, whilst observing for hypoglycaemic events. The client was informed of several new medication options available and a new management plan was agreed to.

The client was asked to contact the diabetes educator at the PAH, initially fortnightly and later monthly, to manage the blood glucose levels. A chart review of medications was ordered in four weeks, as the client had complained of multiple medication allergies. During the first year of operation, two further consultations with the specialist were conducted via telehealth. The HbA1c level of the client at first videoconsultation was 7.7 and at the end of the first year, it was 6.4 (optimal control).

7.5 Discussion

The study aimed to review usage (uptake) of the teliabetes service and review how patient care has been managed during the first year of operation.

Service delivery

The service had provided 59 videoconsultations over the first year of service (excluding cancellations, no-shows, reschedules, and non-Indigenous clients). Similar Indigenous teliabetes services from Australia have recorded higher numbers of consultations during the first year of service ^{81, 206}. The possible reasons this service recorded a lower number of consultations are: 1. the availability of frequent outreach programs in Cunnamulla reducing the overall number of clients using telehealth; 2. videoconsultations taking a longer duration per client compared to an imaging (retinopathy) intervention, leading to a lower number of consultations per day; and 3. high number of non-attendance at scheduled appointments.

A review of medical records showed evidence of specialists addressing more than one clinical condition during a videoconsultation, leading to lengthy consultations. Furthermore, clinicians sometimes addressed problems that could be regarded as outside their usual clinical scope, as clients wouldn't have the opportunity to meet with an appropriate specialist for that condition within a determined period of time (that would be reasonable).

Data from the Australian Bureau of Statistics show that there are more Indigenous females with high blood sugar levels, compared to their male counterparts ²⁰⁷. However, analysis of the consultation records (of the included group of clients) showed that there were a higher number of males having videoconsultations. The reason for this may be that there were a higher number

of male clients requiring specialist review (possibly as they may have neglected care), though the actual number of female clients with diabetes (possibly well-controlled) may be higher.

Impact of medication regimen changes

Though 20% and 31% of consultations had changes to renal-protective medications and cardio-protective medications, respectively, this would be a normal expectation with a specialist review - a specialist will most likely optimise the medication regime during a consultation. A long-term evaluation would be needed to see whether these videoconsultations have had a clinically significant impact in mitigating chronic sequelae of diabetes, such as diabetes-associated renal disease. However, evidence shows that close review by specialist teams for diabetes reduces long-term complications^{208, 209}. It would be interesting to know if clients who lived further away (in further remote locations) were on medications for longer durations (due to limited access) and whether the telehealth option influenced clinicians in their decision-making. This would essentially require a clinical audit (which was beyond the scope of this study).

Factors affecting uptake

One of the negative aspects identified during this review was the low uptake of the service in Cunnamulla. The high number of Did Not Attends (DNAs) in Cunnamulla is also a concern. As stated earlier, Cunnamulla had a routine outreach program throughout this period, giving clients a secondary option to meet a specialist. It is likely that clients have preferred the in-person option in this instance. In contrast, Charleville and Gladstone AMSs were provided with the telediabetes service only (without any regular outreach program from the PAH) and uptake of videoconsultations was higher, and the non-attendance rates lower. However, this could also mean that change in practice in Cunnamulla has simply taken more time (compared to other sites) to be implemented.

Uptake of this telehealth service is also a measure of referrals made by GPs, as they are the gatekeepers for escalating care when warranted. Since the specialist endocrinologist was specifically recruited for the telehealth service, it is likely the specialist was receptive and conversant to using technology for care delivery from the outset. Positive attitudes of tele-clinicians are found to be extremely useful for the success of any telehealth service²¹⁰.

Usefulness of telehealth service

The usefulness and uptake of the telediabetes services are limited if a remote Indigenous community has another option for accessing specialist consultations for diabetes. Yet, delaying the setting up of a telediabetes service in a remote Indigenous community is not advisable, as clients could use the service for urgent consultations in between outreach activities. In the event that adequate client numbers are not available in one community (for a day clinic on telehealth), sites could be combined (switching between multiple telehealth clinic sites) to make up for the shortfall.

Rotation of GPs

In Cunnamulla, GPs rotated every four weeks. Newly recruited GPs who rotate may not know about the availability or usefulness of, or may not be comfortable using, the telediabetes service, and may have inadvertently referred clients to the outreach program only. Furthermore, in Cunnamulla, GPs do not regularly sit in with the client during a videoconsultation, due to scheduling difficulties. Contrarily, in Charleville, there was a regular GP for the telediabetes service, who attended all videoconsultations if time permitted. This made it easy for the specialist to make changes in the management of a patient. Furthermore, both Charleville and Gladstone AMSs had regular GPs throughout the study period. It is likely that uptake among clients is affected by the attitudes of GPs about the telehealth service. However, the telehealth coordinator (either central or distant site) could have checked the eligibility of clients (per previous records) for videoconsultations, at least for selected cases.

Short duration of observation of this study

This service evaluation was conducted for a period of one year only. Such a short duration is inadequate to understand, with certainty, how clients interact with the service and how uptake will change over time. It is likely that, at least for the initial period, usage will increase, with the service identifying ‘new’ known clients with diabetes presenting to the service for the first time. But over time, with clients being gradually optimised and discharged back to the GP, it is likely that consultation numbers and demand will plateau, as the patient numbers at each community are finite. A long-term evaluation can help identify how the service evolves, either with further services being added or with gradually reducing activity, as a result of waning interest amongst clients or local health staff.

Problems encountered in conducting the research

Challenges with ethical clearances

Further complicating this study was the duration required to obtain ethics approvals. In September 2016, approval to commence the research at the PAH was received from the PAH research governance office. From the initiation of the first ethical clearance application to the approval for data collection required nearly one year. The delays included time taken for initial consultations with the data custodians (Director of the HIMS, PAH and the systems manager in charge of the Practix database), and the requirement for several ethical approvals from UQ, PAH, and PHA offices. The medical records were of Indigenous clients, increasing the sensitive nature of the information; clients had the potential to be identified even with minimal information.

The delay in ethical clearance could also have been due to the included client group being of Indigenous origin (sensitive information). If released data could identify clients (as patient numbers were small) it would be detrimental to the credibility and integrity of this study, not to mention client confidentiality.

Access issues to the database

The access to data required authorisation from two data custodians: The Director, Health Information Management System (HIMS) and the local data custodian for the Practix database. The Practix database, though primarily used for billing services, holds the endocrinologist's clinical notes from the three selected Indigenous sites. Since (confidential) financing information was also accessible when reviewing records, these approvals caused lengthy delays and several rounds of explanations.

7.6 Conclusion

This twelve-month service evaluation shows that remote Indigenous clients with diabetes benefited (through increased access) from the telehealth service. However, an average number of videoconsultations per clinic was low, between 1-3 consultations per patient/year at each site, where a higher number of consultations could have been accommodated. Charleville AMS recorded the highest total number of consultations in the first year of service, with 35 videoconsultations in total for 13 clients. A gradual increase in the number of consultations can be seen for Charleville and Gladstone AMSs during the first year of service. Average non-attendance rates across the sites were 13%, with Cunnamulla recording the highest rate of 19%.

A review of client records showed that several clients had significant clinical improvements in care due to the teliabetes service. Drug regimen changes were made during 57 videoconsultations (97%) and cardio-protective and renal-protective medications were newly added during 31% and 20% of videoconsultations, respectively. A clinical audit or a long-term clinical evaluation would be needed to evaluate reasons for clients with poor clinical improvements.

The extensive qualifications (described above) around data collection, ethics approval and competing services may undermine the confidence of the findings. The fragmentation of Indigenous service delivery (competing health services, poor communication between different service providers and lack of adequate staff) complicate the service delivery to these Indigenous communities. Furthermore, inadequate understanding of the context and systems engaged in, primarily due to lack of comprehensive access (distance), the availability of easy access to data increased the difficulty in conducting research in these communities.

In conclusion, the teliabetes service seems to have provided Indigenous diabetes clients living in distant areas of Queensland a relatively easy option of accessing specialist care, rather than travelling to a city-based hospital or waiting for an outreach program. Early uptake among clients, though there is room for improvement, seems encouraging.

7.7 Key findings

- Availability of other options for care (e.g. regular outreach program) in a remote community reduces telehealth usage (as was the case in Cunnamulla) and limits early uptake.
- Telehealth provides an easier option of care than making clients travel (often on their own) to a metropolitan centre. This has led to several clients, who had not previously met an endocrinologist, accessing appropriate care.
- Telehealth has given remote clients the opportunity to receive routine specialist endocrine care without leaving their own community.
- A clinical audit (or a long-term evaluation) is required to assess whether the service is able to improve outcomes in the long term.

Chapter 8: Comparing HbA1c results pre- and post-implementation of the telediabetes service

8.1 Overview

This chapter evaluates the short-term outcomes of the telediabetes service. HbA1c levels of clients and diabetes-related admissions to local hospitals and emergency units (in Cunnamulla and Charleville) were evaluated pre- and post-telehealth.

8.2 Aim

The study aimed to investigate the effects of telediabetes service on client HbA1c levels, admissions to local hospitals and emergency units for diabetes-related conditions.

8.3 Methods

Ethical clearance

Ethical clearance for the study was obtained from the University of Queensland ethical clearance committee (2015001105, and amendments 1 and 2). Queensland Health and Public Health Act (PHA) approvals were also obtained from the relevant (ethics) departments.

Pre-post intervention study design

The study is a descriptive study with data evaluated in a pre-post manner. The establishment and use of the telehealth service was defined as the intervention. Retrospective data from the pre-intervention and post-intervention periods were evaluated using descriptive statistics (proportions).

HbA1c assessment

HbA1c levels of clients from Cunnamulla and Charleville AMSs were assessed, pre- and post-intervention.

Emergency department admissions assessment

Admissions to emergency departments in Cunnamulla and Charleville hospitals for diabetes-related conditions were assessed.

Hospital admissions assessment

Admissions to the Cunnamulla and Charleville hospitals for diabetes-related conditions were assessed, pre- and post-intervention.

These admission-assessment studies were designed to assess whether the new telehealth service had any impact on the admissions to the local hospital (for in-ward care) and emergency department regards to the client-community living with diabetes.

The research questions are described in Chapter 4 above.

8.4 Methods

HbA1c level measurement (Pre- and post-design)

HbA1c level of the general diabetes client population in Cunnamulla

From 2012 to June 2016, a GP (with Indigenous origins) provided monthly outreach services to Cunnamulla. The clinician, with a team of three to five health professionals (e.g. clinical nurses, dietician, etc.) travelled to Cunnamulla AMS on a chartered flight sponsored by the CHECKUP fund (of the Queensland Government). The clinical team spent two days at a time in the community conducting a general practice clinic. Anonymised HbA1c levels of diabetes clients measured from January 2015 to June 2016 were obtained from the GP's office. HbA1c measurements were descriptively assessed. Although some of these diabetes clients may have had a videoconsultation, there was no way to verify this fact. This evaluation was useful to gauge the average HbA1c level of the diabetes client-community in Cunnamulla.

Client-matched HbA1c level assessment

Clients who had received at least one videoconsultation from the new service were selected. HbA1c levels of these clients were collected for the pre- and post-telehealth period.

Data collection

The study assessed the HbA1c levels of clients who had at least one videoconsultation for diabetes. HbA1c levels of clients from Cunnamulla and Charleville AMSs were obtained with the assistance of the local health workers, who coordinated the telehealth service. Three (anonymised) HbA1c measurements, two years prior to, and two years post-intervention were obtained. Clients with at least one videoconsultation were included in the study. If clients had more than one HbA1c measurement conducted within a short period, average values (mean) were extracted for the study (to include three measurements pre and post).

If three readings from one client could not be retrieved, the last observation carried forward (or backward) method (LOCF) was used to complete the dataset. The age and gender of clients were not considered. Data were analysed using simple descriptive statistics. A 0.5-unit reduction of HbA1c was considered a clinically significant improvement. The highest and the average HbA1c values pre- and post-intervention were used for the analysis. The study uses mean values for interpretation. ‘Median value’ is a better index of central tendency for small sample sizes. However, use of median measurements was not possible in this study due to the way data was extracted (mean value of multiple measurements extracted). Furthermore, some clients only had two readings (median cannot be calculated – use of LOCF method).

Evaluation of emergency unit admissions (pre- and post-design)

This part of the study evaluates diabetes-related admissions to Cunnamulla and Charleville emergency departments. Clients admitted to the emergency department were discharged either to the local hospital for further care, or home, to be managed later as an outpatient.

Data extraction

The emergency department data were stored centrally at the Queensland Health statistics unit. All admissions for diabetes-related International Classification of Disease (ICD) codes were extracted for the 2 years pre- (from May 2013 to April 2015) and post- (May 2015 to April 2017) telehealth. A separate extract for each hospital, stratified by year, ICD code and age group was retrieved. The study population consisted of adult (> 18 years) Indigenous (Aboriginal or Torres Strait Islander) clients. Retrieved data were analysed descriptively.

Potentially preventable admissions for the emergency departments were not made available by the data custodian, as client numbers were too small (potential to identify clients). The study assumed that clients would use the local emergency department if a need arose. However, both communities are remote areas in Western Queensland, and most likely clients would have no other option.

Evaluation of hospital admissions (Pre- and post-design)

This part of the study evaluates pre- and post-telehealth admissions to local hospitals of Cunnamulla and Charleville.

Data collection

The number of distinct Indigenous client admissions aged 18 years and over with a diagnosis of diabetes mellitus (or related conditions) was obtained from the Statistics and Data Governance Branch Department of Health, Queensland Government. Data for Charleville and Cunnamulla hospitals from January 2013 to April 2017 were obtained. As client numbers were low (increased chance of identifying clients), data for both institutions were combined prior to release. Furthermore, as data had been extracted from both hospitals as a combined dataset, there was no way to exactly match either to the relevant institution or to the initiation of the telehealth service. Hence, the pre-telehealth portion of the data was assumed to be from 2013 to the end of 2015, and the post-telehealth portion from January 2016 to April 2017. However, in the analysis, the number of admissions per 12-month period was calculated for both durations. Furthermore, a second analysis excluding the overlap year (2015) was carried out using averaged admissions. Descriptive methods were used in reporting findings.

Data extraction items

Diabetes and related conditions were requested to be extracted as per the ICD-10 manual (principal or additional codes). These codes included:

- E16.2 – Hypoglycaemia unspecified
- R73 – Elevated blood glucose level (hyperglycaemia, unspecified)
- E10-E14 – Diabetes mellitus total (below codes are a subset of E10–E14)
- E10.1 – Type 1 diabetes mellitus with acidosis

- E10.9 – Type 1 diabetes mellitus without complication
- E 11.5 – Type 2 diabetes mellitus with circulatory complication
- PPH diabetes – Potentially preventable hospitalisations for diabetes complications (excluding renal dialysis). These are a subset of total diabetes (E10–E14) clients.

8.5 Results

Pre- and Post-HbA1c level assessment

Cunnamulla -

HbA1c level of the general diabetes client population in Cunnamulla

There were 73 measurements of HbA1c made by the visiting general practitioner (and team) for diabetes clients during the period. The mean HbA1c of these measurements was 8.8 units with a standard deviation of 0.48 units. The median and mode HbA1c values of the tested clients were 8 and 7 units, respectively.

Client-matched HbA1c level in Cunnamulla

Nine diabetes clients who had received at least one videoconsultation using the new telehealth service at Cunnamulla AMS were included in the study (see Table 17). These clients were identified either as Indigenous or Indigenous status unknown. In Cunnamulla, a regular outreach service by an endocrinologist was also available with the telehealth service during this period.

Table 17: HbA1c summary levels of clients (pre-post telehealth) in *Cunnamulla* (n=9)

<i>HbA1c Measurement</i>	<i>Pre-telehealth</i>	<i>Post-telehealth</i>
Mean	8.9	8.6
Standard error	0.35	0.40
Median	8.9	8
Mode	7.8	8.8
Standard deviation	1.84	2.1
Minimum	5.9	6.2
Maximum	14	14
Sum	240.9	233.4
Count	27	27

*Analysis of highest recorded HbA1c value, pre- and post-telehealth in **Cunnamulla***

Of the nine clients, six (66%) had a reduction in HbA1c values (see Table 18). The highest recorded value method indicates the worst-case scenario (for HbA1c) in diabetes care.

Table 18: Analysis of highest recorded value (n=9), pre- and post-telehealth in *Cunnamulla* (HbA1c)

Client	Pre-telehealth	Post-telehealth	Reduction (+) or increase (-)	Reduction in HbA1c
1	9.5	7.4	2.1	yes
2	11.3	9.2	2.1	yes
3	11.6	14	-2.4	no
4	14	10.4	3.6	yes
5	6.5	7.5	-1	no
6	9.6	7.4	2.2	yes
7	9.7	13.2	-3.5	no
8	9.2	8.5	0.7	yes
9	9.7	8	1.7	yes

*Analysis of average of recorded values, pre- and post-telehealth in **Cunnamulla***

Average HbA1c values of the nine clients for the pre- and post-telehealth period are presented in Table 19 and Figure 13. The number of clients with improved HbA1c levels was similar to the number found using the highest value analysis method (six out of nine).

Table 19: Analysis of average of recorded values (n=9), pre- and post-telehealth in *Cunnamulla* (HbA1c)

Client	Pre-telehealth	Post-telehealth	Reduction (+) or increase (-)	Reduction of HbA1c
1	9.2	7.1	2.0	yes
2	9.7	8.9	0.8	yes
3	9.9	11.5	-1.6	no
4	11.3	9.3	1.9	yes
5	6.2	7.0	-0.8	no
6	8.1	6.8	1.3	yes
7	8.5	12.0	-3.5	no
8	8.3	7.7	0.6	yes
9	9.2	7.4	1.8	yes

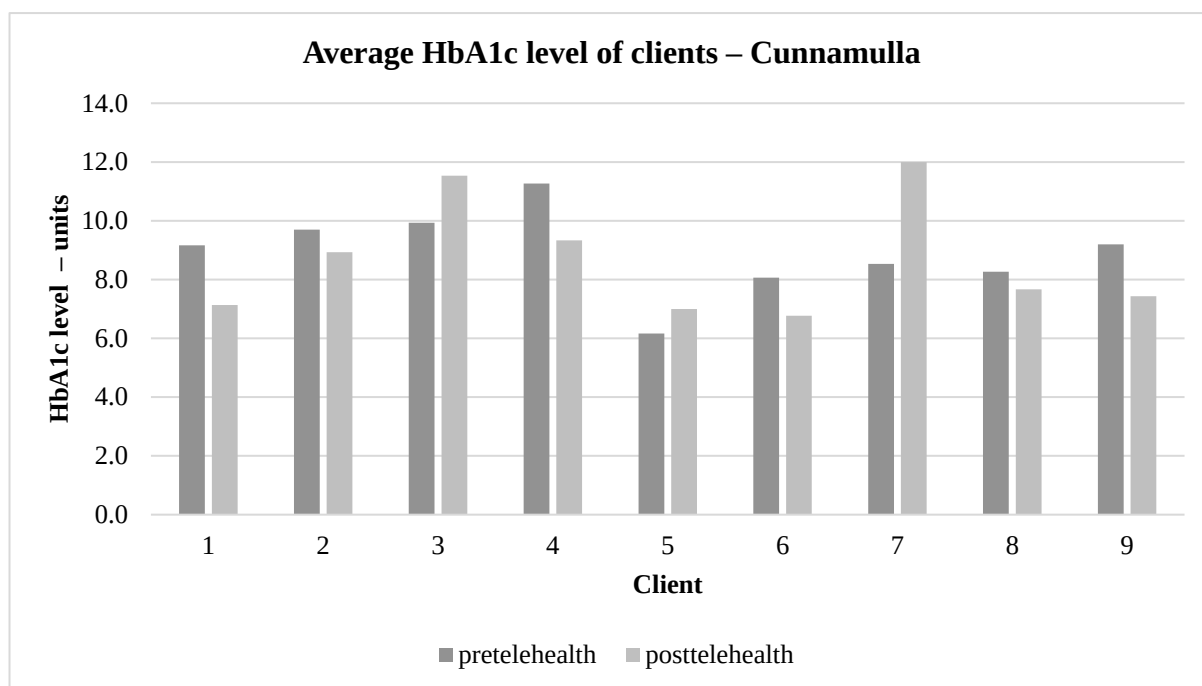


Figure 13: Average HbA1c levels of clients; pre- and post-telehealth in *Cunnamulla*

*Analysis of the ‘date of investigation’ for HbA1c records in **Cunnamulla***

An analysis of when investigations were conducted showed HbA1c levels from the first quarter (January–March) to have a higher mean. The reason for this could be that clients were not strict in the management of their diabetes during the preceding holiday and festive period. However, further investigation is required to ascertain this fact conclusively. Many of the pre-telehealth period readings were from the first quarter of the year – a possible reason for the higher mean HbA1c level for the pre-telehealth period (see Table 20). A similar analysis could not be conducted for Charleville as there was a high number of missing values ($n = 12$; 16%) in the dataset.

Table 20: Analysis of the date of the investigation for HbA1c level in Cunnamulla

	Pre-telehealth				Post-telehealth			
Quarter	Jan– Mar	Apr –Jun	Jul– Sep	Oct– Dec	Jan– Mar	Apr– Jun	Jul– Sep	Oct– Dec
Number of readings in each quarter	11	3	6	6	6	6	12	3
Mean HbA1c level	9.2	7.7	8	8.2	8.2	8.3	9.2	8.1

Charleville –

Client-matched HbA1c level in Charleville

Twelve diabetes clients who had received at least one videoconsultation using the telehealth service at the Charleville AMS were included in the study (see Table 21). The data was collected using the same method as in Cunnamulla.

Table 21: HbA1c summary levels for twelve clients (pre- and post-telehealth) in Charleville

<i>Measurement</i>	<i>Pre-telehealth</i>	<i>Post-telehealth</i>
Mean	8.0	8.1
Standard error	0.2	0.3
Median	7.7	7.8
Mode	7.6	7.8
Standard deviation	1.3	1.7
Minimum	6.2	6.3
Maximum	11.2	11.8
Sum	289.0	292.3
Count	36	36

The mean HbA1c level in Charleville was higher in the post-intervention phase. Furthermore, the median and the mode were also higher in the post-intervention period. As 12 (16%) HbA1c measurements were unavailable, the LOCF method was used to complete them.

*Analysis of highest recorded value, pre- and post-telehealth in **Charleville***

Of the 12 clients, only five (43%) had a reduction in HbA1c values (see Table 22). However, three clients (25%) had an overall reduction of > 0.5 units (two of which had stable HbA1c levels – change < 0.5 units HbA1c).

Table 22: Analysis of highest recorded value, pre- and post-telehealth in Charleville (n=12)

Client	Pre-telehealth	Post-telehealth	Reduction (+) or increase (-)	Reduction in HbA1c level
1	11.2	10.9	0.3	yes
2	7.9	7.5	0.4	yes
3	8.7	7.8	0.9	yes
4	7.9	6.5	1.4	yes
5	8.1	8.4	-0.3	no
6	7.5	8.2	-0.7	no
7	6.3	6.6	-0.3	no
8	9.3	10.8	-1.5	no
9	9.8	11.2	-1.4	no
10	7.8	6.7	1.1	yes
11	6.9	7.4	-0.5	no
12	10.5	11.8	-1.3	no

*Analysis of average of recorded values, pre- and post-telehealth in **Charleville***

Average HbA1c values of twelve included clients are shown in Table 23. Five clients (43%) had a reduction in HbA1c when using average levels (four of which had stable HbA1c levels – change < 0.5 units HbA1c).

Table 23: Analysis of average of recorded values pre- and post-telehealth in *Charleville* (n=12)

Client	Pre-telehealth	Post-telehealth	Reduction (+) or increase (-)	>0.5 reduction
1	9.8	10.2	-0.4	no
2	7.8	7.5	0.3	yes
3	7.9	7.8	0.1	yes
4	7.7	6.5	1.2	yes
5	7.8	7.8	0.0	no
6	7.4	8.0	-0.6	no
7	6.3	6.5	-0.2	no
8	8.9	9.7	-0.8	no
9	9.0	8.6	0.4	yes
10	6.9	6.5	0.4	yes
11	6.9	7.2	-0.3	no
12	9.9	11.1	-1.2	no

Pre- and post-emergency department admissions

The emergency department information system only became operational in Cunnamulla and Charleville in November 2013. As client numbers were small, data were extracted after grouping (reduces the probability of identifying clients). Therefore, the requested and reported (in Tables 24 and 25) ICD codes are dissimilar. Data has been grouped for November 2013 to December 2015 (pre-telehealth) and from January 2016 to April 2017 (post-telehealth). Data for Cunnamulla - Table 24, and Charleville - Table 25 are presented below.

Table 24: Emergency department admissions at *Cunnamulla* local hospital

	18–30 years		31–40 years		41–50 years		51–60 years		61 years and above		Total	
Disease category (according to ICD -10)	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Diabetes stabilisation (insulin-dependent)	1	1			1			1			2	2
Diabetes ketoacidosis (insulin-dependent)	1	1			1						2	1
Diabetes ketoacidosis (non- insulin-dependent)												
Hypoglycaemia												
Hyperglycaemia	2				3	5			1		6	5
Diabetic complication	1				1						2	
Total	5	2			6	5		1	1		12	8

*Pre = Pre-telehealth (November 2013 to December 2015); Post = Post-telehealth (January 2016 to May 2017)

Table 25: Emergency department admissions at *Charleville* local hospital

	18–30 years		31–40 years		41–50 years		51–60 years		61 years and above		Total	
Disease category (according to ICD-10)	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Diabetes stabilisation (insulin-dependent)	1	2				1			1		2	3
Diabetes ketoacidosis (insulin-dependent)	6	2									6	2
Diabetes ketoacidosis (non-insulin-dependent)									1		1	
Hypoglycaemia	2	2					2	3		3	4	5
Hyperglycaemia	2	4		1			1	1			3	9
Diabetic complication		2										2
Total	11	12		1		1	3	4	2	3	16	21

*Pre = Pre-telehealth (November 2013 to December 2015); Post = Post-telehealth (January 2016 to May 2017)

Cunnamulla

There were seven individual Aboriginal (non-Torres Strait Islander) clients accounting for 12 admissions during the pre-telehealth period. Post-telehealth, there were eight admissions for eight clients. There was no difference in glycaemic-related events (hypoglycaemia or hyperglycaemia) during the two periods (Table 24).

Charleville

There were 16 admissions of Aboriginal (non-Torres Strait Islander) clients during the pre-telehealth period (four individuals in all). Two of the clients aged between 21 and 29 years were admitted for either hyperglycaemia, hypoglycaemia or diabetes ketoacidosis episodes. In the post-telehealth period, there were 21 Aboriginal (non-Torres Strait Islander) admissions for 10 clients. One client was admitted 10 times during the period for either hyperglycaemia, hypoglycaemia or diabetes ketoacidosis (Table 25). There was a reduction in Insulin dependent client admission numbers in the post-telehealth period (though numbers are small).

Pre- and post-admissions to local hospital

Data were obtained from the Queensland Health statistics unit in July 2017 for the period from 2013 to April 2017 for (inward) hospital admissions for diabetes-related conditions. Table 26 presents the pre- and post-telehealth data according to age group and disease category (ICD). Admissions for the 18–39-year age group were mostly related to type 1 diabetes, while those in the older age groups (> 40 years) were generally related to diabetes type 2. Out of all admissions, nearly one third of cases were potentially preventable (Table 27). Due to the potential risk of client identity being exposed, data were grouped for both Cunnamulla and Charleville (on release).

Several clients who were reviewed by the specialist (via telehealth) required hospital admissions for further care. It is likely many of the Indigenous clients who had a teleconsultation, also accessed the local hospital for optimisation of diabetes care (referred by the specialist) or for review of another morbidity. Furthermore, Indigenous clients were able to access the local general practitioners at the local hospital, outside the usual working hours of the Indigenous medical service.

Table 26: Review of admissions to *Cunnamulla* and *Charleville* hospitals for diabetes-related conditions

Age group (years)	Type 1 diabetes with acidosis		Type 1 diabetes without complications		Type 2 diabetes without complications		Potentially preventable hospitalisations for diabetes		All admissions for diabetes-related conditions	
	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>
18–39	5	3	2	2	6	4	10	6	21	13
40–59			1		37	25	18	10	54	33
60+					30	23	10	14	38	36
Total	5	3	3	2	73	52	38	30	113	82

Analysis of potentially preventable hospitalisations

After removing data pertaining to 2015 (as data for 2015 was overlapping for both pre- and post-telehealth datasets), the totals of the potentially preventable hospitalisations (PPH) and all diabetes-related hospitalisations were converted to annual averages by considering the duration observed. Hence, the pre-telehealth values were corrected by ($\times 12/24$) and the post-telehealth values by ($\times 12/16$). The comparison (in Table 27) shows that in the post-intervention period, relevant admissions to local hospitals increased exponentially, by 320% (up to three times) – for the over 60 years age group.

Table 27: Analysis of averaged pre- and post-telehealth data for potentially preventable hospitalisations (PPH) and total admissions (2015 data removed)

<i>Age groups (years)</i>	<i>PPH – pre</i>	<i>PPH – post</i>	<i>PPH # increase</i>	<i>PPH % increase</i>	<i>All diabetes – pre</i>	<i>All diabetes – post</i>	<i>All diabetes # increase</i>	<i>All diabetes % increase</i>
18–39	3.00	4.50	1.50	50	8.00	9.75	1.75	22
40–59	5.00	7.50	2.50	50	17.50	24.75	7.25	41
60+	2.50	10.50	8.00	320	13.00	27.00	14.00	108

- All values are annualised averages per age group

8.6 Discussion

This study found that mean HbA1c levels in the post-telehealth period increased in Charleville (by 0.1 units) and had decreased in Cunnamulla (0.3 units). However, the evaluation of emergency department admissions was inconclusive. Emergency department admissions in Charleville had increased in the post-telehealth period, even over the shorter duration of observation (reduced in Cunnamulla). Hospital admissions in the post-telehealth period had increased in both sites. These findings were contrary to the expectation that the specialist service would eventuate in lower presentations to emergency departments or hospital admission events (discussed below).

HbA1c level assessment

In Cunnamulla the mean HbA1c level had decreased. However, several ‘high’ readings were recorded for the pre-telehealth period, especially from the first quarter. The high average HbA1c level in the first quarter of the year may be related to consumption behaviours in the preceding holiday period. The mean HbA1c level in Charleville increased in the post-telehealth period. The low initial HbA1c level may be the reason for this.

Measurement of HbA1c is a widely used measure for diabetes monitoring when telehealth interventions are used among Indigenous clients ²¹¹. Furthermore, telehealth interventions among non-Indigenous communities show considerable improvement in HbA1c levels ¹⁴¹ when used over a long period. A recent (non-telehealth) study conducted in a remote community in the Northern Territory by Arnold *et al.* found the HbA1c levels of Indigenous clients with diabetes to be around 6.6–9.8 units ²¹². The Cunnamulla and Charleville communities also recorded similar ranges. There are no Australian studies presently available to compare HbA1c levels when telehealth is used for Indigenous clients with diabetes.

Emergency admissions

The analysis of emergency unit admissions was inconclusive (probably as a result of small client numbers and the short evaluation period). In Cunnamulla, the number of admissions in the post-telehealth period decreased. With the new telehealth service, it is expected that emergency presentations will decrease as clients are optimally managed. In Charleville,

emergency admissions for hyperglycaemic and total events increased in the post-telehealth period. However, there was one client who was admitted repeatedly (10 times). However, this analysis did not match clients with their previous experience of videoconsultations.

One reason for the absence of a reduction in admission numbers (Charleville) in the post-telehealth period could be due to the repeat admissions of a single client (repeat measures). The most prevalent diagnosis for admissions in both communities was hypo- or hyperglycaemia. Previous evidence from similar interventions in setting up of a new telehealth services found no difference ²¹³ or small reductions ²¹⁴ in emergency-related admissions.

The study durations for pre- and post-telehealth were not equal (due to how the data was extracted) and client numbers were too low for any further analysis. A much longer-term analysis is needed to ascertain whether the telehealth service has had a lasting impact on how clients are managed. Furthermore, a matched analysis, where clients who have accessed the telehealth service are filtered, would also be ideal.

Hospital admissions

Potentially preventable hospitalisations (PPH) and total diabetes-related admissions increased in the post-telehealth period (when annualised averages are evaluated – Table 27). Type 2 diabetes clients from the older age groups were the predominant admission type and showed the highest increase in number. The reason for the high rates, post-telehealth is probably a result of the endocrinologist admitting clients for further care (optimising) or clients self-admitting as they understood more about the disease with increased education. The GPs who worked at the AMSs were also on call at the local hospital. It could also be that consultations with the GPs at the hospital premises were considered as admissions to the hospitals for record purposes. The difference in the ICD codes (9 and 10) may also have affected record classification; however, when overall diabetes admissions were considered for coding purposes, there would be no effect on totals. The main limitation of this study was that results were combined when released, hence no further analysis was possible. Furthermore, the short time duration was inadequate to come to robust conclusions. Another significant limitation in the analysis was the low patient numbers; however, this is unavoidable for a small distant community.

Overall impression of outcomes

This short-term evaluation showed that there was no significant clinical improvement among diabetes clients in the two communities. During this time, other clinical specialities were delivered via the telehealth service to the community; hence, cost savings would have been achieved via reduced patient travel for overall health access needs. With the services for diabetes education being available on demand through the telehealth service (as a diabetes educator was available at the central service at short notice), it is likely that clients and local staff were able to increase their knowledge about the disease. However, it may take some time for the improved knowledge to translate into tangible clinical and process improvements. Increased admission numbers to the local hospital and emergency departments (after telehealth) may also have resulted due to the increased knowledge and awareness. A long-term analysis (10-15 years, outside the scope of this study) may show that these admission numbers reduce over time as the clients (and their treatment) becomes optimised; however, with the Indigenous community ageing, higher admissions could be a result of increasingly difficult-to-manage diabetes-related conditions and may be entirely appropriate based on clinical indication.

Strengths and limitations

There is no published evidence to date on how telehealth interventions affect remotely living Indigenous clients with diabetes. Client numbers used in this study are small; hence, interpreting findings could lead to inaccurate conclusions. Furthermore, the two Indigenous populations selected for this study are small; hence, similar studies will always have to contend with this limitation (low patient numbers). The study collected data from all possible data sources and incorporated most clients who accessed the telehealth service. The low patient numbers prevented the use of more robust statistical methods and descriptive methods had to be used to describe findings. Furthermore, the extracted data were for all clients admitted to the hospital and emergency departments (not only for clients who have had a teleconsultation). It was not possible to match clients who accessed teleconsultations at the AMSs to admissions at the local hospital.

Another limitation is that the study refers to admissions of clients to local health facilities in the analysis. However, the diagnosis for recording purposes (at health institutions) is generally made at discharge. For the purpose of this study, the terms ‘admission’ and ‘discharge’ have

been assumed to be referring to a similar event (assuming that each admission results in discharge).

8.7 Conclusion

This study finds that telehealth, at least in the short term, does not provide significant clinical improvements (as per HbA1c assessment) for Indigenous clients living with diabetes. While telehealth provided an easy and readily available method for clients to meet an endocrinologist, they (and staff) could also easily access clinicians from other clinical specialities on demand. Importantly, this analysis was conducted within the first two years of the establishment of the service. This time period is inadequate to confidently ascertain whether telehealth is useful or not for these two Indigenous communities.

8.8 Key findings

- Due to the short timeframes, it was not possible to detect any meaningful clinical changes in HbA1c levels for Indigenous clients.
- Clients accessed the local hospital and emergency departments more often after the telehealth service was set up. The reason for this is inconclusive and may, in fact, be due to the analysis of small sample numbers over a short duration.
- HbA1c levels of Indigenous clients were higher when following a holiday period. It would be appropriate to schedule an education program (and clinic), to get clients back on track again.

Chapter 9: A cost-minimisation analysis of the telediabetes service in Cunnamulla

9.1 Overview

This chapter details an analysis of the costs of providing endocrine videoconsultations to the Cunnamulla Indigenous community. The economic analysis was undertaken from the perspective of the health service provider. Firstly, the costs of telehealth and outreach consultations to Cunnamulla were compared (part 1). Secondly, three hypothetical telehealth-supported outreach configurations were compared with an outreach-only option for Cunnamulla (part 2).

9.2 Aim

The study aimed to compare costs of different methods of providing specialist diabetes videoconsultation services to clients in an Indigenous community (Cunnamulla).

9.3 Methods

Research design considerations

Cost minimisation analysis is a method used to calculate the least expensive option of similar outcomes (assuming equal benefits of the alternative methods) ¹¹⁷. Though application of this methodology may seem simple when compared to cost-benefit or cost-utility analysis studies, an accurate assessment of the similarity between the alternative methods is usually difficult ²¹⁵. During this study, the telehealth service provided Indigenous clients' access to an endocrinologist via videoconsultations. Other available methods for an Indigenous client (living with diabetes) to meet a similar specialist would be to either await an outreach program to the community or to travel to a metropolitan hospital. In analysing costs, it is assumed that either of these methods would allow meeting with a specialist and will result in similar end results, i.e. the specialists would manage clients similarly.

During this study, the assessment of costs (direct and indirect) was conducted as accurately as possible, as records were available for all (or most) costs considered for either option measured. Therefore, this cost evaluation study (through cost-minimisation principles) would most likely

provide accurate cost estimations for the options considered. In study planning, some of the other methodologies considered were either cost-benefit or cost-utility analysis. However, the short duration of the study (only 2 years) meant that a clear benefit (clinical improvement – benefit) or change in quality of life measures could not be assessed ²¹⁵. Furthermore, other authors too have utilised cost-minimisation analysis successfully in analysing costs of telehealth and other competing programs of health service assessments in previous publications ^{116, 216}.

The reason for selecting Cunnamulla for this study was that it had simultaneous telehealth and outreach services, delivered by the Endocrinology department at the Princess Alexandra Hospital (same team), during the period of assessment. This meant that comparative cost evaluations were possible and cost modelling could be conducted for simulated workload configurations, according to each service model. (Another site such as Charleville was not suitable to be included as clients only had the option of access to telehealth.)

Part 1

Methods - Costs of telehealth and outreach consultations to Cunnamulla

Cost-minimisation analysis

The variable and fixed costs per consultation for telehealth and outreach travel for the communities were calculated using cost-minimisation analysis (CMA) principles. It was assumed that the outcomes for meeting an endocrinologist (for diabetes), using either telehealth or in-person consultations, would be similar. Costs were calculated for a 12-month period (May 2015 to April 2016). All costs are assumed to be in 2017 Australian Dollars (\$AUD).

Service activity

Service activity data were retrieved from the PAH scheduling database for telehealth services (described above in Chapter 7). The duration of data extraction was from May 2015 to April 2016. Clients from the community includes Aboriginal not Torres Strait Islander, Aboriginal and Torres Strait Islander, and Indigenous status unknown client groups.

Costs of telehealth and outreach service models

During the study period, Indigenous diabetes clients from Cunnamulla had a regular outreach program delivered by the Diabetes and Endocrinology Department (endocrinology department), Princess Alexandra Hospital (PAH), Brisbane. Clients could also access an endocrine appointment via telehealth. Costs of the outreach service and the telehealth service (from the perspective of the public health service) have been compared below.

Calculation of attributable percentages of costs at Cunnamulla

Equipment costs of telehealth were weighted according to the time they were monopolised by the endocrinology telehealth services at each AMS. Videoconferencing equipment, computer system, printer (used for printing client records emailed or faxed from the remote site) and internet connection costs at the central facility and equipment costs at remote AMSs were all weighted at 10% (given usage by other services at the local AMSs). Since the telehealth equipment was used for one day per month for the endocrine clinic, a 5% ($\frac{1}{20}$) cost attribution was considered appropriate.

Fixed costs

Fixed costs of telehealth

The historical costs for establishing the central clinic facility were excluded from this analysis. Building infrastructure at the PAH (e.g. consultation rooms at the central facility) were already in place at the PAH and is, therefore, assumed sunk cost and so excluded. All other fixed costs (videoconferencing equipment, camera, etc.) were depreciated evenly over a five-year period, assuming the value of the item to be zero at the end of the five-year period. Ongoing costs associated with maintenance of computers, software updates, and printing material were excluded from the analysis. All cost data were obtained from the PAH and the AMS in Cunnamulla. The effect of any idle time (e.g. cancelled appointments or ‘did not attends’) during consultations were excluded in the calculations. The reason for this is that these instances were minimal (as most appointments were rescheduled) – reducing the impact on the service.

Fixed salary costs

The telehealth service employed a diabetes educator (DE) and an administrative staff member at 0.4 full-time equivalent (FTE) and 0.5 FTE, respectively. Though client numbers were low, difficulties in scheduling (with the need to reschedule often), in retrieving previous digital or paper records and in connecting with clients, the process was time-consuming. Sessions with clients required extra time due to client factors, including the unfamiliarity of new clients with the telehealth process and pre-appointment and follow-up requirements (referrals, investigations, other). Therefore, fixed salary costs were weighted, based on activity levels, given that the staff provided services to several Indigenous endocrine clinics delivered from the PAH. Cunnamulla was estimated to account for 10% of the total workload.

It was assumed that the fixed costs (staff salary and telecommunication equipment) associated with the telehealth service would remain unchanged when service activity increased.

Variable costs

Variable costs of telehealth

Variable costs of the telehealth service included salary costs of the specialist endocrinologist, AMS staff member (supporting the client at the remote end), and the costs of the point-of-care tests. Salary costs for the specialist endocrinologist were obtained through publicly available pay scale indicators from Queensland Health ²¹⁷.

For costing purposes, the time required for a consultation with the specialist endocrinologist was assumed to be 30 minutes. The salary of the AMS staff member was also obtained from publicly accessible documents ²¹⁸. The time taken for preliminary case preparation at the remote end by an AMS staff member was also assumed to be 30 minutes.

A retrospective review of activity was conducted to determine the number of specialist diabetes consultations provided in Cunnamulla during a 12-month period, from May 2015 to April 2016. Since the total number of consultations was used in the cost calculations, the number of consultations accessed by individual clients was not retrieved.

Variable costs of outreach

Outreach visits were held every three months, with the endocrinologist travelling to the remote community via a chartered flight. For estimating costs, it was assumed that the flight was shared with a parallel cardiology team, as was the case for Cunnamulla. Outreach costs, therefore, only included travel, accommodation and salary costs for the endocrinologist. Accommodation was required for one night. Salary paid to the endocrinologist during an outreach visit was equivalent to 16 hours of pay.

Typically, 15-20 clients were seen during each outreach visit by the endocrinologist. For costing purposes, the time spent by the AMS staff member for each client was assumed to be 30 minutes. At the endocrinology department, an administrative officer spent 30 minutes per consultation in the documentation, managing bookings and billing. The diabetes educator did not attend the outreach visits; hence, salary costs for the diabetes educator were not included. Point-of-care tests carried out during the outreach clinics were costed.

All costs related to outreach activity and the number of consultations during the corresponding 12 months of outreach were obtained from the endocrinology department at the PAH. It was assumed that the same specialist endocrinologist provided services in both outreach and telehealth services.

There were no fixed costs associated with the outreach service.

Sensitivity analysis

A sensitivity analysis was conducted to determine the change in threshold point if costs were to change. Calculations assumed a 10% change (increase or decrease) in costs. Costs were ranked according to sensitivity. As historical costs associated with equipment at the telehealth centre in Brisbane were considered already spent in full, ongoing financing fees (e.g. interest on loan) were not accounted for.

Part 2

Methods – Telehealth-supported outreach configurations for Cunnamulla

Cost analysis

A cost model was developed for Cunnamulla to assess changes to total costs and threshold points, correlated to possible changes in the proportion of telehealth and outreach services (for the telehealth-supported hypothetical configurations). Three telehealth-supported outreach services with increasing proportions of telehealth were tested.

Simulated configurations

The simulated configurations included 25%, 50% and 75% telehealth usage, with the remainder of consultations being provided by outreach. Currently, 19% of consultations (number of telehealth consultations (n=14) as a percentage of the total - telehealth and outreach (n=60)) are provided by telehealth, with the remainder distributed amongst four outreach clinics, spread throughout the year. The study assumed that the reduction of one outreach activity would increase telehealth usage to 25% from the current utilisation, with the rest of the annual requirement provided by outreach. Each subsequent reduction of outreach activity would escalate telehealth workload by a further 25%. The costing model estimated costs from the perspective of the health service provider. A sensitivity analysis was conducted to determine the change in threshold point if unit costs of staff salary were to change by 10%.

9.4 Results

Part 1

Results - Costs of telehealth and outreach consultations to Cunnamulla

Service activity

During the 12-month study period, a total of 74 specialist endocrinology consultations were undertaken in Cunnamulla. Most of these consultations (n=60) were delivered during outreach clinics, with the remainder (n=14) accessed through the telehealth option.

Telehealth costs

The estimated total fixed costs of the telehealth service during the year were \$9,520, with most of the costs related to staff salaries (see Table 28). The total variable cost of providing the telehealth service (for the 14 consultations) was \$1,328, and the variable cost per consultation was \$95 (see Table 28).

Outreach costs

Based on the outreach services conducted during the 12-month period, the total estimated cost of the four outreach services was \$30,753. At a workload of 60 consultations, the variable cost per consultation of each outreach consultation was \$513 (see Table 28).

Table 28: Calculation of average and variable costs per consultation for telehealth and outreach services (\$AUD)

	Telehealth costs (n=14)	Outreach costs (n=60)	Calculations
Fixed costs			
Videoconferencing equipment at the central facility at PAH	\$200	-	Initial cost \$20,000; Depreciated equally over 5 years; Usage Cunnamulla AMS - 5%
Videoconferencing equipment at Cunnamulla AMS	\$300	-	Initial cost \$30,000; Depreciated equally over 5 years; Usage Cunnamulla AMS - 5%
Printer equipment costs at the central facility at PAH	\$10	-	Initial cost \$1,000; Depreciated equally over 5 years; Usage Cunnamulla AMS - 5%
Internet cost at the central facility at PAH	\$60	-	Fixed cost per annum \$1,200; Usage for Cunnamulla AMS - 5%
Computer facility at the central facility at PAH	\$50	-	Initial cost \$5,000; Depreciated equally over 5 years; Usage Cunnamulla AMS - 5%
Salary for the Endocrine Diabetes Educator at the central facility at PAH	\$5,200	-	Annual salary \$52,000; Attributable cost to Cunnamulla – 10%
Salary for the administrative staff member at the central facility at PAH	\$3,700	-	Annual salary \$37,000; Attributable cost to Cunnamulla – 10%
<i>Subtotal</i>	\$9,520	-	

Table 28 continued:

	Telehealth costs (n=14)	Outreach costs (n=60)	Calculations
Variable costs			
Endocrinologist's salary	\$721	\$6,592	Specialist salary \$103.00 per hour; 16 hours per visit, 4 outreach visits per year
AMS staff salary	\$187	\$801	AMS staff salary \$26.70 per hour; 30 minutes per consultation
Point-of-care tests (e.g. HbA1c, etc.)	\$420	\$1,800	Cost per consultation \$30
Chartered flight costs	-	\$20,000	Cost per chartered flight \$10,000; 50% attributed to diabetes outreach service; 4 outreach visits per year
Accommodation cost for endocrinologist during outreach	-	\$480	Cost per night \$120; 1 night per trip, 4 outreach visits per year
Administrative staff salary at the endocrinology department	-	\$1,080	Salary cost - \$36.00 per hour; 30 minutes per consultation
Subtotal	\$1,328	\$30,753	
Total cost	\$10,848	\$30,753	
Variable cost per consultation	\$95	\$513	
Average cost per consultation	\$775	\$513	

AMS – Aboriginal Medical Service; PAH – Princess Alexandra Hospital; - Not applicable

Cost projection – telehealth and outreach options

By using above findings (cost per consultation), cost projections for both options, assuming activity levels and costs increased linearly, were calculated (see Figure 14). When costs of telehealth and outreach-only options are considered, the threshold point is achieved at 23 consultations. This means that if outreach services to Cunnamulla were to be substituted with telehealth, savings would be realised (from using telehealth only) after 23 consultations are completed. However, if the demand for endocrine consultations in Cunnamulla were to reduce to below 23 per annum, using outreach services would be cheaper.

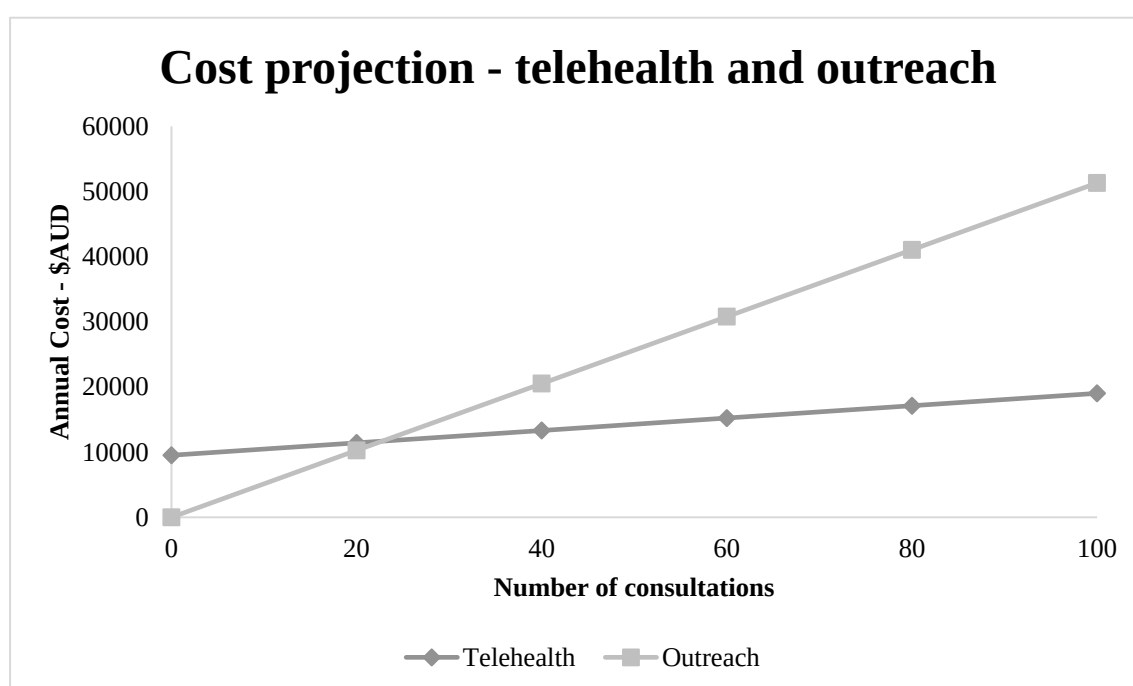


Figure 14: Cost projection – telehealth and outreach

Sensitivity analysis

A sensitivity analysis of 10% (increase and decrease) in costs was conducted and change threshold points were estimated. The fixed staff salary costs had the most significant effect on threshold points if a 10% change were to occur (see Table 29).

Table 29: Sensitivity of costs and the effect on threshold points

Fixed Costs - Telehealth	\$AUD	Threshold	10% increase (A)	10% decrease (B)	A-B	Rank
Equipment costs (total)	\$620	22.79	22.94	22.64	0.30	7
Staff salary (total)	\$8,900	22.79	24.92	20.66	4.26	1
Variable Costs - Telehealth						
Endocrinologist's salary	\$721	22.79	23.08	22.51	0.56	4
AMS staff salary	\$187	22.79	22.86	22.72	0.15	9
Point-of-care tests	\$420	22.79	22.96	22.63	0.33	5
Variable Costs - Outreach						
Endocrinologist's salary	\$6,592	22.79	22.21	23.41	-1.20	3
AMS staff salary	\$801	22.79	22.72	22.86	-0.15	9
Point-of-care tests	\$1,800	22.79	22.63	22.96	-0.33	6
Chartered flight costs	\$20,000	22.79	21.11	24.77	-3.66	2
Accommodation costs	\$480	22.79	22.75	22.84	-0.09	10
Admin. staff costs - Endocrine dept.	\$1,080	22.79	22.69	22.89	-0.20	8

Part 2

Results – Telehealth-supported outreach configurations for Cunnamulla

Costs of simulated configurations

Table 30 illustrates the total variable costs for each of the three telehealth-supported outreach simulations. The 75% telehealth-supported outreach model (75% telehealth, 25% outreach) had the lowest total variable cost of \$14,972. The estimates show that the higher the proportion of telehealth, the lower the total cost compared to the alternative outreach model (see Table 30).

Table 30: Total variable cost for each simulated model (n=74)

	Simulated model 1 25% telehealth / 75% outreach		Simulated model 2 50% telehealth / 50% outreach		Simulated model 3 75% telehealth / 25% outreach	
Number of consultations	19 telehealth	55 outreach	37 telehealth	37 outreach	55 telehealth	19 outreach
Variable cost per consultation	\$95	\$513	\$95	\$513	\$95	\$513
Total variable cost for each consultation type	\$1,805	\$28,215	\$3,515	\$18,981	\$5,225	\$9,747
Total variable cost	\$30,020		\$22,496		\$14,972	

Estimated variable cost per consultation

Table 31 illustrates the calculation of variable costs for each of the three telehealth-supported outreach simulations. The 75% telehealth-supported outreach model (75% telehealth / 25% outreach) had the lowest total variable cost per consultation (\$202).

Table 31: Estimated variable and average costs per consultation for the three simulated models

	Simulated model 1 25% telehealth / 75% outreach	Simulated model 2 50% telehealth / 50% outreach	Simulated model 3 75% telehealth / 25% outreach
Total fixed costs	\$9,520	\$9,520	\$9,520
Total variable costs	\$30,020	\$22,496	\$14,972
Total cost	\$39,540	\$32,016	\$24,492
Variable cost per consultation	\$406	\$304	\$202
<i>Average cost per consultation</i>	<i>\$534</i>	<i>\$433</i>	<i>\$331</i>

Threshold-point analysis

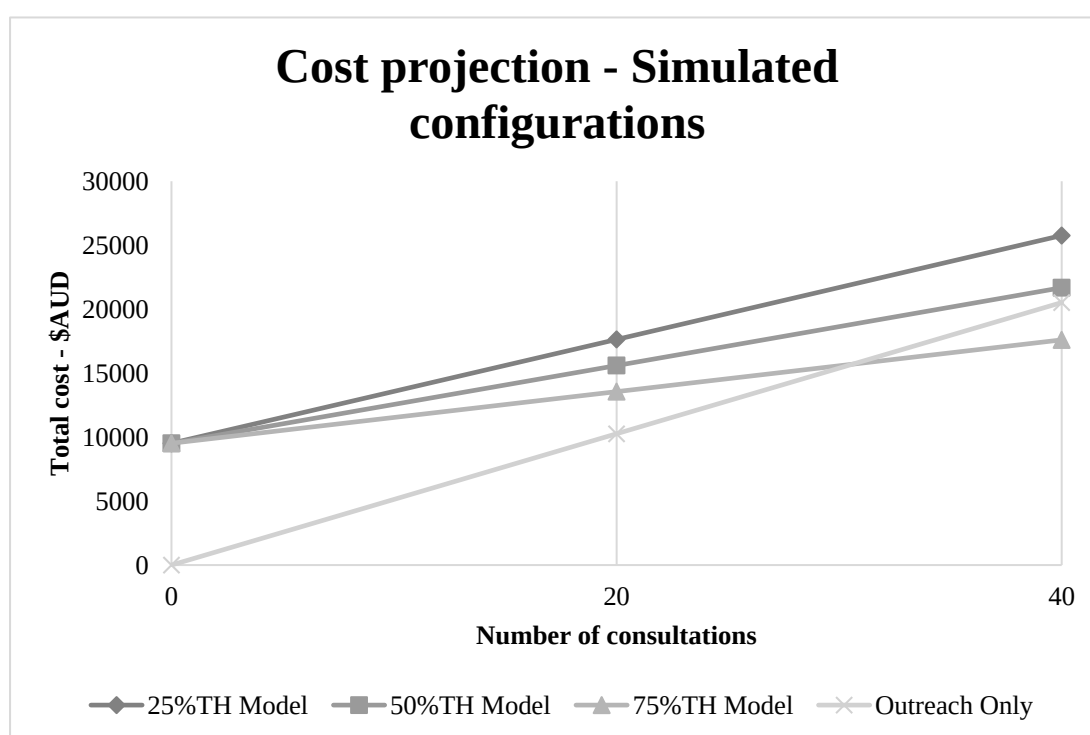
The threshold-points for the 50% telehealth model and the 75% telehealth model were 46 and 31 consultations, respectively, offsetting fixed costs of telehealth within the first year. The 25% telehealth model requires 89 consultations for break-even when compared with the outreach-only model (see Figure 15).

Sensitivity analysis

A one-way sensitivity of a potential 10% *increase* in fixed staff salaries shifts the threshold points to 33, 50 and 97 for the 25%, 50% and 75% telehealth models, respectively.

Cost projections for simulated configurations

Figure 15 shows the variability of costs as the level of activity (and associated workload) increases. According to this cost simulation, the vertical axis denotes the current level of activity (at 74 consultations) in Cunnamulla. The simulated costs for the 25% configuration intersect with the outreach-only cost simulation at 89 consultations - which is outside the annual requirement for Cunnamulla. The 75% model intersects with the outreach-only model at 31 consultations, denoting the lowest cost option for Cunnamulla.



(Note – 74 consultations denotes actual workload in Cunnamulla)

Figure 15: Projection of estimated total costs with increasing activity (\$AUD)

9.5 Discussion

The study compared the costs of different methods available for Indigenous clients to access specialist diabetes services from a distant community. Findings show the telehealth service to record the lowest variable cost per consultation (\$AUD 95) when compared to other options.

High fixed costs of telehealth

The comparably high cost per consultation of the telediabetes service (when fixed costs were considered) was due to the low number of videoconsultations reported during the first year of service and the high fixed staff salary costs required for service provision. The simulated cost model for Cunnamulla for all three hypothetical configurations shows average costs per consultation decreasing as the overall workload increases (as fixed costs are spread across a higher number of videoconsultations). Furthermore, outreach cost estimates have assumed that the cost of the chartered flight is shared with a parallel clinical team, these costs would increase if the endocrinologist had to travel independently (increasing the cost difference between telehealth and outreach methods).

The place of outreach services

Previous studies have shown that Indigenous clients prefer outreach services over telehealth, as it allows them to meet the clinician in person, especially if routinely available ²¹⁹. In-person care can help develop strong clinical relationships with Indigenous clients, which is critical in chronic care management ²²⁰. From findings in Chapter 5, it is evident that clients prefer not to travel to metropolitan hospitals for diabetes care. However, outreach programs find it difficult to attract specialists on a regular basis and risk abrupt termination of services due to human resource or financial constraints. Telehealth can improve continuity of care and access to specialist services when used in conjunction with an outreach program. Furthermore, telehealth-supported outreach services lead to increased utilisation of clinical services by Indigenous people ^{69, 93}. Increased satisfaction among Indigenous clients and their practitioners and reduction of barriers to uptake of health services are also notable benefits of telehealth ^{26, 143}.

Reducing telehealth costs

A probable solution to increase the efficiency of this telediabetes service is to provide services to multiple sites from the metropolitan centre, ensuring optimal resource use. In time, technology, such as web-based real-time communication (WebRTC), will improve access to videoconsultations in remote sites without the need for relatively expensive dedicated equipment ²²¹. However, for a similar community, only a limited reduction in per-consultation costs can be expected, as the principal cost source of each videoconsultation was the fixed staff salary costs. If costs of fixed staff salaries are borne by the central telehealth service, and if the service is able to access the Medicare Benefits Scheme (MBS) for reimbursements ²²², remote Indigenous sites have the opportunity to engage in telehealth-based care at a lower cost, compared to other methods. If remote sites can increase their uptake of telehealth services, this would result in savings related to travel reimbursements and accommodation. Ideally, the decision for an Indigenous community to set up a telehealth service should not be based on initial or ongoing costs, but on the unmet needs of the diabetes patient community.

Limitations

The study uses only a small sample of clients to extrapolate costs; hence, cost projections can shift if there is a significant change in workload. However, a major shift in client numbers in the short term is unlikely for a small remote community, such as Cunnamulla. Furthermore, interventions of this nature will always have to contend with small client numbers, as remote communities will not be able to increase service utilisation even over the long term. Though there are limitations to generalising findings due to setting-specific reasons, the fixed costs and the potential variable costs of telehealth are unlikely to change in a similar community if replicated. The analysis is also dependent on various assumptions associated with salary, travel and accommodation costs.

9.6 Conclusion

This study finds that, for the delivery of specialist diabetes services, telehealth was the least expensive option from the perspective of the health service, assuming fixed costs are already accounted for. This analysis demonstrates that, in Cunnamulla, an outreach model is less expensive than telehealth-supported services at low activity levels. These results will be

important when introducing telehealth as a substitute for specialist outreach services for similar remote communities.

9.7 Key findings

- Each telehealth consultation had a high fixed cost component and a low variable cost portion.
- If Cunnamulla is provided with both outreach and telehealth services for diabetes care in future, a higher proportion of telehealth usage (>50%) will reduce overall costs of providing specialist consultation services, especially compared to outreach services alone.
- Higher telehealth substitution for outreach services can reduce overall costs if used for a higher number of consultations per annum.

Chapter 10: Key findings, limitations and recommendations for future research.

10.1 Overview

This chapter presents a summary of all key findings associated with this research project. The findings provide an overview of the potential usefulness of telehealth services to Indigenous clients living with diabetes in remote regions.

This study is one of the earliest works describing the usefulness of telediabetes services to Indigenous people living in distant parts of Queensland. Although numerous others have already found telehealth a useful method in providing care for acute illnesses (oncology care, acute mental health needs etc.), this study identifies that Indigenous people are also willing to access health care over a long period using telehealth (for diabetes care). Furthermore, the cost analysis shows that telehealth is a relatively low-cost option to providing specialist consultations, compared to an outreach program. Other findings of the study (described in the chapters above) are briefly revisited below.

A brief synopsis of findings

The main *aim* of this study was to explore the (potential) usefulness of a telediabetes service for the Indigenous communities in distant regional areas in Queensland. A multi-method study (qualitative, quantitative and economic analysis) was conducted among Indigenous clients who utilised the service for diabetes care.

The qualitative evaluation of *clinicians* who often used telehealth to provide videoconsultations, also perceived that the service was well-received by Indigenous clients. The (nine) specialists interviewed concluded that they were able to achieve meaningful clinical management endpoints via the new service.

Perceptions about the new service, from the perspective of the *Indigenous clients* who utilised the service at least once, were also positive. They accepted the new service, were comfortable (especially when a local health worker was sitting in with them) and found that they were able to achieve meaningful clinical endpoints during the videoconsultations. However, there were several conditions that needed to be met for clients to be comfortable. These included

significant involvement of local health workers at all stages of the care process (scheduling, during the consultation, follow-up), occasional in-person consultations with the specialist, and the inclusion of the local GP in the consultation, if available.

Evaluation of *activity data* showed that when a secondary option to access an endocrinologist was available to a remote community, as was the case in Cunnamulla, uptake of the telehealth service was poor (and ‘did not attends’ were higher).

Though the service was able to achieve acceptability and satisfaction among the Indigenous clients, there was minimal improvement in client-matched HbA1c levels and hospital and emergency department admissions, during the first two years of the service.

The *economic* analysis (through cost-minimisation) showed telehealth or telehealth-supported outreach services were cheaper, especially at a high number of (simulated) teleconsultations, than an outreach-only model.

10.2 Discussion of findings

The overall aim of the study was to understand the potential usefulness of a telehealth service for Indigenous diabetes clients living in remote communities. Findings show that, although clients, local health workers and clinicians found the new telehealth service a useful addition, clinical parameters (HbA1c) and related hospital admissions had not improved. However, the cost evaluation showed significant savings using telehealth, especially if workloads were high.

Perceptions of diabetes specialists

The two endocrinologists who were interviewed for the study highlighted the usefulness of the telehealth service for the clients with diabetes from these Indigenous communities. The endocrine consultations (for diabetes) were heavily dependent on the availability of relevant investigations at the time of the consultation (evidence from clinician interviews) and the availability of GPs to conduct clinical examinations of the clients on the specialists’ behalf. When all these needs were met (at least partially), videoconsultations were able to deliver a comprehensive level of care for clients. The clinicians also found that, after some time had passed (especially during a long consultation), clients responded as if they were attending an

in-person consultation. The usefulness of videoconsultations and improved clinical outcomes by using telehealth-based services for Indigenous clients have been previously identified by other authors ⁷⁶. However, videoconferencing-based videoconsultations, similar to this intervention, have only been evaluated minimally (or not at all) for Australian Indigenous clients.

Perceptions of general practitioners

The interviews identified that local GPs utilised the new telehealth service for early referral of difficult-to-manage diabetes clients to the specialists. For local GPs, the availability of a monthly telehealth clinic meant that they could get a client reviewed by the specialist at short notice. During these consultations, clients too preferred the GP to sit in with them during a videoconsultation (supported better clinical decision-making). However, this was not always possible due to scheduling difficulties. Improved clinical outcomes are described in previous interventions for Indigenous people when GPs are closely involved in patient care within telehealth initiatives ²²³.

Indigenous clients

The study found that the Indigenous clients' acceptance and comfort level with the new telehealth service was dependent on two factors. Firstly, the service needed to be set up at the local AMS. Secondly, AMS staff members (local staff) had to be involved in all stages of the care process. As the telehealth service was set up at the AMSs the first requirement was easily met. This placement also meant that local staff members from the AMS could easily attend to client needs. Client comfort with videoconsultations increased as time passed, probably as a result of reduced anxiety through experience (repeated exposure). However, clients who used the service for the first time (new diagnosis or new complication of a stable client) almost always had reservations prior to their first videoconsultation. Furthermore, technologically inept clients and older clients were also initially hesitant. Previous studies evaluating acceptability and comfort with telehealth among Indigenous clients also show that inclusion of local staff and setting up services at the local AMS are important enablers ^{69, 131}.

Inclusion of family and privacy

Other than for a few male clients, the inclusion of family within the videoconsultation was generally welcome. The reasons for not welcoming family into the videoconsultation were: lack of family support, family unavailable locally (divorced or deceased), or the need to discuss sensitive matters (e.g. sexual dysfunction) with the clinician. These clients also stated that local staff need not be included during a videoconsultation (especially when sensitive health matters were discussed). If a staff member was needed during such a consultation (e.g. for tracing a report, etc.) they could be called in, as and when needed. The most likely reason for this could be that many of the AMS staff members were from the surrounding Indigenous community and clients may find it uncomfortable to interact with them outside the health services context. Therefore, the inclusion of AMS staff members within the videoconsultation should be at the request (or with permission) of the client only.

A fragmented therapeutic relationship

As described in Chapter 5, there is a clearly identifiable fragmented therapeutic relationship, developed between clients, specialist, local staff and the site where the consultation takes place (the AMS health centre). The analysis of interviews shows that this relationship could be affected if any one element were to be removed. An example would be if the site (AMS) was to be changed and clients had to visit the local hospital (a non-Indigenous health facility), there is a good chance that as a result, satisfaction scores may fall. However, when clients presented for repeat consultations (second or third videoconsultation), the need for AMS staff and family lessened as they felt comfortable being alone at the videoconsultation. Therefore, an actual measure of satisfaction with the care received could be more accurately measured in a client who has had several videoconsultations (possibly over several years) and is comfortable with the whole notion of telehealth-based care.

Satisfaction measures

Satisfaction with the care received was high among Indigenous clients after receiving the videoconsultations. The involvement of the AMS staff in the care process and the ability to meet the endocrinologist without having to travel were the main reasons highlighted by clients. For many clients, it was the first time they had met an endocrinologist. However, they would not have travelled to meet an endocrinologist either (for diabetes care). Therefore, most likely,

satisfaction measures were not simply a measure of the care received, but a cross-product of not having to travel, perceived quality of care received, and the inclusion of local staff (includes all allied health professionals such as nurses, diabetes educators, Indigenous health workers, dietitians, etc.) and family in the consultation.

Though client interviews and surveys both showed good satisfaction with the telediabetes service, barriers such as difficult data collection (low client numbers, possible reluctance to participate and fail-to-attends) reduces the confidence of the findings. The reason for these difficulties may be cultural reasons (Indigenous patterns of communication - cultural aspects may mean clients are unlikely to tell you exactly how they feel, they may not be used being directly asked about health services or did not want to say anything wrong about the service). These cultural reasons may have affected the data collection process and, most importantly, the form of data collected (inaccurate response to appease the research and data collection process).

Service uptake

Service uptake measured through analysis of completed videoconsultations (from activity data) showed that, when clients did not have a secondary option of accessing an endocrinologist, uptake of telehealth was higher and absences lower. However, when a routine outreach program was available to clients (as was the case for Cunnamulla), they preferred the in-person consultations over telehealth. This is also the likely reason for the increased absences from scheduled appointments, as observed in Cunnamulla. Findings from client interviews also showed that if a secondary option was available, most clients preferred an in-person consultation.

Evaluation of client outcomes

Even though client and clinician perceptions were positive, and uptake of the service was relatively good (other than for Cunnamulla), the average HbA1c levels, and hospital and emergency department admissions for diabetes-related morbidities failed to reduce. The reason for this is most likely that the observation period of this study has been inadequate to clearly see any improvements related to the new service. Currently, there are only early studies (projects) exploring the usefulness of telehealth for Indigenous diabetes clients, and the findings from these studies are still unavailable.

Costs of telehealth

The costing study showed that when an outreach endocrine service was available to a community (as for Cunnamulla), at very low workloads, outreach services alone were cheaper compared to a telehealth-supported outreach (mixed) model. Therefore, for Cunnamulla, the telehealth service needs to provide >50% of required consultations (the balance by outreach) for the telehealth-supported model to be cheaper than an outreach-only service. Hence, for a small remote community with an annual demand of around 75 specialist consultations (such as Cunnamulla), telehealth substitution of >50% of activity will be needed from the outset to realise cost savings (cost modelling).

Overall impression

Overall, though there is inadequate evidence to show that the telehealth service (and access to specialist) have failed to provide better clinical outcomes for the clients, when compared to clients who are only managed by local primary care services, the service has been beneficial at many levels (access to other clinical subspecialties, health education, and staff training) for these communities. As clients are further optimised by endocrinologists (and other specialists), it is likely improvements in outcome measurements (such as HbA1c) will be seen. This is further evidenced by studies conducted among non-Indigenous communities, where specialist diabetes care has provided better outcomes when compared to clients who have accessed primary care alone ²²⁴.

10.3 Limitations

Distance

Among the several limitations of this study, the most significant was the difficulty to access study participants, primarily due to the distance between Brisbane and the selected distant communities. Financial limitations were also an important consideration, further limiting the number of field visits that could be conducted – the distance meant that costs included air travel, car hire, accommodation costs, etc. Working with remote communities remains a challenge due to the logistical challenges of travelling to and from the region. Occasional visits were

possible thanks to funding support from project grants, and additional communication relied on phone calls and email correspondence.

The geographical distance meant that it was often difficult to meet local staff in person and, as a result, the clients who were primarily accessed through them. Consequently, lengthy periods of limited research activity were experienced. This also meant that the research was essentially done ‘at a distance’, as the researcher only made periodic visits to the community and, as a result, rapport built with clients prior to interviews was (most likely) somewhat superficial.

Working at a distance also meant that the research was conducted essentially at suboptimal conditions (ideally the researcher should be placed closer to the community allowing for close contact with clients as and when required). This also meant that most of the research work was essentially conducted ‘remotely’. This most likely led to some of the assumptions made by the researcher (with a view from the central end) to be inadequate or (possibly) incorrect. One such example is the assumed knowledge of how the AMSs and local health workers were allocated to telehealth services and to other Indigenous health centres to cover for staff shortfalls (discontinuous professional support) and the effect it has on the delivery of local health services (assumed knowledge of Indigenous health systems). Furthermore, issues such as poor infrastructure (poorer than expected) and low bandwidth in internet connectivity were important limitations.

Another problem arising due to lack of close access to the communities was the inability to evaluate, in-depth, the client responses which were less than predicted (or hoped) – e.g. low uptake of the telehealth service in Cunnamulla. Furthermore, lack of close access meant that opportunities for observations of the service in action were also limited. Therefore, in order to understand how telehealth services were located in the Indigenous health service context, perceptions of the local health workers or clinicians (*‘second-hand’* information) had to be interpreted, rather than through direct observation of the interaction.

Delays in ethical clearances and data release

Lengthy delays were experienced for ethical clearances and release of data as clearances and information requested were of a sensitive nature due to the client group involved (small Indigenous community, relatively small number of clients with diabetes and the potential to identify).

Telephone interviews

During the data collection period, some client interviews could not be conducted in person. It is likely the researcher could have developed a better working alliance with clients if all interviews were conducted in person (better understanding of the personal contexts and how telehealth fits in). Again, this was not possible as visits to the communities were limited and not possible to be matched with telehealth clinic days of the endocrinologist.

Analysis

The analysis of the qualitative studies was conducted by the researcher *alone*, thus increasing chances of bias. However, the supervisory team closely observed the steps taken during the data analysis process, and changes were made where relevant. Though there was a large investment of time and resources from the central end (in setting up telehealth equipment and specialist services), the success of the service was reliant on the local infrastructure. At the initiation of this service, it is likely the understanding of how local health systems and social dynamics of the selected communities were limited. However, it is unlikely that the qualitative studies were able to fully comprehend how these dynamics interacted, as analysis (and interpretation) was dependent on information from interview content only. If an ethnographic study could have been conducted, with the researcher embedded closely in the telehealth service delivery process (possibly by residing in the community for some time), a better understanding of the utility of the new service may have been achieved. Furthermore, such a study could have given greater insight into other issues, such as how Indigenous people interacted with fragmented and competing health services (especially in rural areas), poor coordination of existing services where some centres functioned in relative isolation (distance), limited communication with metropolitan-based specialist health services, and poorly understood cultural dynamics in health-seeking of Indigenous people, possibly outside the scope of this study due to the type of available data ^{30, 225, 226}.

The evaluation of the service uptake and outcome assessment (quantitative studies) was conducted from two years' worth of data only. Comparing evidence of other long-term studies, this is an inadequate duration of time to make definitive observations for health service interventions of this type. The cost-minimisation analysis also used several assumptions which need to hold true for findings to be accurate, as described within the chapter.

10.4 Conclusions

When this study was first commenced, there were no peer-reviewed academic publications available describing the use of telediabetes solutions for clients from distant Indigenous communities in Australia. This is one of the first attempts to implement a videoconference service for diabetes clients in distant Indigenous communities in Queensland. Although some studies had found mental health services and oncology services had some success using telehealth in Indigenous communities, these were essentially for acutely significant and short-term needs. With diabetes, clients would have to live with and manage the disease for longer. Therefore, their interactions with telehealth, and how they accept the modality over a long period is important.

During this study (qualitative work), close associations were developed with distant Indigenous medical services (staff) and clients. This meant that perceptions described by them were more likely to be actual and truthful, unlike those obtained from a survey-based study. Indigenous Australians' relationship with diabetes is complicated (described in chapter 2). This is due to the perception that the disease has been caused by changes made in adopting a western lifestyle, and that the prescribed treatment was also from the same western type of health services. This study was able to discuss this issue with Indigenous clients living with diabetes and was able to ascertain that this is an archaic perception and that Indigenous communities have moved forward to accepting the treatment prescribed. One of the well-described limitations in Indigenous research is that findings may not be generalisable. However, this study was able to connect with several distant Indigenous communities, and health and administrative staff from many Indigenous medical services at various levels; therefore, findings would most likely be applicable to health services in other distant Indigenous communities in Australia.

The findings from this study show that the new telehealth service is a useful intervention for the Indigenous diabetes clients, for accessing specialist services. Clients were able to have a consultation with an endocrinologist at short notice, in most cases for the first time ever in their diabetes journey. Though the short-term clinical outcomes (e.g. HbA1c and diabetes-related admissions to local health institutions) have been inconclusive (or not reduced), the increased accessibility to specialist diabetes services and the availability of other clinical subspecialties at short notice, is a definitive advantage to the communities. Telehealth services seem to have been easily incorporated into the usual services of the AMSs (as evidenced by early uptake by local staff), without the need for any additional staffing or infrastructure. With

the service expanding (by adding other subspecialties), telehealth will most likely change how specialist healthcare is provided to these remote communities in the future. Telehealth services also seem to have quickly ingrained into how Indigenous clients expect health services to be delivered, as evidenced by the numerous requests for other clinical subspecialties (during interviews) to also be delivered using the service.

As a result of the new telehealth service, delivery of health services in these areas may change completely or, in fact, may have changed already. Incorporation of telehealth into the normal operations of AMSs in a culturally appropriate manner will change how services are usually delivered to local communities and, eventually, most likely how clients expect them to be delivered. Telehealth enables services to be delivered to people in the community (saves the need for travel) and cultural norms (e.g. ‘sorry business’; a day of mourning) can also be respected. This change will create a new paradigm for health services in remote Indigenous communities, where access to specialist health services for locals in the community changes from a ‘possible’ to an essential part of the service mix.

10.5 Recommendations for practice and education

Increase access to other clinical subspecialties

Several clients (during interviews) requested for further clinical subspecialties to be made available through the service. This may take some time, as attracting specialists who use telehealth facilities (comfortably) may be difficult. However, once available, clients may be able to avoid travelling to access specialist consultations altogether, especially for chronic diseases such as diabetes or mental health diseases, especially if the GP could conduct the clinical examination as per the specialist’s requirements.

Short turnaround times for appointments

Currently, telehealth endocrine clinics are held only once a month. As patient numbers are limited, accommodating more frequent clinics would not be economical. However, if the service could evolve into an on-demand service, where the telehealth clinician could be made

available at short notice, clients (and local GPs) could use the service more effectively, without needing to wait several weeks for the monthly tele-clinic.

Increase the use of telehealth to educate AMS staff

The telehealth service could be easily utilised for the education and training of health staff at the AMSs, when not used for clinical consultations. When in-service training programs are conducted for remote staff, travelling entails a significant investment of time, given the distance to these remote communities. Therefore, if the training is information-based (i.e. without any practical training component), telehealth could be an easy (and practical) alternative to travelling.

Inform all local staff members regarding the availability of the service

During the study period, staff turnover (including local GPs) at the AMSs was high. This led to several refresher training sessions being requested by the AMSs. If a high staff turnover at the AMSs is expected in future, it would be prudent to schedule periodical planned training sessions by the central service.

Furthermore, when GPs rotate every few weeks, as in Cunnamulla, the new (locum) GP may not know about the telehealth service or the new services (e.g. other clinical subspecialties having access to a telehealth-based specialist) incorporated in the interim. Furthermore, since local staff members are from the Indigenous community, they too can be a good source of disseminating information to the local community regarding new telehealth services (informal dissemination).

10.6 Future research

Several future research projects are required to assess the long-term effects of this new service. A long-term assessment of HbA1c levels (and other clinical parameters, such as renal function, age at dialysis whilst using telehealth services) of clients who receive telehealth-based specialist consultations for diabetes, could show whether the service has had an impact in improving outcomes. Cohorts of clients who do not access the specialist service (i.e. managed only by the local GP), and those who access specialist services through multiple other methods

(travel to a metropolitan centre, during ad-hoc outreach clinics, and other combinations using telehealth) can be compared to see how improvements happen through either method over time.

In future, assessment of knowledge regarding diabetes amongst Indigenous clients can be a guide to see whether the diabetes education service, the frequent specialist consultations, and the diabetes education leaflets have had an effect on improving disease-specific knowledge. Assessment of patient-reported outcomes for hypoglycaemic episodes and lag time between symptoms of diabetes and diagnosis can be used as proxy measures to inform of any increased knowledge about the disease.

An evaluation of the telehealth service over the long term (10 – 20 years), observed through diabetes-related complications such as renal failure, would be needed to definitively ascertain whether it is a useful addition for these communities. If the age of the clients being diagnosed with complications were to increase (i.e. older at diagnosis), it would suggest that the telehealth service may have had an impact on the clients, in delaying complicated stages of disease (if all other services remain constant). An evaluation of life-span changes among clients from the communities could also be useful, after the telehealth intervention. How health services in Indigenous communities (especially at the AMSs) change as a result of the new telehealth services would also need to be studied in future (could inform future implementation of similar services). Such a study could provide an understanding of how an Indigenous health service evolves with the advent of new technology into the service mix, and how to accommodate such changes safely in future.

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Annexure

Contents:

1. Ethical clearances
2. Interview guides
3. Diabetes education leaflets
4. Publications included in the thesis



THE UNIVERSITY OF QUEENSLAND
Institutional Human Research Ethics Approval

Project Title: Establishment and Evaluation of a Telediabetes Service for Rural Indigenous Communities in Queensland

Chief Investigator: Dr Sumudu Wickramasinghe

Supervisor: A/Prof Anthony Smith, Dr Liam Caffery, Dr Natalie Bradford

Co-Investigator(s): A/Prof Anthony Smith, Dr Liam Caffery, Dr Natalie Bradford, Dr Noel Hayman, Dr Tony Russel

School(s): School of Medicine/Centre for Online Health

Approval Number: 2015001105

Granting Agency/Degree: NHMRC; Diabetes Queensland Fund

Duration: 31st August 2018

Comments/Conditions:

Note: if this approval is for amendments to an already approved protocol for which a UQ Clinical Trials Protection/Insurance Form was originally submitted, then the researchers must directly notify the UQ Insurance Office of any changes to that Form and Participant Information Sheets & Consent Forms as a result of the amendments, before action.

Name of responsible Committee:

Behavioural & Social Sciences Ethical Review Committee

This project complies with the provisions contained in the *National Statement on Ethical Conduct in Human Research* and complies with the regulations governing experimentation on humans.

Name of Ethics Committee representative:

Associate Professor John McLean

Chairperson

Behavioural & Social Sciences Ethical Review Committee

Signature JP McLean

Date 24/8/2015



THE UNIVERSITY OF QUEENSLAND
Institutional Human Research Ethics Approval

Project Title: Establishment and Evaluation of a Telediabetes Service for Rural Indigenous Communities in Queensland - 10/03/2016 - AMENDMENT

Chief Investigator: Dr Sumudu Wickramasinghe

Supervisor: A/Prof Anthony Smith, Dr Liam Caffery, Dr Natalie Bradford

Co-Investigator(s): A/Prof Anthony Smith, Dr Liam Caffery, Dr Natalie Bradford, Dr Noel Hayman, Dr Tony Russel

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Name of responsible Committee:

Medical Research Ethics Committee

This project complies with the provisions contained in the *National Statement on Ethical Conduct in Human Research* and complies with the regulations governing experimentation on humans.

Name of Ethics Committee representative:

Dr Jennifer Paratz

Acting Chairperson

Medical Research Ethics Committee

Signature

Date

16/3/16



25 May 2015

Chief Executive Officer
Cunnamulla Aboriginal Corporation for Health
PO Box 231
Cunnamulla QLD 4490

To whom it may concern,

It is my pleasure to write in support of the following research program consisting of:

1. Investigating Indigenous prospective of the telemedicine system for diabetes care (telediabetes);
2. To use and review diabetes education leaflets to educate diabetes patients of CACH, in a culturally appropriate format;
3. To carry out a post implementation evaluation of the telediabetes service.

I confirm our willingness to collaborate with the research agenda and provide any additional support necessary, where possible.

I believe this research project is important to ensure ongoing continuous improve in the care and treatment of diabetes patients, feasible and consistent with the aim of the Cunnamulla Aboriginal Corporation for Health and will assist us in utilising available technology for diabetes care and treatment effectively.

Yours sincerely

Kerry Crumblin
Chief Executive Officer
Cunnamulla Aboriginal Corporation for Health



THE UNIVERSITY OF QUEENSLAND
Institutional Human Research Ethics Approval

Project Title: Establishment and Evaluation of a Telediabetes Service for Rural Indigenous Communities in Queensland

Chief Investigator: Dr Sumudu Wickramasinghe

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Name of Ethics Committee representative:

Associate Professor John McLean

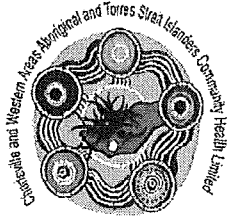
Chairperson

Behavioural & Social Sciences Ethical Review Committee

Signature

Date

24/8/2015



Charleville & Western Areas Aboriginal & Torres Strait Islander Community Health Ltd.

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Sheryl Lawton

Chief Executive Officer

Charleville and Western Areas Aboriginal and Torres Strait Islander
Community Health Limited (CWAATSICH)

Friday, 12 February 2016

To whom it may concern,

It is my pleasure to write this letter of support for our planned research partnership with Associate Professor Anthony Smith and his research team, representing The University of Queensland's Centre for Online Health and the NHMRC funded Centre of Research Excellence in Telehealth.

Our collaboration involves the planning, implementation and evaluation of a range of telehealth services to support people in our community. I believe that this research is important, feasible and relevant to the goals of the CWAATSICH – which include “to ensure quality research builds the evidence base to promote innovation and continuous improvement, influence positive change, meet new challenges, exceed national health standards and inform best practice”.

I support this partnership because of the potential benefits to the community and look forward to contributing to this effort.

Sincerely,

Sheryl Lawton
Chief Executive Office
CWAATSICH



THE UNIVERSITY OF QUEENSLAND
Institutional Human Research Ethics Approval

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School(s): School of Medicine/Centre for Online Health

Approval Number: 2015001105

Granting Agency/Degree: NHMRC; Diabetes Queensland Fund

Duration: 31st August 2018

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This project complies with the provisions contained in the *National Statement on Ethical Conduct in Human Research* and complies with the regulations governing experimentation on humans.

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Dr Jennifer Paratz

Acting Chairperson

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Signature

Date

16/3/16



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Our collaboration involves the planning, implementation and evaluation of a range of telehealth services to support people in our community. I believe that this research is important, feasible and relevant to the goals of the CWAATSICH – which include “to ensure quality research builds the evidence base to promote innovation and continuous improvement, influence positive change, meet new challenges, exceed national health standards and inform best practice”.

I support this partnership because of the potential benefits to the community and look forward to contributing to this effort.

Sincerely,

Sheryl Lawton
Chief Executive Office
CWAATSICH



25th February 2015

Chief Executive Officer
Cunnamulla Aboriginal Corporation for Health
PO Box 231
Cunnamulla Q 4490

To Whom it May Concern

It is my pleasure to write a letter in support of a research program investigating an Indigenous perspective of the potential of telehealth in rural Queensland. I confirm our willingness to collaborate with the research agenda.

I believe this research project is important, feasible, and consistent with the goals of the Cunnamulla Aboriginal Corporation for Health and will assist us in utilising available technology for effectively.

Sincerely,

A handwritten signature in black ink, appearing to read 'Kerry Crumblin'.

Kerry Crumblin
Chief Executive Officer
Cunnamulla Primary Health Care Centre

Enquiries to: Metro South
Human Research Ethics Committee
Phone: 07 3443 8049
Fax: 07 3443 8003
HREC Ref: HREC/16/QPAH/324
E-mail: EthicsResearch.PAH@health.qld.gov.au

Dr Sumudu Wickramasinghe
Telehealth Centre
Ground Floor
Princess Alexandra Hospital
199 Ipswich Rd
Woolloongabba Q 4102

Dear Dr Wickramasinghe

HREC Reference number: HREC/16/QPAH/324

Protocol title: An evaluation of service level activity of the Indigenous Telehealth service for patients living with Diabetes in rural Queensland

Thank you for submitting the above research protocol to the Metro South Health Human Research Ethics Committee for ethical and scientific review. This protocol was considered by the Low Risk Review Panel and will be ratified at the next Metro South HREC meeting.

I am pleased to advise that the Low Risk Review Panel of the HREC has granted approval of this research protocol and a waiver of consent.

You are reminded that this letter constitutes ethical approval only. You must not commence this research protocol at a site until separate authorisation from the Hospital Health Service Chief Executive (CE) or Delegate of that site has been obtained.

A copy of this approval must be submitted to the Research Governance Office(r)/Delegate of the relevant institution with a completed Site Specific Assessment (SSA) Form for authorisation from the CE or Delegate to conduct this research at the Princess Alexandra Hospital.

If this study currently receives grant funding, please remember to forward a copy of this approval letter to the relevant Grants Office of the Administering Institution(s) for the grant.

The documents reviewed and approved include:

Document	Version	Date
Low or Negligible Risk Research Application for Ethical Review		9.5.16
Study Protocol		

This HREC approval is valid from 24/05/2016 until 24/05/2019

Please note the following conditions of approval:

1. The Principal Investigator will immediately report anything which might warrant review of ethical approval of the protocol in the specified format, including unforeseen events that might affect continued ethical acceptability of the protocol. Serious Adverse Events must be notified to the HREC as soon as possible. In addition the Investigator must provide a summary of the adverse events, in the specified format, including a comment as to suspected causality and whether changes are required to the Patient Information and Consent Form. In the case of Serious Adverse Events occurring at the local site, a full report is required from the Principal Investigator, including duration of treatment and outcome of the event.
2. Amendments to the research protocol which may affect the ongoing ethical acceptability of a protocol must be submitted to the HREC for review. Major amendments should be reflected in a revised online

NEAF (accompanied by all relevant updated documentation and a cover letter from the principal investigator, providing a brief description of the changes, the rationale for the changes, and their implications for the ongoing conduct of the study). Hard copies of the revised NEAF, the cover letter and all relevant updated documents, with *tracked changes*, must also be submitted to the HREC office as per standard HREC SOP.

3. Amendments to the research protocol which only affect the ongoing site acceptability of the protocol are not required to be submitted to the HREC for review. These amendment requests should be submitted directly to the Research Governance Office/r.
4. Proposed amendments to the research protocol which may affect both the ethical acceptability and site suitability of the protocol must be submitted firstly to the HREC for review and, once HREC approval has been granted, then submitted to the Research Governance Office/r.
5. Amendments which do not affect either the ethical acceptability or site acceptability of the protocol (e.g. typographical errors) should be submitted electronically (track changes) and in hard copy (final clean copy) to the HREC Coordinator. These should include a cover letter from the Principal Investigator or Study Co-ordinator providing a brief description of the changes and the rationale for the changes, and accompanied by all relevant updated documents with tracked changes.
6. The HREC will be notified, giving reasons, if the protocol is discontinued at a site before the expected date of completion.
7. The Coordinating Principal Investigator will provide an annual report to the HREC and at completion of the study in the specified format.
8. If you require an extension for your study, please submit a request for an extension in writing outlining the reasons. Note: One of the criteria for granting an extension is the compliance with the approval's conditions including submission of progress reports.
9. Any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects on health outcomes ([WHO / ICMJE 2008 definition](#)) should be registered, including early phase and late phase clinical trials (phases I-III) in patients or healthy volunteers ([WHO Recommendation](#) / [ICMJE policy](#)). If in doubt, registration is recommended. All studies must be registered prior to the study's inception, i.e. prospectively.
<http://www.anzctr.org.au/>

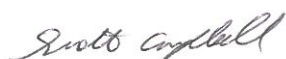
Should you have any queries about the HREC's consideration of your protocol please contact Ethics Secretariat on 07 3443 8049.

Please note that the Metro South HREC is constituted and operates in accordance with the National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*, *NHMRC and Universities Australia Australian Code for the Responsible Conduct of Research (2007)* and the *CPMP/ICH Note for Guidance on Good Clinical Practice*. Attached is the HREC Composition with specialty and affiliation with the Hospital (Attachment I).

Once authorisation to conduct the research has been granted, please complete the Commencement Form (Attached) and return to the Metro South Human Research Ethics Committee.

The Metro South HREC wishes you every success in your research.

Yours sincerely,



A/Prof Scott Campbell
Chair - Low Risk Review Panel
Metro South Hospital and Health Service
Human Research Ethics Committee (EC00167)
Centres for Health Research
Princess Alexandra Hospital

2015/11/6



**Queensland
Government**

This approval means that you must undertake the responsibilities and obligations of confidentiality of the information under the provisions of the *Public Health Act 2005*. You must take all reasonable steps necessary to ensure that the confidential information is kept confidential, including storing or disposing of all data, information, documents and associated correspondence in a secure manner. Unauthorised use or disclosure of confidential information may incur a penalty under the laws of the Queensland Government. These obligations include providing notification of any change in the names of persons who will be given the information for the research.

When conducting research within the Queensland public health system, a copy of this Approval Letter must be provided to the relevant Research Governance Officer as part of your research governance application.

Please note: This letter constitutes *Public Health Act 2005* approval only. The project cannot proceed until separate Research Governance authorisation has been obtained from the relevant authority.

Please display this letter and a copy of your application when requesting the confidential information from the relevant data custodian.

You are required to provide an annual progress report and a final report at the completion of your project, to Health Innovation, Investment and Research Office, Office of the Director-General. Templates can be found on the web page

http://www.health.qld.gov.au/ohmr/html/regu/aces_conf_hth_info.asp

Should you wish to extend your research project beyond this time or amend the study protocol, you will need to seek approval of these amendments from the approving HREC and re-apply for approval of the release of confidential data. This includes disclosing this information to and recruiting additional people to this project. Please provide a copy of your HREC approval of the amendments when re-applying.

Please feel free to contact Health Innovation, Investment and Research Office, Office of the Director-General on email PHA@health.qld.gov.au or phone 07 3096 2047 if you have any queries on this matter.

Yours sincerely



Sue Hooper PhD

Director

Health Innovation, Investment and Research Office

Office of the Director-General

31/8/2016

Department of Health

Enquiries to: Claudine Wilson
Health Innovation, Investment and
Research Office
Office of the Director-General
Telephone: (07) 3096 2047
Ref: QCHO/009321/RD006373

Dr Sumudu Wickramasinghe
Centre for Online Health
Ground Floor, Building 33
Princess Alexandra Hospital
199 Ipswich Road
WOOLLOONGABBA QLD 4102

Dear Dr Wickramasinghe

Research Title: An evaluation of service level activity of the Indigenous
Telehealth service for patients living with Diabetes in rural
Queensland

HREC / Project Number: HREC/16/QPAH/324

I am writing to inform you that your request for access to confidential health information for the above project has been approved under the delegation of the Director-General. In accordance with Section 284 of the *Public Health Act 2005* the researchers listed in your application, received 21 June 2016 can access and use the specified confidential information, providing they act within the limits detailed in your submission.

This approval (RD006373) commences on the date of this letter and is valid to 24 May 2019.

This approval relates to information:

- for the period from 1 May 2015 to 31 March 2016 from the following repositories for information relating to Cunnamulla, Charleville and Gladstone patients:
 - Princess Alexandra Hospital medical record
 - Centre for Online Health scheduling data for Cunnamulla, Charleville and Gladstone tele-diabetes (tele-endocrine) service
- for the period from 1 May 2015 to 30 May 2016 from PRACTIX

The following researchers may be given the information as noted in the above application:

- Dr Sumudu Wickramasinghe
- Associate Professor Anthony Smith
- Associate Professor Anthony Russell
- Dr Liam Caffery
- Dr Natalia Bradford

Version 1: Interview guide for the interviewer

Semi-structured interview guide (for interviews with specialist clinicians)

Introductions...

- Tell me about your telehealth experiences? How often do you use telehealth?
- Do you have Indigenous clients? How often? For what types of morbidities?
- Do you think they accept telehealth? What are your impressions about what they think?
- How is the clinical quality of the teleconsultations? Consultation quality? Appropriateness to the clinical context? Is technology feasible?
- Do you think Indigenous patients are comfortable during interactions over telehealth? Are they satisfied of the service they have received?
- Is local staff presence useful? Is family presence important?
- How important was the pre-consultation work-up? What is required from the local services?
- About using the service in training local staff using the staff?
- Are culturally appropriate diabetes-education leaflets important? Why?
- What are the problems, limitations of telehealth - in general and in respect to your field?
- What is your overall impression? Is telehealth a useful intervention for these Indigenous groups?

Semi-structured interview guide (for the primary researcher to use during interviews)

Introduction

- Keep it simple. Tell them about yourself and where you're from (COH/UQ).
- Briefly explain purpose of study.
- If the person has diabetes – with your permission, would it be OK to check your HbA1C?
- Have you ever been involved in a videoconference before? EG – skype, facetime etc.
- Do you know what telehealth is? Explain and give an example/show pictures. Emphasis use of videoconferencing as the modality.

Have you had a telehealth appointment?

Yes/No

If yes:

Perceptions and acceptability - Tell me about your experience:

1. Were you comfortable having a telehealth appointment? Why? Why not?
2. Did you feel like there was a benefit for you by having this appointment?
3. What did you like about the telehealth appointment?
4. Was there anything you didn't like about the telehealth appointment?
5. How could your experience be made better next time?

If no:

Perceptions and acceptability

1. Do you normally see a doctor for your diabetes? If yes, how often? Do you also see a specialist? If yes, how often?
2. Would you be happy to see your doctor by telehealth? (videoconference) GP and/or specialist?
3. How do you think this would compare to the way you normally see your doctor?

4. What might be some of the benefits of a telehealth appointment?
5. Do you think there could be any disadvantages?

Other questions – if time permits:

- If you had a choice, would you prefer to have an appointment in person with the doctor or via videoconference? Please tell us why? Any differences - GP versus specialist?
- Do you feel it is necessary to see a specialist as well as the GP or IHW? Why?
- Where would you prefer to have your appointment (the AMS, local hospital or specialist hospital?) Why is that?
- Have you had to travel to see a specialist? What does this travel involve? (time, costs) – investigate
- Would travelling away from the community be inconvenient for you? What would this mean for you? Family, work?
- Have you been provided with any information about diabetes or other health conditions? Yes/No; if no, is this something you would like to have?

Telehealth survey

1. Client's initials:
2. Client's DOB:
3. Telehealth date:
4. During the telehealth appointment did you learn new ways to manage your health?
 - ☐ Yes, I learnt a lot
 - ☐ I learnt a bit
 - ☐ Not sure
 - ☐ I didn't learn very much
 - ☐ No, nothing new
5. Are you comfortable using video conferencing to talk about your health?
 - ☐ Yes, definitely
 - ☐ Most of the time
 - ☐ Not sure
 - ☐ Some of the time
 - ☐ No, not at all
6. Do you think telehealth will help prevent problems with your health?
 - ☐ Yes, definitely
 - ☐ Maybe a bit
 - ☐ Not sure
 - ☐ Not very much
 - ☐ No, not at all
7. Do you feel that it is important to have your family with you during your telehealth appointment?
 - ☐ Yes, very important
 - ☐ Somewhat important
 - ☐ Not sure
 - ☐ Not really important
 - ☐ Definitely not important
8. Are you happy to use telehealth to see the specialist for your next appointment?
 - ☐ Yes, definitely
 - ☐ Somewhat happy
 - ☐ Not sure
 - ☐ Not really
 - ☐ No, not at all
9. Would you recommend telehealth to your family?
 - ☐ Yes, I would definitely recommend telehealth
 - ☐ Probably would
 - ☐ Not sure
 - ☐ Not really
 - ☐ No, I would not recommend telehealth

Only complete Question 10 to 13 if you have had a diabetes teleconsultation

10. What is your most recent Hb1AC?
11. Are you satisfied with your diabetes care?
 - ☐ Very happy
 - ☐ Somewhat happy
 - ☐ Not sure
 - ☐ Not very happy
 - ☐ No, not at all happy
12. In the last month, how often have you felt that your blood sugars have been too high?
 - ☐ Most of the time
 - ☐ Sometimes
 - ☐ Unsure
 - ☐ Not very often
 - ☐ Never
13. In the last month, how often have you felt that your blood sugars have been too low?
 - ☐ Most of the time
 - ☐ Sometimes
 - ☐ Unsure
 - ☐ Not very often
 - ☐ Never

Thank you for your time.

Diabetes

①

How do you know you have diabetes?

Does this happen to you?

- Feeling tired or weak
- Peeing a lot
- Feeling thirsty
- Leg cramps
- Feeling itchy
- Sores and boils that won't heal
- Blurry vision
- Pins and needles

*Through a simple test,
a doctor can find out if
you have diabetes*

If the answer is YES...

You should talk to your doctor, health worker or nurse

What is Diabetes?

Diabetes is a serious life long condition where there is too much glucose (sugar) in the blood.

- Glucose gives your body energy.
- Glucose is a fuel that comes from some of the food you eat and drink.
- Glucose moves from your blood into your muscles with the help of a hormone called insulin.
- Insulin helps to keep your glucose from going too high.
- With diabetes your insulin isn't working properly, or there is not enough insulin, so the glucose doesn't get into your muscles and body easily leaving too much glucose in your blood.
- Everyone has a little bit of glucose in their blood. In people who don't have diabetes glucose levels stay between 4 and 6 mmol./L (before eating food).
- High levels of glucose in the bloodstream can make you feel tired or weak .
- When there is too much glucose in the blood for too long it damages your heart, kidneys, feet, eyes and nerves.



What is Type 2 Diabetes?

- There are three main types of diabetes - type 1, type 2 and gestational diabetes.
- A lot of Aboriginal and Torres Strait Islander people have Type 2 Diabetes. People with Type 2 Diabetes make insulin in their body however your body stops the insulin working properly or you can't make enough.
- Being active, eating healthy and being a healthy weight can help your insulin work better to keep your glucose from going too high for too long.
- Many people also take tablets and insulin every day to keep their glucose level from going too high.

What is Telediabetes?

It's just for people with Diabetes!

Meet your Diabetes Specialist without the hassle of travelling!!

Just make an appointment at the Local Health Center and meet your Diabetes Specialist live on TV.

What is Telehealth?

It's the newest way you can connect with your specialist doctor!

Ask about this from your local health staff

You don't have to travel far to meet your Diabetes Specialist.

Source:

Diabetes Australia website (<http://www.diabetesaustralia.com.au/Living-with-Diabetes/Indigenous-Australians1/>)
Healthy living NT website (http://www.healthylivingnt.org.au/public.cfm/Indigenous_Resources/3/77/)

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Managing Diabetes

②

When there is too much glucose (sugar) in the blood for too long it damages your heart, kidneys, feet, eyes and nerves.

Plan

- Eating healthy
- Being a healthy weight
- Avoiding and eating less fat, sugar and salt
- Taking your medicine

Eating healthy

- Have plenty of bush tucker and have shop foods and home cooked meals that are low in fat, sugar and salt.
- Have something from each of the core food groups (vegetables, fruits, meats, dairy and grains) every day. They give you energy, fight sickness and help care for your body to keep it strong.
- Drink plenty of water.

AVOID

fat, added sugar and salt

- Eat less of carbohydrates and added sugar.
- **Eat less fat** as it makes you put on weight and gives you problems with your heart.
- Choose less fat on the meat you buy. Cut the fat off the meat and take the skin off chicken before cooking.
- **Drain the juices (fat)** after cooking meat and scoop out the fat from the top of stews.
- Avoid cooking with or having fats like butter, oil, margarine or dripping.
- It is better to boil, steam, stew, grill, microwave or stir-fry food.

How to have a healthy weight (not too fat and not too skinny)

- Eat less food, eat healthy and be more active.
- Increased activity and exercise helps you lose weight and keep it off and it keeps you healthy. It helps your insulin to work properly.
- Walk, jog, play sport, hunt, garden, work around the place.
- Be active for 30 minutes or more every day OR do 10 minutes 3 times a day.

What is Telediabetes?

It's just for people with
Diabetes!

Meet your Diabetes Specialist
without the hassle of
travelling!!

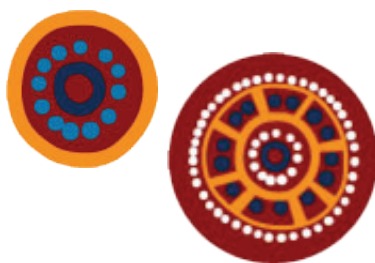
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Diabetes

3

What you need to know about taking your diabetes medicine

Remember to:

Check your blood glucose (sugar) levels at the times your doctor, health worker or nurse advise.

See your doctor, health worker or nurse straight away if you feel sick.

Taking your medicine

- Take your medicine at the times the doctor asks you to.
- Take them correctly as advised by your doctor, nurse or healthcare worker.
- Keep your medicines out of reach of kids.
- Refill: get some more medicine before it gets low... so you don't run out.
- Take your medicine with you when you go to see family, walkabout or go away from home.
- Put your medicines somewhere cool, dry and safe so they won't go bad.

If you notice anything different about your body talk to your doctor, health worker or nurse.

What is hypo (hypoglycaemia)?

Hypo is when your blood glucose (sugar) level goes below 4.0mmol/l.

You can go hypo if you are:

- Not eating, not eating enough or eating too late, being extra active, drinking grog (alcohol)
- When you are hypo you might feel shaky, hungry, get headaches, weak, confused, angry, talk like you're drunk or you may not feel well or may be sweaty.
- If you are hypo: get your blood glucose level up fast by drinking or eating something sweet.

Manage your diabetes via a care plan from the AMS (721, 723)

If you have diabetes - Join our 'Sugar Shakers' group for ladies and the 'BROOM' group for men

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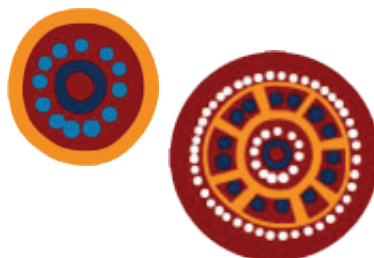
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Enablers and barriers in providing telediabetes services for Indigenous communities: A systematic review

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Running head: Review of Indigenous telediabetes services

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Keywords:

Diabetes, telemedicine, telehealth, Indigenous, Aboriginal

Abstract

A systematic review of studies of tele-diabetes interventions within Indigenous communities was undertaken in June 2016. The aim of this study was to identify enablers and barriers associated with delivery of the specific intervention. Fourteen articles met the study inclusion criteria, reporting work in Canada, Australia, India and the United States. Key enablers included the use of cultural and spiritual elements, acknowledgement of local beliefs and traditions, and appropriate community engagement. The involvement of Indigenous health workers (IHWs) was also very important because of their role in communication of local language, helping clinicians understand the community; and transportation of patients. The main barriers associated with telediabetes interventions were the potential high fail to attend rates, lack of technical skills associated with operation of telehealth equipment, and lack of availability of local staff. Knowledge of the enablers and barriers associated with the delivery of health care interventions to Indigenous communities is important when planning a telediabetes intervention.

Introduction

There are more than 370 million Indigenous people living throughout 70 countries worldwide.¹ Access to high-quality healthcare services for Indigenous people is hindered by distance, lack of access to specialists,^{2, 3} and cultural and economic factors.⁴ Since the majority of Indigenous people live in rural and remote locations, ensuring fair and equitable access to health services can be challenging.⁵ The lack of specialist health services in Indigenous communities is partially compensated by primary care provided via Indigenous medical services, which deliver both acute care services and chronic disease programs.⁶ Consequently, the opportunity to develop telehealth services in partnership with primary care services should be explored as a means of improving access to diabetes care.⁷

The increasing prevalence of diabetes amongst Indigenous populations is well described.⁸⁻¹⁰ The use of telehealth to deliver specialist diabetes care (tele-diabetes) is clinically and economically effective amongst non-Indigenous patients.¹¹ Successful telehealth interventions rely on a variety of factors, which support feasibility, acceptance amongst patients and sustainability. These include appropriate funding allocations, dedicated support staff, user training and education, appropriate telehealth equipment, availability of specialist services, and effective change management.¹² However, it can't be assumed that the same findings apply to telehealth services for Indigenous populations.¹³

The aim of this systematic review was to summarize published research on telediabetes interventions for Indigenous patients, with a particular focus on identified enablers and barriers associated with the delivery of such health services.

Methods and materials

Search strategy

A combination of search terms was used to search the PubMed, Scopus, Embase and Informit databases (Table 1). These combinations included keywords as well as medical subject headings (MeSH) terms, and Emtree terms unique to the Embase database. Hand searching of reference lists of included articles was also conducted. Grey literature was searched using Google Scholar. The searches were conducted in July 2016.

Table 1: Query syntax

Database	Syntax
PubMed, and Informit	(Telemedicine [MeSH] OR telemed*[All fields] OR tele*[All fields] OR teleconsultation [All fields] OR teleconsult*[All fields] OR (Remote consultation)[MeSH]) AND (Diabetes[All fields] OR Diab*[All fields] OR Diabetes Mellitus[MeSH]) AND (Indigenous [All fields] OR (Health service, Indigenous) [MeSH] OR Indigen*[All fields] OR Aboriginal [All fields] OR Aborigin* [All fields] OR Tribal [All fields] OR Native [All fields] OR (First nations) [All fields] OR native* [All fields] OR Indian OR Inuits [MeSH] OR Maori [All fields] OR Eskimo [All fields] OR Islanders[All fields])
Embase	(Telemedicine [Emtree] OR Teleconsultation [Emtree]) AND (Diabetes Mellitus [Emtree]) AND (Indigenous Healthcare [Emtree] OR Indigenous Australian [Emtree] OR Indigenous people [Emtree] OR Alaska Native [Emtree] OR American Indian [Emtree] OR Native Hawaiian [Emtree] OR First Nation [Emtree] OR Eskimo [Emtree] OR Inuit [Emtree] OR Maori [Emtree])
Scopus	(teleconsult* OR Telemed*) AND Diab* AND (Indigenous OR Indigen* OR Aboriginal OR Aborigin* OR Tribe OR Native OR (First nations) OR native* OR Indian OR Inuit OR Maori OR Eskimo OR Islanders)

Inclusion and exclusion criteria

We included articles which described specific interventions for Indigenous patients with diabetes. Abstracts, reports and short communications were included if sufficient data on enablers and barriers were available. Articles not published in English were excluded.

Selection process

The title, keywords and the abstract were screened to determine eligibility for inclusion. Full text reviews were carried out if abstract summaries were inconclusive. Screening was undertaken by two authors.

Data extraction and quality assessment

The full text of articles meeting the inclusion criteria were read and data extraction was undertaken. The data extraction fields are summarized in Table 2.

Table 2: Data extraction

Data extraction category	Fields
Article information	author, country, year of publication, type of article (journal article, conference abstract, letter to the editor, report), and study design
Intervention	Telehealth modality (video conferencing, store and forward, remote monitoring, hybrid), diabetes subspecialty (e.g. diabetic retinopathy screening, diabetes education), service description
Intervention context	Barriers to delivering telediabetes intervention, identified solutions to barriers, enablers for successful intervention of telediabetes interventions, and key findings.

Data points for enablers were identified after reviewing either the introduction,¹⁴⁻¹⁶ methods,¹⁷ results,¹⁵ or the discussion¹⁸ section of each article. Similarly, barriers were identified after reviewing either the introduction,^{6, 14, 15, 19-21} methods,²² results,^{15, 18, 20, 23} discussion^{21, 22, 24, 25} or the conclusion.²⁶ The quality of included articles was assessed using a modified Cultural Identity Interventions Systematic Review Proforma tool.²⁷ We assessed two domains from the original tool namely *study design assessment* and *ability to locally adapt the program/study elsewhere*.

Two reviewers independently performed the data extraction and quality assessment. In cases where consensus was not reached, a third reviewer was used to judge the quality assessment and adaptability scoring.

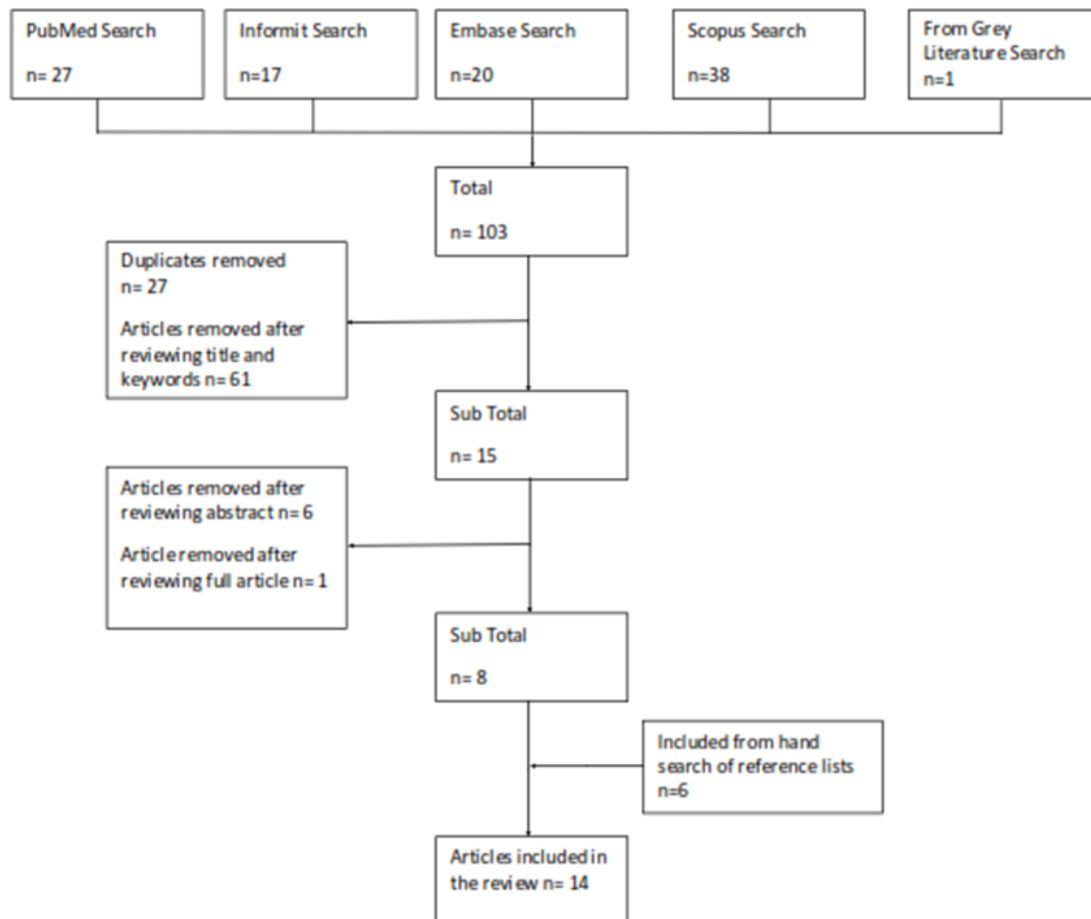
Review procedure

The systematic review protocol was registered with PROSPERO (CRD42016033151). Findings of the review were reported using PRISMA guidelines with a narrative synthesis.²⁸

Results

Fourteen articles were included in the review. The process of screening and selection of articles is shown below.

Figure 1: PRISMA flow diagram.



There were six articles from Canada (Alberta, British Columbia, Vancouver), six from Australia (Western Australia, Northern Territory, Queensland) and one article each from India (Orissa) and the United States of America (Alaska). Articles were published between 1996 and 2015.

Characteristics of the telediabetes interventions

Eleven (78%) articles described a diabetic retinopathy (DR) screening intervention. Four articles provided other clinical investigation or consultation services in addition to DR screening.^{16, 19, 25, 26} Store-and-forward was the telehealth modality of the DR screening services. Images were captured by a visual technician travelling to distant communities,^{19, 22, 26} or a local Indigenous health worker trained in fundal photography.^{6, 15, 20} Grading of ophthalmic images was done remotely (teleophthalmology) by an ophthalmologist at a different center. Both synchronous (e.g. videoconferencing) and asynchronous (e.g. email) communication methods were reported.

In most interventions, clinical investigations were conducted at field level and findings were reported to specialist services. These services included medical history taking and general examination, vascular risk factor identification, investigations (urine for albumin, HbA1c, plasma glucose, serum cholesterol, serum creatinine), blood pressure measurements and diabetes education. Diabetes education was delivered using some method of telehealth in five interventions. These included services of diabetes specialists,¹⁸ diabetes nurse educators,^{19, 26} diabetes educators,¹⁷ and computerized information kiosks,²⁴ to provide diabetes related health information. Videoconferencing was used in one intervention – to deliver medical consultations involving diabetes specialists.¹⁸

The assessment made using the modified version of the Cultural Identity Interventions Systematic Review Proforma,²⁷ showed that *study design assessment* in most articles was either low (43%) or moderate (36%). The study design of three (21%) articles was judged as high. In regards to *ability to locally adapt the program/study elsewhere*, 25% of all articles were scored as low, and the remainder were either moderate (50%) or high (25%).

Enablers and Barriers

Enablers and barriers identified from reading the full text of the articles are listed below in table 3. Cultural appropriateness (use of cultural and spiritual elements, acknowledgement of local beliefs and traditions, and appropriate community engagement) was recognized as an important enabler of the telediabetes service. Aurora *et al.* reported increased patient satisfaction and improvement in patient attendance - from 20% to 85% after inclusion of cultural and spiritual ceremonies, as part of the service.¹⁴ Legislative issues such as local health workers not being allowed to instill eye-drops were overcome by approvals with the relevant authorities. It is an important lesson in moving forward rather than being inhibited by previous legislature.¹⁵

Participation of Indigenous health workers (IHWs) was reported to be an important aspect of making a telediabetes program culturally acceptable to the local community as well.

Furthermore, involving IHWs in the operation of a telediabetes service seemed to be one of the most common enablers reported in the literature. Varying degrees of success have been attributed to the role of the IHWs ^{15, 29} – because of their role in communication of local language, helping clinicians understand the community; and transportation of patients. Similar findings have been reported in tele-oncology, ³⁰ ear health screening, ^{31, 32} and primary care, ²⁹ where involvement of IHWs was considered important for the successful delivery of the service.

Barriers associated with the delivery of telediabetes services included the lack of technical skills associated with operation and maintenance of retinal screening cameras; and the collection of clinical information (such as digital images). For these reasons, the importance of effective training programs for local staff responsible for screening assessments is commonly reported.^{33, 34} Karagiannis *et al.* found that 76% of images captured by IHWs were of good quality following a two week intensive training program.²⁰ Technical training in the operation of camera and credentialing processes have also been reported to have improved the quality of images collected by health workers.²¹ With the advent of portable fundal cameras and the use of smart phones ³⁵ for automated retinal imaging functions, these challenges may eventually become redundant.

The difficulty in recruitment of patients for screening and interval-appropriate repeat screening was another barrier identified. Conducting imaging and clinical consultation services on the same day can help improve screening/rescreening rates. Fail to attend rates of clinic appointments were a commonly reported barrier amongst many services.^{14, 21} As is the case with most chronic diseases, continuity of care through screening and monitoring is important for the early detection of serious complications. Yet, as Chen *et al.* describes for chronic kidney disease programs for Indigenous patients in Australia, lack of awareness of importance of screening, and limited availability of screening resources are still major barriers, to overcome.³⁶

Table 3. Enablers and barriers to telediabetes services

Author Reference/ Country	Intervention	Intervention context			
	Service/Modality	Enablers	Barriers	How barriers were overcome	Key Findings
Arora <i>et al</i> ¹⁴ ; Canada	DR screening; S&F	Spiritual ceremonies before and after each clinic; local workers who spoke local languages provided education; acknowledgement of local beliefs and traditions	Poor attendance; not feeling at ease with the hospital based screening	Clinics were made appealing to patients by incorporating Indigenous cultural elements	Attendance rates increased from 20% to 85% within a two year period
Barry <i>et al</i> ¹⁵ ; Australia	DR screening; S&F	Trained local health staff provided education and transport	Difficulty of maintaining camera equipment during transport; poor quality of images	Custom built foam molded cases for transport of equipment; increasing staff training	High number of patients identified with various stages of eye disease - Program 1: 41.5% of patients with DR (n=2543); Program 2: 22.6% patients with DR (n=164); Program 5: 15.6% DR+ (n= 77)
Dawson <i>et al</i> ²⁶ ; Canada	DR and Clinical Ix.; S&F	-	Delay in follow ups	-	DR screening over the first 6 years of the service - 1,221 assessments on 750 people with Type 2 DM
Dawson <i>et al</i> ¹⁷ ; Canada	Clinical Ix. and DE; Audio visual	Audio- visual material included messages from local Indigenous people	-	-	A number of audio visual based education programs targeting youths Indigenous persons

Dean <i>et al</i> ¹⁸ .; Australia	Clinical consultation and DE; VC	Telehealth trained local health staff member	Scheduling issues; Lack of staff training	Direct links with primary care team	Increasing number of teleconsultations during the first three years of service
Diamond <i>et al</i> ²² .; Australia	DR screening; S&F	-	Inferior quality of retinal images associated with photography of undilated pupils	Pupil dilation prior to DR screening	Image quality improved with pupil dilation; but the overall proportion of inadequate images remained similar different between the techniques.
Jin <i>et al</i> ¹⁹ .; Canada	DR screening, DE and Clinical Ix.; S&F	-	Waiting period for clinical decisions	-	Mean service cost per client was less than the cost of each patient travelling to a tertiary centre
Joshi <i>et al</i> ²⁴ .; India	DE; Health information kiosks	-	Accuracy about information provided by patients couldn't be validated	-	Increased awareness. 79% of the tribal people did not know that they had diabetes previously
Karagiannis <i>et al</i> ²⁰ .; Australia	DR screening; S&F	-	Un-interpretable slides; Lack of training; Poor working environments	-	Skill improvement. IHWs were trained for two weeks and 76% of slides were interpretable
Kim <i>et al</i> ¹⁶ .; Canada	DR screening, Clinical Ix. and DE; S&F	Pre-intervention community engagement	-	-	Clinics were held in existing clinic centres or local centres of community gathering
Mak <i>et al</i> ²¹ .; Australia	DR screening; S&F	-	Recruitment of patients for screenings and rescreening difficult; problems with transport of camera	-	Positive relationship between credentialing health staff and the quality of images
Mansberger <i>et al</i> ²³ .; U.S.A.*	DR screening; S&F	-	Poor quality retinal images increasing referrals	Pre-intervention training of retinal photographer in the	Better access to services. Patients receiving telemedicine services

				use of the camera	were much more likely to receive a DR screening within the first year compared with traditional surveillance group (94% versus 56%, p<0.001)
Murray <i>et al.</i> ⁶ ; Australia	DR screening; S&F	-	Shared single camera being rotated; de-skilling of staff during intervals	Shorter rotation cycles implemented	Trained local IHWs travelled to sites
Rudnisky <i>et al.</i> ²⁵ ; Canada	DR screening and Clinical Ix.; S&F	-	Separate clinic dates for clinical and imaging services	-	The median time in progressing to proliferative retinopathy was 7.6 years.

DR - Diabetic Retinopathy; DE - Diabetes Education; Ix. Investigations; S&F - Store and Forward; DM – Diabetes Mellitus

Discussion

This review of the literature was performed to identify enablers and barriers associated with the delivery of tediabetes services in Indigenous communities. The review was conducted on specific interventions which conducted tediabetes interventions for Indigenous communities. The role of the IHW was also commonly reported as a key requirement, because of their understanding and responsibility in the community. A systematic review by Caffery *et al.* on Australian based telehealth interventions for Indigenous communities too, identifies this aspect as an important component in the successful delivery of such interventions.³⁷ Acknowledgement of local beliefs and traditions through the use of cultural and spiritual elements; and appropriate community engagement were important factors associated with the establishment of telehealth services within Indigenous communities. High fail to attend rates, and the lack of technical skills associated with the telehealth equipment and collection of clinical information (such as digital images) were commonly reported barriers.

Review of literature on telehealth services and interventions in Indigenous communities, through a broader review including multiple clinical sub-specialities, may recognize many more enablers and barriers. It is important to note that these may vary according to the clinical subspecialty and the context which they are practiced in and may render invalid in different circumstances. The review only looks in to specific tediabetes interventions in Indigenous communities and lacks input from other health services. This narrow scope in reviewing of literature is identified as a critical limitation. Furthermore, there is only a small number of included articles reducing the generalisability of findings. Quality assessment of the studies showed that many of the articles have low quality of study design, hence limiting applicability of findings. The assessment, as per the ability to locally adapt a program or study elsewhere shows high or moderate levels of adaptability. But implementing these findings may be limited to local contexts and cultural sensitivities.

Limitations

Enablers and barriers were often not the primary outcome measure reported in many of the included articles. Hence, this information may have had to be extracted from the discussion by the reviewers and therefore it's highly likely not all enablers and barriers were reported.

Conclusion

Knowledge of the barriers and enablers associated with the delivery of health services within Indigenous communities is important when planning telehealth. In the right circumstances, the delivery of tele-diabetes services is promising, especially in circumstances where specialist services are not available or difficult to access.

Acknowledgements

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