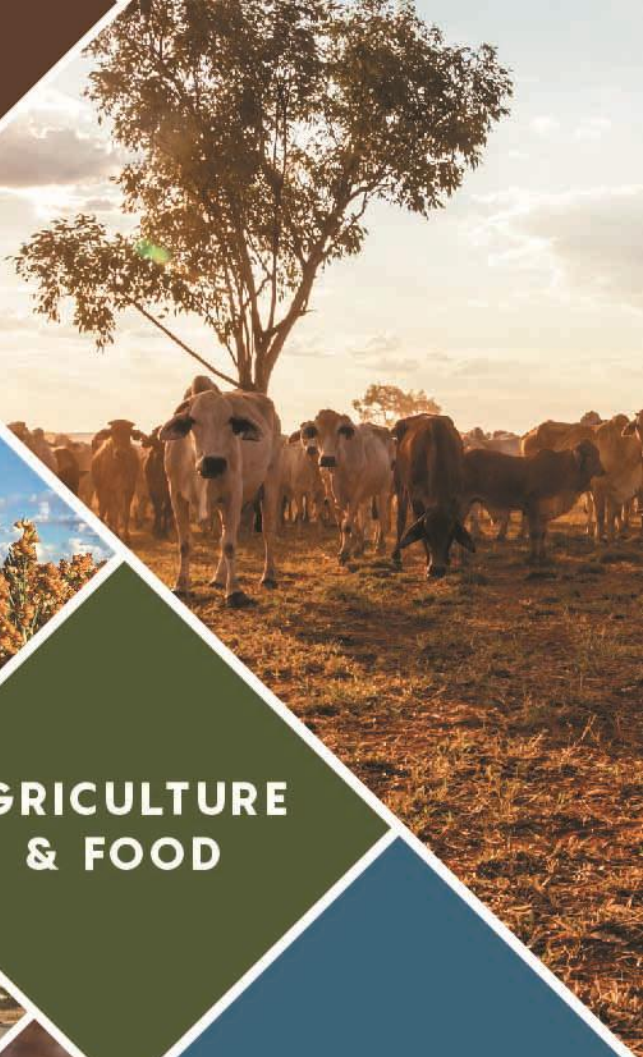
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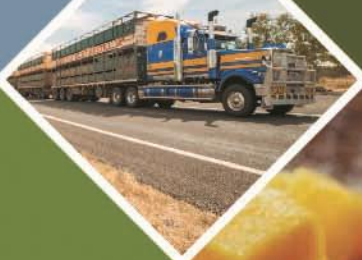






TRADITIONAL OWNER-LED DEVELOPMENT

AGRICULTURE & FOOD





Development of a simple, robust telehealth system for remote communities

H.5.1920041

Marianne St Clair and
David Murtagh

CRCNA
DEVELOPING NORTHERN AUSTRALIA

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Table of contents

Acknowledgements 1
Disclaimer 1
Table of contents 1
Document Information 6
List of Tables 7
List of Figures 8
Acronyms 10
Project Participants 12
Chapter 1. Executive Summary 13
Strategic Recommendations 17
Chapter 2. Project Background and Summary. 19
Internet connectivity: Development of new Sky Muster product Summary. 20
Telehealth Video System (TVS) Summary. 21
Academic activities 23
Conference presentation summary. 23
Abstracts and links for selected presentations. 23
Chapter 3. NBN™ Sky Muster™ Plus Performance Report. 26
Abstract. 26
Keywords. 26
Introduction 26
Methods 27
Installations for the Laynhapuy Homelands Health Service (LHS). 27
Results: Download, upload and latency results from wet season testing. 28
Outages due to weather events. 28
Download, upload and latency results from dry season testing. 29
Discussion 29
Dry season performance. 29
Wet season performance. 29
Implications for clinicians 30
Conclusion 30
References 30
Chapter 4. Video Conferencing Review 32
Introduction. 32
Background 32
Theoretical Foundation and Industry Recommendations 32
Technology requirements for telehealth 33
Practice workflow and patient bookings 34
Summary of videoconferencing software for telehealth 34

Non-health specific videoconferencing software 34
Zoom 35
Zoom for Healthcare 35
Facetime 35
Skype 35
Microsoft Teams 35
2Vu 35
Google Meet/Hangouts/Duo 36
Facebook WhatsApp 36
Pexip 36
BlueJeans 36
GoToMeeting 36
Slack 36
Health Specific Videoconferencing Software 36
National Telehealth Connection Service (NTCS) 36
Coviu 36
National Health Service Directory (NHSD). 37
1st Group 37
Conclusions/Key Recommendations 37
Easy transition from phone to video. 37
High quality video rendering over low bandwidth connections. 38
Multiple camera/video stream input 38
Remote end camera control 38
Internet connectivity 38
Clinical patient data system integrations. 38
Web RTC protocol use and browser-based functional options. 38
Wellness monitoring. 38
Helpful Links 39
References 39
Chapter 5. Development of Telehealth Video System. 41
Testing, demonstration and user acceptance testing 41
Summary of TVS testing: 41
Testing at Simbani (35 kms Southeast of Darwin). 43
Impacts of adverse weather 43
Power outages 43
Consistency in videoconference quality 43
Fundamental TVS principles. 44
Current Telehealth Videoconferencing System (TVS) and indicative costs 45
Rational for selecting TVS devices. 45
Chapter 6. Training and support material summary. 48

Introduction. 48
Posters 49
Patient attends clinic 49
Patient contacts clinic 50
How to use the Logitech Camera 51
How to use Jabra Microphone and Speaker 52
How to do an Ookla speed test. 53
How to set up a video conference with VisionFlex Tablet. 56
How to do a Zoom call 63
Internet (Sky Muster or Sky Muster Plus) Trouble Shooting Guide. 67
Guidelines for Clinicians 69
Checklist before the Telehealth Consultation 69
Steps during the Telehealth Consultation 69
Telehealth Training Links 71
What can you do if your Telecommunications Provider does not resolve your fault? 73
Chapter 7. Site visits, TVS testing and telehealth demonstrations. 77
Dundee Beach. 77
August 24th, 2021 and 13th March, 2021 77
Background 77
Snapshot summary 77
Infrastructure 78
Telecommunications services available and perceived performance 78
Health Services 78
Issues raised by the Dundee Beach and surrounding community 78
Impact of COVID-19, the need for effective telehealth & the community's investment. 79
Implementation of telehealth for the Dundee Beach Community 79
Situation in 2021 79
Dundee Beach Update 30th September, 2021. 79
Gawa 80
Background 80
Site Report: Site Visit 4-5th May, 2021 80
Next step for Gawa? 81
Longer term plans 82
The benefits of collaboration briefing for the Gawa Community 82
Transcript from the Digital Health for the Bush Forum, Darwin, December, 2020: 84
Transcript from the Digital Health for the Bush Forum, Darwin, December, 2021: 84
Transcript from the Digital Health for the Bush Forum, Darwin, December, 2021: 84
Gawa Site Report July, 2021 85
Gawa Site Report September, 2021 85
Gawa update June, 2022. 85

Laynhapuy Homelands Health Service. 87
Laynhapuy Health Service. 88
List of Laynhapuy Communities. 88
Previous telehealth implementation with Laynhapuy Homelands. 89
Telstra's Telehealth System. 91
Integration of telehealth into day-to-day clinical practice. 91
Post Project. 92
Location of project sites. 92
General Comments. 93
Airstrips. 95
Layout of clinics 95
Location of Telehealth Video System (TVS). 96
Gan Gan 98
Yilpara 101
Wandawuy 102
Site Report September, 2020. 102
Site Report September, 2021. 103
Puntukurnu Aboriginal Medical Service 104
Background. 104
Newman Healthcare Hub 106
Parnngurr Clinic. 107
Punmu Clinic. 107
Kunawarritji Clinic. 108
Site Report January, 2021: Trial of VisionFlex System at Jingalong. 108
Site Report 12-13th May, 2021: Newman and Parnngurr. 109
Site Report Parnngurr Clinic. 110
Results of speed tests at Parnngurr clinic 13th May, 2021. 113
Outcomes and findings from the May 2021 trip to PAMS Clinics. 115
Summary and conclusions: 116
Work done with PAMS between the May and September, 2021 visits. 116
Site Report 28th September – 1st October, 2021: Newman and Jigalong. 117
Site Report 30th September, 2021: Jigalong Clinic. 125
Outcomes and findings from the September trip to PAMS' Clinics. 129
Coodardie Station. 130
Background 130
Telehealth demonstration Coodardie Station Wednesday 23rd June, 2021. 130
Coodardie Station update 30th September, 2021. 130
References. 131
Chapter 8. Impacts of Medicare changes as of 1st July, 2022 132
The benefits of videoconferencing for telehealth over audio only. 132

Discrimination against some cohorts of patients and clinicians 133
Minimising transmission of COVID-19 and other airborne diseases. 133
Professional Services Review (PSR). 133
Basis for the change in Medicare Telehealth Item numbers. 133
Requirement for GPs to see the patient in person prior to being able to claim Medicare Telehealth items. 133
The impacts of the 30:20 Rule. 134
Impacts Summary. 134
Recommendations: 134
Chapter 9. Key findings from research and activities. 135
Background. 135
Issues impacting on the use and effectiveness of telehealth. 136
Expansion of telehealth from a national perspective. 137
Research sites. 141
Benefits and uptake of telehealth. 149
Issues with My Health Record (MHR) 154
Evolution of My Health Record. 155
Overall conclusions. 157
References. 159
Additional References and Resources 161

Document Information

This report is dedicated to the memory of our dear friend, Roy Martin Ebrey, whose compassionate nature and commitment to others serve as a poignant reminder of the critical importance of equitable access to healthcare.

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List of Tables

Table 1 Weather index description. 27
Table 2 Summary of TVS testing at various sites in Northern Australia. 42
Table 3 Current TVS and connectivity systems and costs 46
Table 4 Ookla speed tests Newman Clinic, 12th May, 2021 110
Table 5 Ookla speed tests Parnngurr Clinic, 13th May, 2021. 115
Table 6 List of equipment purchased by PAMS from VisionFlex. 120
Table 7 List of equipment purchased by PAMS from VisionFlex 2. 121
Table 8 Summary of results of speed tests on PAMS Jigalong WiFi (NBN Business Grade Satellite) at Jigalong clinic (approximately 165 Kms east Newman) 30th September, 2021. 128
Table 9 Ookla speed tests Jigalong Clinic, 30th September, 2021 – over Telstra 3G mobile service. 128

List of Figures

Figure 1 Telehealth Video System (TVS) – camera (and remote control device), speaker and microphone. 13

Figure 2. Map of sites the researchers took NBN Co Satellite Internet Expert and NT/SA nbn local Manager in 2018. The aim of this field excursion was to assist NBN Co staff in understanding the issues faced by remote people in relation to internet access. 20

Figure 3 Speed tests 19 - 24 January 2020. 28

Figure 4 Outages 19 - 24 January 2020.Outages varied from 2 – 26 minutes. 29

Figure 5 Three router security system. 44

Figure 6. Jabra speaker recommended for videoconferencing and telehealth. This speaker microphone combination uses computer algorithms to improve sound quality and provide noticeable audio performance during telehealth consultation. 47

Figure 7 Telehealth demonstration with diagnostic tools at the Old School House, Gawa. 80

Figure 8 Gawa Community Wi-Fi cabinet, NTD and UPS supplied by NBN Co and EasyWeb. 81

Figure 9 Gawa community as seen from a light plane. 86

Figure 10 Map of North East Arnhem Land 88

Figure 11 Kim Winter, Comcat with Satellite Dish. 90

Figure 12 Telstra Health's video conferencing equipment in Gan Gan Clinic. 91

Figure 14 Road sign at the Mainoru turn off. Note the conditions of the road in the dry season. 94

Figure 15 Main Road to Nhulunbuy with road damage following the wet season 94

Figure 16 Wandawuy Air Strip 95

Figure 17 Layout of LHS clinics. All three clinics had the same layout although different orientation. Treatment Room 3 was deemed the most suitable room for telehealth. 96

Figure 18 Location of disused Telehealth Video System. 97

Figure 19 Gan Gan Clinic 98

Figure 20 External wall of clinic room 3 99

Figure 21 Internal layout of Clinic Room 3. Note the patient bed location which was directly opposite the wall housing the disused video and camera equipment. 100

Figure 22 Yilpara Clinic. 101

Figure 23 Wandawuy Clinic. 102

Figure 24 NACCHO Member Service Baseline Profile (https://www.naccho.org.au/member-services/member-service-baseline-profiles) 104

Figure 25 Newman from the air, source Google Earth 105

Figure 26 On the 30th July 2020, PAMS and the community of Newman officially opened the newly built Newman Clinic and Administration building. 106

Figure 27 Another view of the newly built Newman Clinic and Administration building. 107

Figure 28 VisionFlex Pro Ex Hub on cart. This was the initial system PAMS were considering purchasing from VisionFlex. 108

Figure 29 David ferrying the VisionFlex, videoconferencing and computer tools into the visiting clinician's consulting room. All the gear is packed into cases with foam and o ring seals to protect against vibrations on rough roads, dust and moisture. 109

Figure 30 Demonstrating the VisionFlex Geis Camera with its extension device at the Newman Clinic. 110

Figure 31 Parrngurr Clinic, Parrngurr 111

Figure 32 Rear view of the Parnngurr Clinic providing an appreciation of the size and layout of the clinic. 112

Figure 33 The IT Hub, the NBN NTD (Network Termination Device) for the NBN Business Grade Satellite service and one of the desktops at Parnngurr Clinic. 112

Figure 34 Packing up equipment in the Parnngurr Clinic after doing telehealth demonstrations with the Activing Clinic Manager. 113

Figure 35 NBN Satellite Dish. Note the position and proximity to the metal veranda which may cause signal interference. 114

Figure 36 Another view of the NBN Business Grade Satellite Dish. Note the proximity to the metal veranda. It is possible the proximity to metal may cause attenuation and diminish bandwidth. 114

Figure 37 Speed test done on a staff member's laptop at the Newman Clinic. Note the ping of 19 ms, download of 94.52 Mbps and an upload of 34.73 Mbps. 116

Figure 38 TVS in Clinic Manager's Office at the Newman Clinic. Note the combined speaker and camera are positioned at the top of the screen and the system is on a cart so it can be moved from place to place. However, it is not easily transported from room to room due to its bulk and weight. 117

Figure 39 Training the Child Health Nurse and the NDIS Coordinator at Newman Clinic (Clinic Manager's Office) in the use of VisionFlex equipment. 118

Figure 40 Marianne demonstrating the VisionFlex digital stethoscope using the Jabra Speaker. 119

Figure 41 Demonstrating the VisionFlex ECG. Note the pulse oximeter and temperature gauge in Marianne's hands. All these devices are simple to use and can be used by non-clinicians under the supervision of a remote clinician..... 122

Figure 42 Marianne demonstrating the VisionFlex digital otoscope. 123

Figure 43 Telecommunications infrastructure at Radio Hill overlooking Newman..... 124

Figure 44 Jigalong Clinic front entrance. This is a very busy clinic usually manned by 3 nurses, a GP and an administration person. 125

Figure 45 Upload error messages received when attempting to do speed tests. 126

Figure 46 Latency error messages received when trying to do speed tests..... 126

Figure 47 When checking the TVS it was found the camera/microphone/speaker were not working. Note the error message. 126

Figure 48 Attempting to establish a videoconference in the tearoom at Jigalong Clinic. David in the tearoom 127

Figure 49 Attempting to establish a videoconference in the tearoom at Jigalong Clinic. Marianne in consultation room attempting to establish a videoconference between Marianne's Mac Book Pro and the PAMS TVS in the tearoom at Jigalong Clinic. David had the Mac Air in the tearoom. Both Mac devices were able to do videoconferencing, but PAMS TVS was not able to do videoconferencing. 127

Figure 50 TVS System at PAMS Jigalong Clinic mounted on trolley apparatus, stored in Tea Room. Not the significant ping (656 ms), good download (23.63 Mbps) and poor upload (0.4 Mbps). The poor upload ability renders the system unable to be used for videoconferences and therefore is not adequate for telehealth. 128

Figure 51 Staff accommodation at Jigalong. Note the NBN Sky Muster satellite dishes on the buildings. 129

Figure 52 The Centre for Online Health has published Medicare consultation reimbursement data showing significant phone-based telehealth using Covid MBS item numbers..... 137

Figure 53 Specialists had been using more Medicare videoconferencing pre-Covid and since March 2020 have increased uptake of videoconferencing by a greater proportion than GPs..... 138

Figure 54 Psychiatrists have been using more Medicare videoconferencing pre-Covid and since March 2020 have increased uptake of videoconferencing by a greater proportion than GPs..... 139

Figure 55 There has been more mental health Medicare videoconferencing pre-Covid and since March 2020 have increased uptake of videoconferencing by a greater proportion than GPs..... 139

Figure 56 There has been more Allied Health Medicare videoconferencing since March 2020. There has been increased uptake of videoconferencing by a greater proportion than GPs. There were no Medicare items for Allied Health pre-Covid 140

Figure 57 There has been more Nurse Practitioner Medicare videoconferencing since March 2020. There has been increased uptake of videoconferencing by a greater proportion than GPs. There were no Medicare items for Nurse Practitioners pre-Covid 140

Acronyms

Abbreviation	*Full name*
ACCAN	Australian Communications Consumer Action Network
ACCHO	Aboriginal Community Controlled Health Organisation
ACRRM	Australian College of Rural and Remote Medicine
ADHA	Australian Digital Health Agency
AHCWA	Aboriginal Health Council of Western Australia
AMS	Aboriginal Medical Service
AMSANT	Aboriginal Medical Services Alliance Northern Territory
B4BA	Broadband for the Bush Alliance
CDU	Charles Darwin University
CHF	Consumers Health Forum of Australia
CHIA	Certified Health Information Australasia
CPD	Continuing Professional Development
CRCNA	Cooperative Research Centre for Developing Northern Australia
DCC	Darwin City Council
DNA	Did not attend. Describes the situation where the patient does not attend a scheduled appointment
DoH	Department of Health
ECG	Electrocardiogram
GP	General Practitioner
GPS	Global Positioning System
ICD	International Classification of Diseases
ICPA	Isolated Children's and Parent's Association.
ICPA NT	Isolated Children's Parents' Association of the Northern Territory
KAMS	Kimberley Aboriginal Medical Service
LHS	Laynhapuy Homelands Health Service
Mbps	Megabits per second
MHR	My Health Record
MP	Medical Practice
NBN Co	National Broadband Network Corporation
NDIS	National Disability Insurance Scheme
NFF	National Farmer's Federation
NP	Nurse Practitioner
NRHA	National Rural Health Alliance
NT PHN	Northern Territory Primary Health Network
NTCA	NT Cattlemen's Association
OOP	Out of pocket expenses
PAMS	Puntukurnu Aboriginal Medical Service
PHI	Private Health Insurance

PHN	Primary Health Network
PSR	Professional Services Review
RACGP	The Royal Australian College of General Practitioners
RRRCC	Rural, Regional and Remote Communications Coalition
WACHS	Western Australia Country Health Service
WONCA	World Organization of Family Doctors

Project Participants

Simbani Research
Emerge IT Solutions
Laynhapuy Homelands Aboriginal Corporation
Puntukurnu Aboriginal Medical Service
SkyMesh Pty Ltd
Synapse Medical Services
VisionFlex Pty Ltd
Charles Darwin University
BIZ365

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Chapter 1. Executive Summary

Project Summary.
This project developed a simpler, more robust and affordable telehealth system using NBN satellite connectivity and a range of telecommunications and diagnostic tools to enhance telehealth access and use in remote Aboriginal Community Controlled Health Organisations (ACCHOs) and other remote locations such as cattle stations.

The project team developed and piloted innovative technological solutions:

- The Sky Muster Plus product (in collaboration with NBN Co and SkyMesh).
- A Telehealth Videoconferencing System using affordable hardware and software, and, a range of support tools for telehealth implementation at a number of remote sites.

The overall aim of the project was to reduce the disparity of health service delivery between Urban and Rural, Regional and Remote (RRR).

Approximately 500,000 people live in RRR (Modified Monash Model Regions 6 & 7). The have a disproportionate access to services including health services and consequently poorer health outcomes (National Rural Health Alliance, 2016). RRR people in Northern Australia have a number of challenges; remoteness, low population density, unreliable communications and power (typically local generators), limited access to health services, poor roads (many people are isolated for months in the wet season), severe weather events, dust, high temperatures and humidity. Many RRR still people have issues in accessing reliable, adequate and affordable internet.

This project focused on three areas:
1. Internet connectivity: The development of an NBN Sky Muster product specifically designed for telehealth.

2. Telehealth Video System: The development of a reliable, simple, cost effective, and easy to use Telehealth Video System (TVS) using a combination of hardware (computers, smart phones, cameras) and software (such as video conferencing tools) that will work well with NBN Sky Muster.

3. Operator Capacity: Development of training, support, trouble-shooting and messaging tools for Aboriginal Community Controlled Health Organisations (ACCHOs).

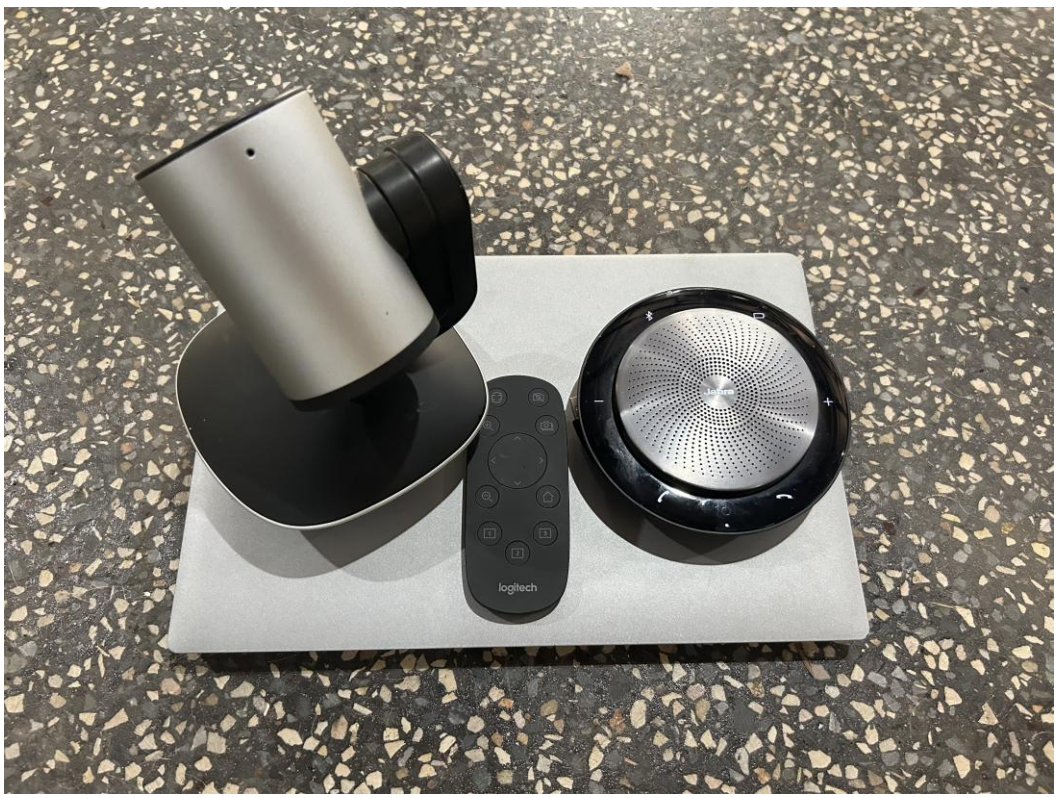


Figure 1 Telehealth Video System (TVS) – camera (and remote control device), speaker and microphone.

Collaboration involves participants (individuals or organisations) working together to achieve something they cannot do as individuals/organisations. The project team use the theory of collaboration (common goals, collaborative leadership, distributed power, shared decision-making, time, nurturing, good communication, relationship-building, shared-learning, trust-building, networking) to facilitate development of this innovative healthcare model. Collaboration is resource-intensive but the benefits may provide remote communities increased access to primary healthcare and improve health outcomes. Can this collaborative approach "Close the Gap"?

Key findings and outcomes:

1. Telehealth can be successfully delivered over SkyMuster™ Plus Internet Service (testing indicated typical downloads of 29 Mbps down, >9 Mbps up and a fairly consistent ping (delay) of 550-570 ms). Testing in the monsoonal period of the 2019-2020 wet season found outages of between 2-26 minutes during storm periods and the system quickly recovered.

2. Zoom was found to be the most suitable videoconferencing platform as it was easy to use, worked well over satellite internet and allowed far-end camera control. This allows the remote clinician to zoom into the area on the patient to aid diagnosis.

3. Telehealth can be done using inexpensive resources (laptops, smart phones, tablets, Jabra speaker/microphone ($300) and video cameras)

4. The Video camera PTZ Pro 2 ($1,100) provided the remote clinician with excellent lens quality and pan, tilt and zoom functions. In combination with Zoom, this camera allows remote end camera control and adequate zoom and picture quality for high quality video imaging.

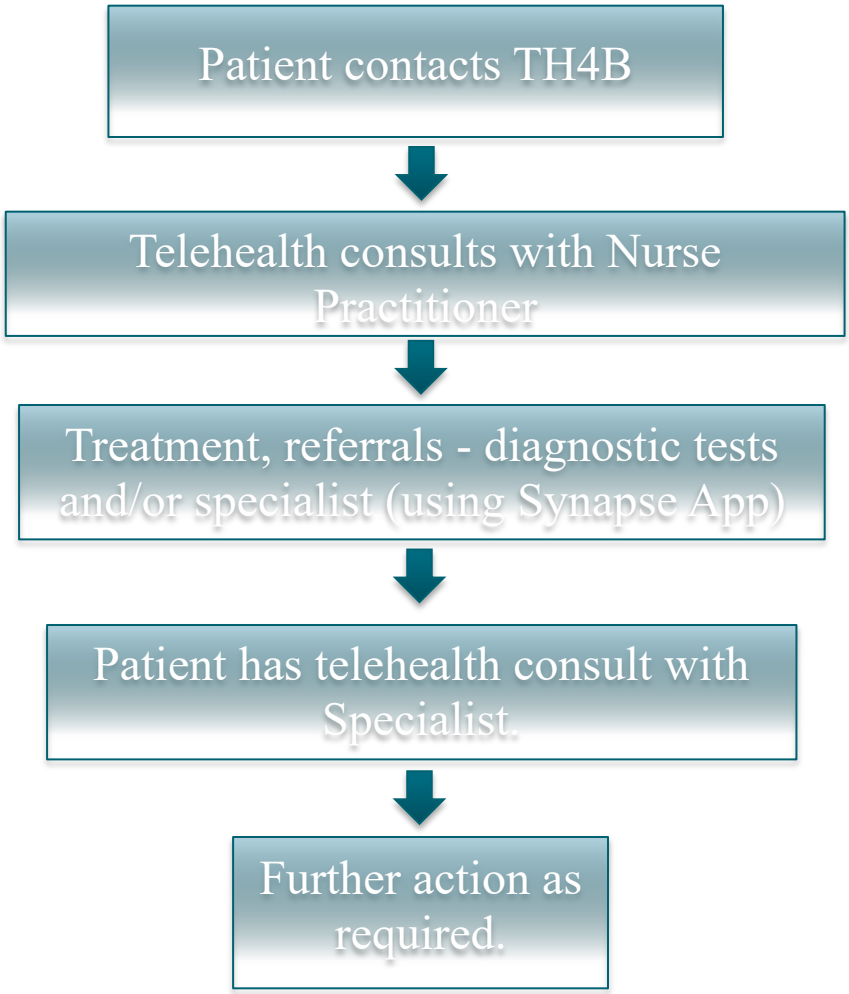
5. Clinicians can more accurately assess patients using videoconferencing rather than phone.

6. Telehealth experience can be enhanced with the provision of simple to use and clear training and support materials.

Community Wi-Fi was established for the Gawa Community and telehealth demonstrations led to the community wanting increased access to health services via telehealth. This will be explored in future research.

Nurse Practitioners provide patient-centered care similar to the GP role, are skilled and qualified to diagnose, prescribe & treat patients, can see patients via telehealth without initial in-person requirement, can access Medicare rebates, can refer patients to specialists, diagnostic tests and allied health professionals. The Synapse mobile application facilitates billing and referral pathways and can also assist in loading patient data to My Health Record (MHR).

A new model of service (Telehealth for the Bush (TH4B) was developed connecting doctors, specialists and nurses to patients in the same way ride sharing companies connect drivers. This technology combined with the NP pathway have evolved to provide access to a wide range of health services for regional and remote people.


Patient contacts TH4B
Telehealth consults with Nurse Practitioner
Treatment, referrals - diagnostic tests and/or specialist (using Synapse App)
Patient has telehealth consult with Specialist.
Further action as required.

This model does require a high level of collaboration and administration with the following issues identified:

- Requires access to adequate internet
- Difficulties in data transfer between diagnostic services, referring clinicians and patients
- Primary care data not uploaded to MHR
- Diagnostic services refusing to upload data to MHR
- Diagnostic services sending results to referring clinician by post (causing extensive delays)
- No funded patient-end support
- Lack of patient data interoperability
- Collaboration and administration required (not funded)
- Changes to MBS may exacerbate difficulties in accessing health services.

Preliminary conclusions from trialing this model of service delivery indicate TH4B can:

- Supplement existing services.
- Link into existing services.
- Expand access to a wider range of health services for RRR people.
- Improve health outcomes for RRR.
- Potentially can address the disparity in health service delivery for RRR people.
- Potentially assist in “Closing the Gap” in health for remote Aboriginal people.

Future research will examine how this model can be effectively be implemented and sustainably funded in a very remote Aboriginal Homeland community utilizing local community members trained as Telehealth Technicians.

Barriers and issues identified:
Barriers to telehealth include lack access to adequate and affordable internet, clinicians, (especially GPs) are reluctant to use telehealth including via videoconferencing, lack of patient-end support and the lack of collaboration between service providers results in a siloed approach to healthcare.

There is a need for resourced patient end support particularly in remote Aboriginal Homelands. “Telehealth Technicians” will support telemedicine providing on-community jobs and improve the social determinants of health.

Below is a brief outline of each chapter. Many of the chapters are stand-alone documents which have been produced during the course of the project and are available on the project website as separate documents. Therefore, there is some overlap in content to ensure each report/chapter includes the required detail.

Chapter 1. Executive Summary: Provides a brief overall summary of the outcomes from the project.

Chapter 2. Project background and summary: Provides relevant background to the project, summarises previous work with some of the homeland communities, project partners and NBN Co and summarises activities and outcomes of the of the project.

Chapter 3. NBN™ Sky Muster™ Plus Performance Report: This chapter is the paper produced early in the project reporting on the performance of the Sky Muster™ Plus internet service and its suitability for telehealth. This chapter also contains a summary of telehealth implementation using the NBN™ Sky Muster™ Plus product at the commencement of this project.

Chapter 4. Video Conferencing Review: The chapter presents the review of videoconferencing software done early in the project and outlines the conclusions drawn from that review.

Chapter 5. Development of Telehealth Video System (TVS): The chapter outlines the final recommended TVS developed by this project. This document was updated iteratively (7 times) through the project.

Chapter 6. Training and Support Material Summary: Training and support materials were developed iteratively throughout the project. Specific materials were developed for each of the participating Aboriginal Medical Services. More generic forms of these materials were made available on the project website and the final version of these are presented in this chapter.

Chapter 7. Site visits, TVS testing and telehealth demonstrations: This chapter summarises site visits and telehealth demonstrations done throughout the project.

Chapter 8. Impacts of Medicare Changes as of 1st July, 2022: During the course of the research activities issues were identified with the proposed changes in Medicare. A Media Release was developed by the project team to outline the issues and their potential impacts on telehealth implementation. This chapter presents an updated version of that Media Release.

Chapter 9. Key findings form research and activities: This chapter outlines key issues impacting the implementation of telehealth, barriers to telehealth and recommendations for the expansion of telehealth with a focus on regional and remote Australia. The chapter also outlines proposed future research and activities generated by the project.

Chapter 10. Strategic recommendations: This chapter presents the strategic recommendations and relevant information generated by the project.

Strategic Recommendations

Key priority actions for sector development	Action owner and key partners	Pathways to implementation and timelines	Intended industry impacts
Operator Capability: Develop ICT network configuration best practice standards and guidelines	**B4BA, NBN Co**, NACHO, other ACCHOs, PHN who have RRR responsibilities, ADHA, AIDH.	Education and training based on the standards and guidelines for ICT support staff to improve the quality of user support for regional and remote healthcare organisations. This is a long-term implementation and may take 5 years. Ideally, lead agencies (NACHO, ACCHOs, PHNs) would be funded to support and train ICT providers to use the standards and guidelines.	Increase access of telehealth to patients including via videoconferencing. Increase access to patient data for clinicians. Improve and increase reliability of internet. Increased data security. Improve the telehealth experience by improving telecommunications services including videoconferencing, access to patient data and reduce replication of diagnostic testing as clinicians would have better access to patient data.
Operator Capability: Improve digital literacy and empowerment of RRR healthcare consumers and providers.	**B4BA** to work with NBN, NRHA and NACCHO to disseminate basic support materials, other ACCHOs, ARC Centre of Excellence for Automated Decision-Making and Society, PHNs who have RRR responsibilities, CHF, ADHA, ACNP, RACGP and ACRRM	Develop parallel tool kits to support training for clinical providers and healthcare consumers. Deliver targeted training through regional roadshows (NBN Co, nbn local, various conferences). Perhaps through cultural festivals (such as Garma and the Barunga Festival (NACHO, ACCHOs) and through the rural show circuit (nbn local). Should be for a minimum of 3 years, but realistically should be on-going. Possibly measure through survey.	Increase digital skills and consumer/clinician capability and empowerment. This may lead to more clinics developing skills which would facilitate them using more digital tools such as videoconferencing, smart diagnostic tools, remote monitoring tools.
Operator Capability: Improve health literacy and empowerment of	**B4BA** (through DH4B Forums and B4BA network), NRHA, CHF, NACHO, other ACCHOs,	B4BA to liaise with NRHA, CHF and NACCHO for them to develop parallel tool kits for the development of health literacy and support healthcare consumers. Simbani can provide telehealth support materials.	Increase healthcare provider and consumer capability. Reduce technical overhead to virtual consultations.

RRR healthcare consumers.	CHF, PHNs who have RRR responsibilities, ADHA, ACNP, RACGP and ACRRM	Deliver targeted training through newsletters and websites (NRHA, NACCO and ACCHOs). Initially could be for 3 years, could be measured by a survey tool, but realistically would be on-going.	Increase continuity of care for RRR healthcare consumers by making access to services more convenient.
Produce and trial new health service models to incorporate telehealth virtual care for RRR areas.	**Simbani**, B4BA, **NRHA**, RFDS, NACHO, other ACCHOs, PHNs who have RRR responsibilities, ADHA, ACNP, RACGP and ACRRM	The Telehealth for the Bush (TH4B) trial has demonstrated a valuable, potential healthcare pathway for RRR consumers. The next steps for TH4B are to incorporate it into existing RRR based healthcare providers to increase continuity of care and access to health services. This is currently being investigated in the CRCNA Telehealth Technicians Project. Simbani providing the NRHA with supporting data to further support their lobbying to implement a patient-centred model of care – Rural Community Controlled Health Organisations (RCCHOs). This proposed model of care is modelled on the ACCHO model. NRHA is seeking funding to trial the RCCHA model of service delivery. B4BA may be able to assist in establishing a trial of this model in the GP sector, probably in the NT as this is a small jurisdiction and presents less risk to the Federal Government as it deals with small population numbers. This would need to be a trial for 3 years and would need to be measured qualitatively.	Increase RRR healthcare provider and consumer access through improved models of care. Increase continuity of care for RRR healthcare consumers by providing access to currently healthcare services (such as specialist and allied health), more convenient and available through existing RRR based healthcare services. Provide funds for existing RRR healthcare providers to incorporate these technology and healthcare practice changes without financial risk or compromising patient safety.

Chapter 2. Project Background and Summary.

This project developed a simpler, more robust and affordable telehealth system using NBN satellite connectivity and a range of hardware, software, telecommunications and diagnostic tools to enhance telehealth access and use in remote Aboriginal Community Controlled Health Organisations (ACCHOs) and other remote locations such as cattle stations.

The project team developed and piloted innovative technological solutions; a Sky Muster product (in collaboration with NBN Co and SkyMesh) was found to be adequate for telehealth via videoconferencing, a more affordable, reliable (robust) and easy-to-use Telehealth Videoconferencing System (TVS), and a range of support tools for telehealth implementation at a number of remote Aboriginal communities.

This project focused on three areas:

1. Internet connectivity: The development of an NBN Sky Muster product specifically designed for telehealth.

2. Telehealth Video System: The development of a reliable, simple, cost effective, and easy to use Telehealth Video System (TVS) using a combination of hardware (computers, smart phones, cameras) and software (such as video conferencing tools) that will work well with NBN Sky Muster.

3. Operator Capacity: Development of training, support, trouble-shooting and messaging tools for Aboriginal Community Controlled Health Organisations (ACCHOs).

Below is a summary of work done on this project from December, 2019 to June, 2022. This is followed by a series of individual reports which provide more detailed information about specific aspects of the research and associated activities.

Internet connectivity: Development of new Sky Muster product Summary.

The researchers have worked closely with NBN Co since 2017 to develop a product more suitable for remote area needs particularly with respect to videoconferencing for telehealth. At that time the researchers were involved with Broadband for the Bush David Murtagh (Board Member) and Marianne St Clair (Executive Officer). They also participated in the Rural, Regional and Remote Communications Coalition (RRRCC) hosted by the National Farmers Federation (NFF).

As a result of this work, in 2018 NBN Co sent their NT/SA nbn local Manager (Tim Saul) and the satellite internet expert (Rocco Buzzo) to Darwin so the researchers could take them both to inspect the problems faced with internet access in a number of remote communities including Galiwin'ku, Gawa, Yirrkala, Gan Gan, Garrthalala, Gurrumuru, Dhalinybuy and Bremer Island (https://simbani.files.wordpress.com/2019/03/20180608-laynhapuy-homelands-b4ba-1.pdf). The development of the NBN Sky Muster Plus product by NBN Co was the product of this collaboration and the work done with Broadband for the Bush and RRRCC.

This new NBN Co product not only meets the requirements for telehealth in a small clinic or other remote setting such as cattle stations (see NBN™ Sky Muster™ Plus Performance Report below) but also meets the requirements for videoconferencing for education, training and other activities. The project team have continued to test the Sky Muster Plus service at their property and have found it to be adequate for telehealth including using internet enabled smart diagnostic tools while doing videoconferencing concurrently. Performance was subject to weather conditions and availability of power.



Figure 2. Map of sites the researchers took NBN Co Satellite Internet Expert and NT/SA nbn local Manager in 2018. The aim of this field excursion was to assist NBN Co staff in understanding the issues faced by remote people in relation to internet access.

Telehealth Video System (TVS) Summary.

The TVS and VisionFlex tools work well (that is, clear picture, small amount of latency (ping), little freezing and good sound quality) when there is adequate internet access (ping not greater than 650 ms, stable minimum download of 2 Mbps and stable minimum upload speed of 2 Mbps. However, when the internet is poor, performance is limited. The researchers quantified the internet requirements for both the TVS and VisionFlex systems. A number of speed tests (download, upload and ping (latency) have been done at a variety of sites (see Table 1).

Minimum requirements for videoconferencing.

The minimum requirements of internet for good performance (clear picture, minimal freezing of video, good quality sound) of the TVS and VisionFlex equipment is:
• Minimum 2 Mbps of stable download and upload • Ping of less than 650 ms.

TVS uptake: A number of stakeholders (VisionFlex, Synapse, both project partner ACCHOs and a Nurse Practitioner working with the research team) have purchased the Jabra speaker or a similar Jabra microphone/speaker. A number of project network members have also purchased the Jabra speaker. VisionFlex provide the Jabra Speaker and the Logitech camera with their equipment as standard issue. Uptake of the camera has been limited. This may be for 2 reasons: 1. Expense not perceived as warranted; 2. Clinic already has video conference resources installed. However, in some cases, the systems installed in those clinics are too complex and difficult for the staff to use (as is the case with Parnngurr, Jigalong and previously with the Telstra system at Laynhapuy Homelands Health Service (LHS). Puntukurnu Aboriginal Medical Services (PAMS) has purchased a Logitech integrated camera, microphone and speaker system as recommended by their Information and Communications Technology (ICT) provider. Staff continue to have difficulties in establishing a reliable videoconference with the equipment and internet connectivity available.

A combined video camera, microphone and speaker was purchased by the project (Logitech Conferencecam Connect SI). This was approximately $600 and testing indicated videoconferencing performance was inferior, and it is not recommended for telehealth at this time. The built-in camera uses digital zoom instead of optical zoom which does not provide good quality resolution at extreme zoom.

The recommended TVS has been tested with a variety of stakeholders and different locations and acceptance testing done. The project team continue to look for more cost-effective options. A combined and cheaper option may have a greater uptake in small clinics or non-clinical situations (eg homeland communities, cattle stations, roadhouses, etc).

The SkyMuster Plus service was deployed at the following communities in the Laynhapuy Homelands at the start of the pandemic and as part of this project:

- Gan Gan
- Dhalinybuy
- Wandawuy
- Yilpara
- Garrthalala
- Gurrumurru
- Dhuruputjpi.

LHS have used videoconferencing enabled telehealth as Business As Usual (BAU) since installation of the SkyMuster Plus services and have also increased Medicare income. The LHS Clinic Manager has been provided a high level of support in the early stages of this project. This was done remotely as the researchers were unable to travel to the homelands due to Covid travel restrictions. The Clinic Manager became known to staff as the “ICT Expert” and has moved to a higher level position overseeing all the Laynhapuy Homelands ICT services. This demonstrates the value of providing intense support and training to key, long term staff within an organisation.

Smart Diagnostic Equipment: It was decided to purchase a set of VisionFlex equipment as the loaned set was invaluable when demonstrating the opportunities accessible through telehealth. It has been invaluable for clinicians on-site to gain first-hand experience with the equipment and has been useful when doing telehealth demonstrations with on-

site patients and remote clinicians. The system has been used for training the Child Health Nurse and NDIS Coordinator at PAMS on the researchers' September 2021 site visit. Both LHS and PAMS have purchased VisionFlex equipment. The researchers and VisionFlex continue to support clinicians in the use of this equipment.

David Murtagh has worked both for the Aboriginal Medical Services Alliance of the NT (AMSANT) and for Remote community-controlled health services as an ICT technician, auditor and advisor for the past 25 years and has helped Aboriginal Community Controlled Health Organisations (ACCHO's) across the country to define and improve security and performance standards for Clinical Information Systems. He has the technical skills to make these systems work more effectively and has assisted ICT providers to configure Communicare both securely and efficiently.

PAMS's Clinical Information System (CIS) is a software product (Communicare) that was initially created in the early 1990's. The product is an old 32bit SQL based system that has several configuration options. These include an off-line mode for remote work with poor or no internet connectivity. Generally, Communicare is configured this way when the internet service is not reliable. The downside of this setup strategy is the synchronisation process requires a full copy of the database to be copied every time the update is done. PAMS is currently copying this database which is substantial (ie up to 100GB) to every computer at their remote sites. This is currently being done using the same internet connection used for videoconferencing. It is suggested a separate internet connection may resolve this issue.

The staff in each of these remote clinics do this process at least once a day. The new Quality Improvement Manager is now suggesting this be done twice a day. So, for Parnngurr clinic, this represents 12 database synchronisations a day, creating significant network traffic and additional work for the lone nurse (Parnngurr is a single nurse clinic).

An alternate configuration for Communicare is to host the desktop client in a datacentre or centralised server environment. This requires remote desktop software. PAMS is using this configuration in their Newman site and for remote home access. This is also a significant security risk in its current configuration. Best practice guidelines defined by Microsoft (https://www.microsoft.com/security/blog/2020/04/16/security-guidance-remote-desktop-adoption) suggest this be done using a Virtual Private Network (VPN).

One of the issues with videoconferencing performance is internal network contention (ie other internal traffic). In a home situation this is often seen when teenage children are playing internet-based games and their parents are on Zoom or Netflix. In these remote clinics, if Zoom or another videoconferencing system is running at the same time as the Communicare synchronisation processes there is poorer video conference performance.

Several clinical sites have been visited and there are clearly issues with ICT providers not ensuring adequate systems infrastructure for video-conferencing. These revolve mainly around the standard workstation installations not allowing upload traffic back to the internet. Internet upload is vital when undertaking videoconferencing-based telehealth because video images need to be transferred to and from the remote clinic. The situation observed indicated a non-PAMS workstation or iPhone on the same Wi-Fi network had on average 7 Mbps upload. The same speed test on PAMS workstations resulted in a consistent 0.3mb/s which is not suitable for videoconference-based telehealth.

These technical issues can become very complex and may be impacted by other site or wide area network-based configurations. Conversations with ICT providers result in confusion for non-technical staff and possibly instigate questions of trust rather than valid and technically correct solutions being created. This is why AMSANT offered David Murtagh's assistance to ACCHOs and their ICT providers to improve security and performance of ICT environments. ICT providers, as any other business entities, can be very protective of their customer relationships and established income streams so it was important a respectful and technical approach was taken to assist ACCHOs and their ICT providers to improve their ICT performance and security.

In summary, PAMS does use videoconferencing based telehealth and videoconferencing for staff meetings on a regular basis, but has difficulty in accessing good quality videoconferencing reliably. Additionally, clinical staff have limited and varied levels of ICT expertise to establish videoconferencing or troubleshoot issues arising. Some onsite and remote (via videoconference) training has been provided by the researchers as well as some support materials (see Chapter 7). Training and support have also been provided by the researchers and VisionFlex staff in the use of VisionFlex equipment.

Academic activities.

Conference presentation summary.

2020

Health Informatics Virtual Conference 12 October, 2020. A tool for remote health service delivery NBN™ Sky Muster™ Plus: Helping remote communities access health services during the COVID-19 Pandemic. This was the first conference presentation for the NBN Sky Muster Plus testing done over the 2019 – 2020 wet season.

2021

Digital Health Summit 21-22 February Conference presentation: Abstract submitted and accepted: Digital Health Institute Summit Melbourne 18-19 October, 2021. However, the conference was postponed to 21-22 February and David presented on behalf of the project team. The aim of this presentation was to promote the understanding of how telehealth can increase access to a range of health services for remote people, thereby potentially reducing the gap between Urban and RRR (Rural, Regional and Remote) areas. In addition to promoting the use of telehealth using video conferencing and smart diagnostic tools, the presentation provided an update on the CRNCA Telehealth Project. This presentation was required to meet Milestone 31. However, due to the conference being postponed to February, 2022 to meet the objectives the presentation and Milestone 31, the presentation has been distributed through the Broadband for the Bush Network and the Project Network (as per communications plan, Appendix 3) and made available on the project website. An expanded version of the presentation was done at the DH4B Forum on 9th November, 2021 in Darwin. This was recorded and made available on the project website.

2022

Abstracts were submitted for 2 conferences in 2022, both being accepted. The first conference presentation was at the Australasian Institute of Digital Health's Digital Health Summit (International Conference). The second presentation was in August 2-4 in Brisbane at the National Rural Health Alliance's 16th National Rural Health Conference (a biennial national conference).

2023

A presentation summarising the project's outcomes was done at the international MedInfo23 conference in Sydney in July, 2023. These conferences are aimed at the Health Informatician and Clinician and Rural/Remote service providers audiences. These audiences are generally more open to digital health tools.

Abstracts and links for selected presentations.

Below are the Abstracts for selected presentations and links provided for power point presentations and video if available. Note, some presentations were essentially repeated presentations, so repeated presentations are not included. All presentations are available on the project website.

Digital Health Institute Summit 2021.

Collaboration in Action: Can community Wi-Fi and Telehealth "Close-the-gap" in remote Aboriginal Health? Abstract.

Simbani Research, VisonFlex and Synapse Medical supported Gawa community and NBN Co as the community WiFi was installed at the Old School building. The first telehealth consultations were delivered over the NBN SkyMuster Plus satellite service with managed Wi-Fi. Telehealth equipment was deployed for the community's first community driven telehealth demonstration and consultations. All the community members came to see the telehealth equipment and how it worked. Elders requested education about telehealth for the school children, and the children were sent to the Old School in rotation so all the children and teachers could see telehealth in action. Seventeen members of the community had health checks supervised by an Aboriginal Nurse Practitioner located in far north Queensland. A number of community members were identified needing further follow up.

Nurse Practitioners (NP) are highly qualified Registered Nurses. NPs are educated and authorised to work independently, diagnosing, and treating patients in collaboration with medical practitioners. NPs can provide in person and telehealth consultations, access Medicare rebates, provide prescriptions and access to PBS medicines, order diagnostic tests and refer patients to specialists. National standards ensure NPs provide high quality, patient centred care working in similar roles as GPs.

Synapse Medical's mobile phone application is a medical billing system which facilitates clinicians' billing Medicare from their mobile devices and can also be used to connect primary health care providers, specialists and patients for telehealth appointments. VisionFlex provides telehealth diagnostic devices as well as a telehealth platform. These

services combined with the NP pathway have essentially “Uberised” access to a wide range of health services for regional and remote people.

Through collaboration, this new model of service delivery may address gaps in health care for regional and remote areas, including remote Aboriginal Communities.

Collaboration in Action: Can Community Wi-Fi help to Close the Gap in remote Aboriginal Health?

Abstract for 16th National Rural Health Conference, Brisbane 2-4 August, 2022.

Gawa community is a remote Aboriginal community on Elcho Island 600 kms from Darwin by air and comprises of approximately 20 Adults and 46 children. Community leaders Dr Kathy Guthadjaka AM and her husband Colin Baker had to relocate to Darwin to access essential health services. However, they remain active leaders for their community and their engagement with Gawa people has been enhanced via community Wi-Fi.

Simbani Research, VisionFlex and Synapse Medical supported the Gawa community and NBN Co to install and use the new Community Wi-Fi. The first telehealth consultations were delivered over the NBN Sky Muster Plus satellite internet connection. The managed Wi-Fi provided the community with a level of control over content-filtering and time-of-day access. Initially, the community requested Wi-Fi be available from 3 to 6 pm. However, a few weeks later, the community requested availability be extended (2 to 7 pm) to expand access to services, without making the Wi-Fi available for children during school time.

Telehealth equipment (videoconferencing and smart diagnostic tools) was deployed for the community’s first community driven telehealth demonstration and consultations in May, 2021. A number of community members came to see the telehealth equipment and how it worked. The children were sent to the Old School in rotation so all the children and teachers could see telehealth in action. Seventeen members of the community had health checks supervised by an Aboriginal Nurse Practitioner located in far north Queensland.

Being able to communicate through the community Wi-Fi with their trusted community leaders located in Darwin, has provided the people at Gawa the opportunity to have their questions answered and gain the assurances they needed to have the COVID-19 vaccinations.

It is well known there is a shortage of health professionals in the Northern Territory, and this is especially true for remote locations. The Gawa community is keen to increase access to a wider range of health services via telehealth to supplement current services and move to a pro-active primary health care model. This will entail training local community members as “Telehealth Technicians” to support videoconferencing and the use of smart diagnostic tools. This may also provide more on-community jobs and improve the social determinants of health. Community Wi-Fi and telehealth may be part of the solution to this long-term problem and help to “Close the Gap” in remote Aboriginal Health.

Telehealth for the Bush Trial: An innovative model of service delivery for remote Australia

Abstract. For National Rural Health Alliance Academic Conference

Aim: The Telehealth for the Bush (TH4B) Trial aims to deliver a wider range of services to regional, remote and very remote areas where, typically, health services are limited and health outcomes are poorer relative to urban locations.

Setting and participants: There has been a long history of the Northern Territory having limited health services due to a lack of clinicians, particularly GPs, specialists and allied health professionals. This situation is more acute in remote Aboriginal communities. Much of the Territory is “cattle country” with cattle producers and their families having to drive up to 7 hours to see a GP and possibly further for specialists and allied health professionals. They also experience long waits for services. For example, children are often not diagnosed with learning difficulties (let alone being treated) until they start interacting with others through School of the Air or similar services.

Design and methods: Nurse Practitioners (NP) are highly qualified, are educated and authorised to work independently, diagnosing, and treating patients in collaboration with medical practitioners. NPs can provide in person and telehealth consultations, access Medicare rebates, provide prescriptions and access to PBS medicines, order diagnostic tests and refer patients to specialists. There are approximately 2,000 NPs in Australia. National standards ensure NPs provide high quality, patient centred care using a similar (but more limited) scope of practice as GPs.

Synapse Medical and Simbani Research have established the TH4B Trial in response to issues raised by NT Isolated Children’s and Parents Association. Synapse Medical’s mobile phone application facilitates clinicians’ billing Medicare from their mobile devices and provide referrals to specialists and allied health care providers. These services combined with the NP pathway have essentially “Uberised” access to a wide range of health services for regional and remote people via telehealth.

Results: Twenty-four Territorians (mostly remote) had consultations with NPs, often requiring diagnostic services and access to specialists and/or allied health professionals. The referral pathway was successfully managed through the

synapse application. However, there were interoperability issues between jurisdictions for diagnostic and pathology services with NPs, specialists and allied health professionals not being able to access the results of services requested by those clinicians. The immediate solution was for patients to obtain the results and provide to the clinicians. The preferred solution would be all services entered into My Health Record in a form that could be easily accessed by all parties.

Conclusion: This paper presents results from case studies from the patient and clinician perspectives on this new model of health service delivery and addresses the question: Can utilizing the services of NPs through this innovative business model close the gap in the health divide between regional/remote and urban health?

Chapter 3. NBN™ Sky Muster™ Plus Performance Report.

Abstract.

It has been demonstrated that telehealth can be successfully implemented via high-quality (mining-grade), expensive satellite internet. However, the lack of adequate and affordable internet remains a barrier to telehealth. This research aimed to determine if the NBN™ Sky Muster™ Plus satellite service would be adequate for telehealth in remote areas. Consumer grade Sky Muster™ Plus services were installed at a rural property approximately 35 kms south of Darwin. The area is subject to severe weather events and cyclones in the wet season. The quality (ping (or latency), download and upload speeds) were monitored during the wet season at different times of the day and night including throughout moderate weather events. The Ookla speed test was used to monitor internet quality. It is important to note the assured rate for Sky Muster Plus is 25 Mbps down and 5 Mbps up. Performance in light weather seemed reasonably consistent with the mean download speed of 29.02 Mbps and the mean upload speed of 8.82 Mbps, with an average ping of 567ms (n = 497). However, during moderate weather, while outages occurred (2-26 minutes), the system recovered quickly. This internet service was used successfully with a variety of video-conferencing tools. These initial results demonstrated the Sky Muster™ Plus service was adequate for videoconferencing and therefore for videoconferencing for telehealth. These preliminary data were provided to Laynhapuy Homelands Health Service (LHS) in January 2020.

During the early stages of the COVID-19 Pandemic, LHS requested assistance to have seven Sky Muster™ Plus Services installed as a matter of urgency so telehealth could be implemented in their East Arnhem remote Aboriginal communities. At the time, the communities were closed and there were extensive restrictions on travel within the Northern Territory. Through collaboration between NBN Co, SkyMesh (the Retail Service Provider), JMAC Comms (the contracted installer), the NT Senator's Office, the Chief Minister's Office and the researchers, 7 Sky Muster™ Plus satellite installations were done within approximately 3 weeks of the request. LHS were so impressed with the performance of these services they later requested an additional 4 installations for their communities via their retail service provider, SkyMesh. This paper will describe the process of evaluation and outline the preliminary results from testing the Sky Muster™ Plus service. These initial results indicate Sky Muster™ Plus is adequate for telehealth via video conferencing and could be potentially be used for smart diagnostic tools such as tele-monitoring devices.

Keywords.

Telehealth, telemedicine, remote primary health, remote telecommunications, internet connectivity, collaboration.

Introduction

For approximately ten years, the National Broadband Network (NBN) has been establishing and improving Internet connectivity for Australia. In 2011, the NBN Interim Satellite Service was established with the first Sky Muster™ satellite launching in October, 2015 and becoming operational in April of the following year (Brown 2015). During the same time period, the Broadband for the Bush Alliance was advocating for better Internet services in rural, regional and remote (RRR) Australia. At the Alliance's Annual Forums representatives of the NBN listened and shared updates on the progress of the rollout of their network.

In 2018, NBN™ Sky Muster™ satellite (not Sky Muster™ Plus) services were reported to be inadequate for telehealth (St Clair and Murtagh 2019) with research indicating issues with download limits, reliability and poor video-conferencing quality (Steele 2013, St Clair and Murtagh 2019, Lee and Roberts 2020). As part of their commitment to B4BA and improving their services to RRR Australia, members of NBN's management and satellite engineering teams visited remote health services and communities to develop a deeper understanding of the challenges and working environments of RRR residents, communities and businesses. In 2019, NBN released the Sky Muster™ Plus service. This service was designed to allow individuals, small businesses, health services and small community groups to pay a higher rate compared to Sky Muster for a substantially customised service with several types of traffic being unmetered. This allowed videoconferencing-based activities with less concern for bandwidth/download limits and was potentially suitable for telehealth videoconferencing in clinics in small remote Aboriginal communities or cattle stations.

Videoconferencing-based Telehealth has been demonstrated to work over high quality "mining-grade" satellite internet (ie very expensive - approximately $40,000 per installation and $100,000 pa for connectivity for up to 7 sites) (St Clair et al 2018). During the COVID-19 pandemic, quality health services were provided to people who were isolated by factors other than geography. With improved and cost effective NBN services and Medicare based remuneration for Telehealth consultations, a new business model for health delivery in remote Australia is now a reality. "Telehealth is a disruptive innovation that is changing health care, and its influence is likely to increase rapidly" (Schwamm, 2014). The COVID-19 pandemic had demonstrated the value of telehealth to isolated patients and presents an opportunity to expand access to

telehealth services for RRR people. It is important to note face to face consultation is the preferred mechanism for many situations but telehealth provides an viable option for a range of situations, particularly in a pandemic situation.

Methods

Sky Muster™ Plus services were installed on a rural property approximately 35kms South of Darwin in the 2019-2020 wet season (November – April). The first satellite service installation was successfully installed in mid-December 2019 and the second in late January, 2020. Both services were installed by the same technician (JMAC Comms). The first satellite dish was installed on a single story shed with large trees and palms surrounding the area. A second Sky Muster™ Plus service was installed later in the wet season on a two-story house which had a relatively clear line of site to the satellite. The services were provided as an in-kind contribution to the research by SkyMesh and supported by NBN Co.

Evaluation of the internet service was achieved using a combination of speed-testing tools, weather observations and qualitative user experience measures. The testing of internet quality was done using Ookla speed test at random times and during weather events to determine how well the service would work during varying weather conditions. It was also deemed useful to determine how frequent and long outages would be in severe weather. The Ookla speed test uses servers located around the world to receive and transmit test data to Internet users. The test measures download speed, upload speed, duration of ping and gives the location of the test server used. A Netgear Nighthawk router was installed to provide internet connection via a Wi-Fi service to a local computer that was used for testing.

The weather in the “Top End” (geographical region encompassing the northernmost section of the NT) can be very severe in the wet season with cyclones such as Tracy (1974) and Marcus (2018). There are frequent storms with heavy cloud, torrential rain, strong winds and numerous lightning strikes. A weather index was developed quantifying the extent of cloud cover, strength of the wind, rain intensity and severity of lightning strikes. The weather index was an attempt to quantify the severity of the weather. Rain was rated from 0 (no rain) to 5 (torrential rain). Cloud cover and wind were similarly rated from 0 – 5 (see Table 1).

Table 1 Weather index description.

Score	Rain	Cloud Cover	Wind
0	Nil	Nil, sunny	Not noticeable or light breeze
1	Very light drizzle	Light/patchy, some sun	Breeze
2	Drizzle	Mixed light & moderate	Moderate
3	Light rain	Moderate	Strong
4	Moderate rain	Dark	Very strong
5	Heavy rain	Very heavy cloud	Cyclone strong

Testing was done between 16 December and 24 January. Further testing was done on the second satellite installation between 3/3/20 and 16/7/20.

Installations for the Laynhapuy Homelands Health Service (LHS).

In the early stages of the COVID-19 pandemic, the LHS sought confirmation of the performance of the Sky Muster™ service. Based on those preliminary data, LHS requested assistance to install seven Sky Muster™ Plus services urgently in their homelands to implement telehealth widely. Through collaboration between NBN Co and SkyMesh approval was obtained to use the same contractor who had installed the services at the research site. This reduced any possible variance in quality of installation. Additionally, the installer had not left Darwin through the pandemic and therefore was a minimal risk to the community and had extensive experience and knowledge of the East Arnhem communities. The contractor was able to obtain the required equipment.

At the time, there were extensive delays in obtaining the relevant permits through the Northern Land Council and the NT government. Assistance was sought from the NT Senator and the Chief Minister’s Office to expedite the permit approvals. Through collaboration between the two offices (both sides of politics), the required permits were obtained within approximately two weeks.

There was a requirement to install routers to provide wireless access to the internet as well as to facilitate remote monitoring and management. Emerge (ICT company based in Katherine and project partner) pre-configured seven routers which were concurrently installed. UPSs (Uninterrupted Power Supplies) were later connected to the systems therefore protecting against power surges.

Results: Download, upload and latency results from wet season testing.

The monitoring of download, upload and ping (latency) of successful connections are summarised in Fig 1. The mean download speed was 29.02 mbps, the mean upload speed was 8.82 mbps, and the mean ping was 567 ms (n= 497). Speed data during outage events associated with severe weather have been excluded from this data set' were excluded from this data set. There were frequent power failures during the wet season resulting in the Sky Muster™ Plus service failing. These events were excluded from the analysis. Deterioration of signal prior to failure were included in the data set.

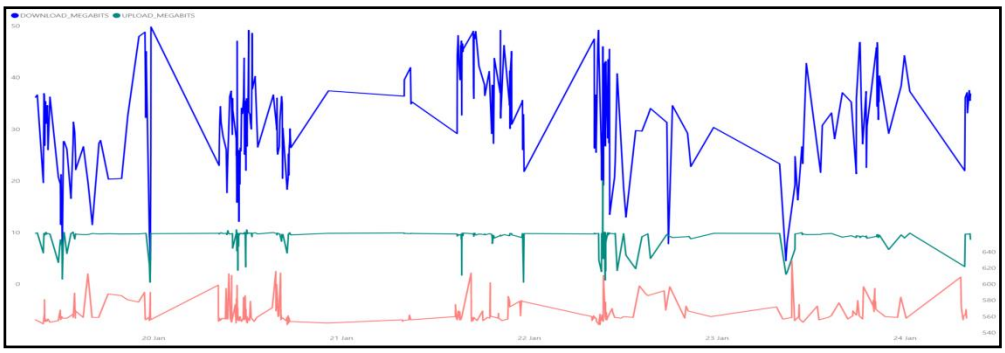


Figure 3 Speed tests 19 - 24 January 2020.

Note the variability due to weather impacts on performance. Testing was specifically targeting adverse weather events and very little testing was done when the weather was clear. The aim of the research was to understand how adverse weather affected the performance of the service and determine how frequent and long outages would be due to adverse weather events.

Outages due to weather events.

Detailed weather observations and monitoring were done from 19th January – 24th February. The Bureau of Meteorology recorded 435mm of rain in the nearest observation station (approximately 8kms away from the satellite dishes) (BoM 2020). Outages varied in duration from 2 to 26 minutes. There seemed to be a trend for the download and upload speed to reduce prior to outage, with upload failing more often than download. There was a trend for outages to be longer when rain was light (score = 2) or moderate (score = 3). There were no events with torrential rain (score = 5) during the testing period. Moderate cloud cover (score = 3) with light drizzle (score = 1) seemed to have little impact on performance with download speeds varying between 28 and 45 mbps and upload speeds remaining fairly consistent around 9.8 mbps. Ping remained fairly consistent between 556 – 570 (derived from one daytime rainfall event). When heavy weather was approaching, downloads were often possible, but there were up-load errors. Upload error is defined as being unable to connect to the internet.

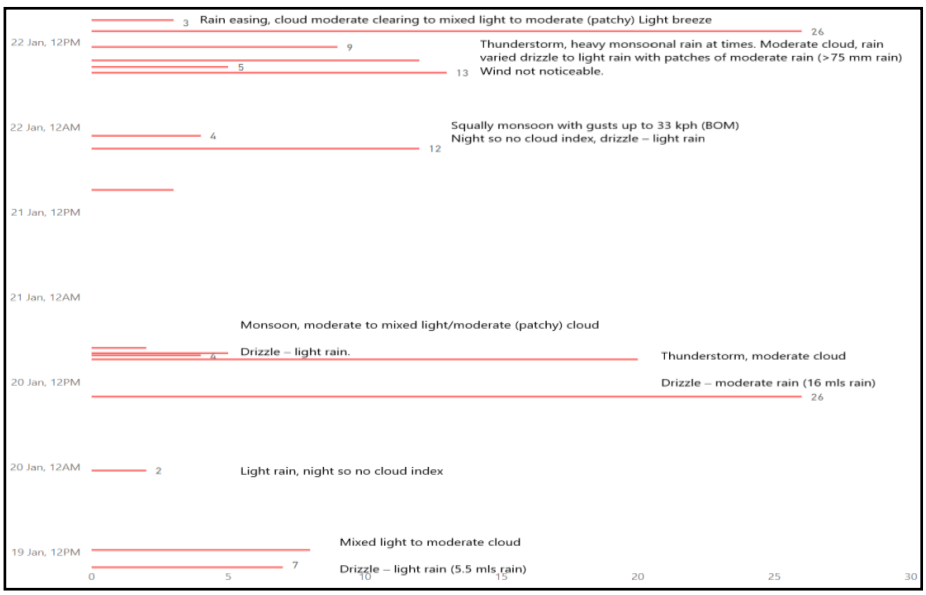


Figure 4 Outages 19 - 24 January 2020.Outages varied from 2 – 26 minutes.

The testing period included monsoonal conditions with heavy rainfalls during this period. Weather events were targeted for monitoring in this research.

Download, upload and latency results from dry season testing.

Monitoring of the second satellite service was done at random times during the dry season (May – October). The mean download speed was 36.18 mbps, the mean upload speed was 8.97 mbps, and the mean ping was 566 ms (n = 28). There were few connection failures during this time.

Discussion

Dry season performance.

Monitoring of the second satellite service seemed to be reasonably consistent with a typical download speed of approximately 36 mbps, upload 9 and ping remaining consistently around 566. There were few connection failures during this period and these seemed to be related to scheduled outages for upgrade purposes. The sample size was small and other data were obtained by NBN with a small monitoring device, but those data were not available for this analysis. Up to three consecutive video- conferences on three different devices were successfully done although there was some freezing of images. There was some variability in performance which may be related to contention issues ie the amount of traffic on the NBN network or internal network traffic/issues. The Sky Muster™ Plus service seems to be a reliable form of internet suitable for video conferencing (1-2 video conferences concurrently). However, for telehealth, it would be useful for the upload speed and bandwidth to be at least as good as the download speed to allow the remote clinician a sound source of video data on which to base decision making.

The reliability of the Sky Muster™ Plus service during the dry season is validated by the successful deployment of seven installations in remote Aboriginal communities. LHS indicated the services were working well with the exception of some router issues. When the clinician connected directly to the NTD (NBN's Network Termination Device) signal strength was adequate to do video-conferencing. To alleviate this problem, SkyMesh provided an additional three pre-configured routers that could be used as "hot swappable" devices to replace non-performing routers until they could be restored. The performance of the service is further confirmed by the request from LHS to install a further four services in their communities several weeks after the first seven installations.

Wet season performance.

The Sky Muster™ Plus service, though affected by weather, performed well with good download and upload speeds the majority of time during the wet season. The Sky Muster™ Plus service, though affected by weather, performed above the assured download and upload speeds of 25Mbps download and 5Mbps upload the majority of time during the wet season. There were multiple outages during weather events varying from approximately 2 – 26 minutes. This preliminary analysis confirms that like all satellite systems, the service can be impacted by weather, but, further and

more accurate testing needs to be done to gain a deeper understanding of how weather affects this satellite internet service. Although the weather index was subjective, it does provide an indication of weather activity and its impact on internet service performance. It may be the researcher's perspective on severity of weather events have been influenced by living in the NT for many years and a more rigorous method of monitoring weather events (eg via automatic weather stations) would be beneficial in understanding weather affects on satellite internet performance.

Implications for clinicians

Rain refracts the satellite signal therefore creating transmission errors. Data are transferred in 'chunks' and when errors occur, recovery is quick (ie within 1-2 minutes) because the protocol is designed to resend lost data. When working in remote locations that rely on satellite telecommunications, light to moderate rain, will cause the satellite signal to fail, but the internet communication will recover quickly (ie within minutes). Preliminary trends observed indicate reduction of internet quality is a precursor to failure, and this continued for up to 9 mins prior to failure. However, when the system recovers, it recovers well with normal speeds. recovers to expected download and upload performance within X period of time. For day-to-day consultations these interruptions to connectivity can be managed as are other causes for delayed consultations. Clearly, there are other causes of poor internet service, such a router issues or contention due to large volumes of traffic on the service. The experience, including the speeds depends on the network technology and configuration over which services are delivered to a premise, whether the internet is used during the busy period, and other factors including equipment quality, software, broadband plan, signal reception, how the service provider designs its network, and latency (NBN Co, pers comm).

Conclusion

NBN Sky Muster™ Plus satellite internet is a significant improvement of previous NBN satellite products and in this test environment, results relating to bandwidth and availability suggest that it may be adequate for telehealth via video conferencing. It may be suitable for other telehealth activities such as transmitting data from smart digital tools. However, the traffic needs to be managed eg up to two connections may be viable on Sky Muster Plus, but in larger environments with greater traffic additional connections may be required. Given the bandwidth requirements for other smart digital tools, this service may also be suitable for other digital health applications including the transmission of data from telemonitoring devices. There needs to be further research to determine how weather affects satellite telecommunications and if there are mechanisms to strengthen the signal during moderate to severe weather. The team are investigating various options that may be available to prioritise health data transmission, particularly in an emergency. More accurate weather and transmission monitoring will be done in the 2020-21 wet season and options for minimising outages will be investigated.

During the COVID-19 pandemic, health services were provided to people who were isolated by factors other than geography. However, many of these services were delivered via telephone rather than video. The Royal Australian College of General Practitioners (RACGP) survey of more than 1,000 GPs found that 99 per cent of GP practices were offering telehealth services, with 97 per cent also continuing to offer face-to-face consultations. This indicates the continued importance of face to face clinical consultations in health service delivery. However, only a small percentage of GPs do telehealth via video conference with 5% of telehealth consultations being delivered by video conference (McDonald, 2020). With improved and cost effective NBN services and Medicare based remuneration for Telehealth consultations, a new business model for health delivery for RRR is now possible. The research team will continue to work with project partners to develop innovative service delivery models for RRR Australia using affordable NBN internet services.

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Chapter 4. Video Conferencing Review.

Introduction.

With the COVID-19 Pandemic and the new Telehealth Medicare items designed to allow all doctors to deliver their services to remote and isolated patients via telehealth, there is an overwhelming body of evidence isolated people have benefited from telehealth (St Clair and Murtagh, 2019; Zhao et al., 2010; Edmunds et al., 2017; RACGP, 2020). Since the start of the pandemic until late 2020 the medical profession has, through Medicare, billed about 97% of Telehealth consults using the phone as versus videoconferencing. Over the March to June 2020 period, Polar primary health data from 1000 clinics in Victoria and New South Wales indicated COVID-19 telehealth items represented 40% of MBS billed GP consultations with only 5% through video-based telehealth (McDonald 2020). This represents a significant change in practice as a response to the pandemic. The approach to opening up telehealth use in primary care has helped to protect the medical profession as well as the Australian population by enabling health service delivery to isolated people. This has demonstrated an effective method of augmenting healthcare delivery to remote Australians and should continue through supported developments, collaborations and skills improvement both for clinicians and patients.

Background

In remote Australia there are many known significant health issues that impact both the individual's longevity and quality of life. There is a greater burden of disease including diabetes, heart disease, kidney failure, significant eye issues and a high number of hospital presentations through accidents (AIHW, 2022) This contrasts with the metropolitan context where quality of life and life expectancy are higher. Ease of access to medical facilities and treatment is the difference between the two contexts. Many proposed solutions to address this difference in access include the use of communications technologies such as telehealth. Research has demonstrated technology can play a significant role in addressing many of the health issues of remote communities (Edmunds et al., 2017; Bradford et al., 2016; St Clair et al., 2018). However, there has been a clear lack of uptake of technology in the Australian remote health context.

Barriers to the uptake of Telehealth in remote Australia include:

1. Telecommunications quality.
2. Affordable, easy to use and reliable videoconferencing software.
3. Capable clinical staff willing to embrace quality improvement in their work practice.
4. A viable business model that allows for the remuneration of these services (St Clair and Murtagh, 2019).

With demonstratable improvements in communications services to remote Australia and the world-wide experience of millions of COVID enforced telehealth consultations creating changes driven by patient demand, Health Minister Hunt confirmed the ongoing funding of telehealth through Medicare (Medical Republic, 2020). As a result, these additional questions have become a priority:

1. Why is there only 3% of COVID MBS items (McDonald 2020) billed for Videoconference based Telehealth?
2. What are the change and quality improvement strategies needed to support videoconferencing for telehealth uptake?
3. Can multidisciplinary collaborative advantage be achieved through the development of change processes, workforce support and technology development within and between health industry leadership organisations?

Theoretical Foundation and Industry Recommendations

Walter Isaacson (the author of the Innovators, How a Group of Hackers, Geniuses, and Geeks Created the Digital Revolution (2014), Steve Jobs'(2015) and Einstein's biographies (2007)) states "innovation can be found at the intersection of art and science that is fostered through groups of collaborative individuals with common goals". The art of medicine is well understood: John Murtagh (2011) states: "Much of the art of general practice lies in the ability to communicate". But what are the changes required for clinicians to add remote videoconferences to existing modes of patient consultations to enable improved quality of healthcare?

The theory of Collaboration underpins potential strategies for changing attitudes to telehealth. Huxhum and Vangen (2005) describe the key attributes to collaborative advantage eg shared goals, trust, communication, nurturing culture and leadership. Changes to clinical practice will come through supportive communication from trusted health industry leadership organisations with agreed shared goals. Methods to encourage multi-disciplinary collaborative advantage have been demonstrated and could be applied to work practice improvement (St Clair, 2023, in prep).

Goldratt's Theory of Constraints (2008) describes the management of identified "constraints" within business processes to improve workflows and work practice. The "constraint" is an important and irreplaceable part of the business. However, if not managed well, it has the tendency to become a bottleneck or a point in the work process that impedes other parts of the enterprise, reducing efficiency and increasing costs. The remote health system has unique similarities to operations of businesses observed by Goldratt. The "constraint" he describes could be the highly trained health knowledge workers. These professionals are the rural doctors and outreach specialists who are currently using a very limited amount of telehealth and other innovative technologies in remote Australia. They travel great distances, consume a large amount of other peoples' time and inconvenience patients by requiring return visits that could be done over the phone or by videoconference. The activities of the "constraint" in the primary health system are currently dictated by the Medicare funding model, organisational and professional inertia. Rural doctors have been trained to avoid risk and be conservative with clinical decision making. This leads to clinical inertia described by Christensen et al. (2008) in the Innovators Prescription.

The Technology Acceptance Model (TAM) (Songa et al., 2019; Rahimi et al., 2019) with its various versions has described recipes for introducing ICT changes into many industries. It identifies three components:

- Perceived usefulness.
- Perceived ease of use.
- Attitude toward use.

Changes in doctors' attitudes toward videoconferencing-based telehealth will come from patient demand created by nearly six months of mostly positive experience with telehealth consultations. A careful approach to creating balance between ease of billing and risk of providing a poor service must be introduced (Abimbola et al., 2019). There is some feedback (pers. coms.) from senior rural doctors to indicate the need for greater care and a risk-based approach to choosing telehealth over in person consultations. This is a quality choice that will be made by doctors who will be informed by various support services, training entities and personal observations.

The US based Taskforce on Telehealth Policy 2020 has recommended the following key areas of development, improvement and focus:

- Workforce training and development.
- Financial policy changes.
- Improved privacy protection.
- Improved patient access to internet.

The Task Force also suggest a clear set of definitions to describe what telehealth is, its various modes (ie phone, videoconference, remote monitoring, store and forward, etc) and when these aspects should be used. For example, when a phone conversation should be changed to a face-to-face/videoconference consultation.

Thomas et al. (2020) have developed and described an Australian healthcare improvement plan with five key requirements to develop sustainability of telehealth:

- Develop a skilled workforce.
- Empower consumers.
- Reform funding.
- Improve the digital ecosystems.
- Integrating telehealth into routine care.

Technology requirements for telehealth

As a general set of principles, the Australian College of Rural and Remote Medicine (ACRRM) (2020) have developed a guide to telehealth in clinical practice with the following recommendations:

- Where appropriate and available, use technology that is recommended by, or available from your Primary Health Network or health organisation.
- Use technology accessible to, and usable by, the general public and other health organisations.
- Have available adequate network capacity for the technology supplied by your organisation or an internet service provider to operate reliably.
- Have timely access to technical support for detecting, diagnosing and fixing technology problems.

- Take measures to protect the identity of patients when using commercial service providers or social media networks, for instance by only using a dedicated account owned by your practice.
- When using commercial service providers or social media networks to communicate by phone or video with patients ensure no health information such as chat interactions, documents, images are retained by the commercial service provider or social media network.
- Understand the Office of the Australian Information Commissioner Privacy policies for GPs as they may apply to information and communications technology used for telehealth services.

These recommendations are the basis for our evaluation of the following video conferencing software. The main reasons for using well know software is to take advantage of existing skills within the community to use these more common communications tools. Also, the skills required to support this software already exists in the ICT companies who provide services to General Practices around the country. It is clear from the data already collected by Medicare and other primary care datasets the majority of telehealth consultations are by the phone (Baird, 2020). This is clearly due to our familiarity with this technology. During the pandemic, office-based workers were exposed to mainstream videoconferencing software which is now very familiar to those of us working from home. This being the case, there is a strong argument to recommend well-known videoconferencing solutions such as Zoom, Skype, Facetime, Microsoft Teams, etc.

Practice workflow and patient bookings

The workflow of a typical primary care service is embedded into practice software. Since the pandemic, there have been some developments to this software to include videoconferencing functionality. These systems have been created to be a one stop shop for all practice data and patient management needs. There is a strong argument to have videoconferencing embedded into these types of software.

Summary of videoconferencing software for telehealth

Hospitals and Health Services (HHS) tend to run their own clinical videoconferencing systems behind firewalls in their own secure networks. Their systems are based on well matured products deployed across multiple sites, cities and countries with high price tags. The software and hardware used are designed for large corporate ICT environments with significant multi-site infrastructure and high numbers of staff requiring access and bandwidth. The interconnectivity with these environments can be difficult from outside the HHS firewall and represents the main disconnect from primary care in terms of telehealth in Australia. Some states operate telehealth connection services but these have been recent additions and represent further functionality and integration which may not have been included in early telehealth systems developments.

High end videoconferencing systems have traditionally been dominated by two hardware/services companies: Cisco and Polycom. They are installed as part of internal network infrastructure. They each have patient/remote end client software to connect back into the larger network product. This software runs on a patient/remote end person's browser. It has an install initiated by clicking on a meeting link sent through email. A small remote clinic may consider WebEx by Cisco or Polycom RealPresence but need to understand the licensing and ongoing service costs of this software and make comparisons of equivalent software as seen below.

Success in government-based telehealth has been within their firewalls. With the onset of COVID, significant software development resources were invested in videoconferencing for the general public in the cloud. Where Skype was the software of choice an influx of new users has changed the percentage balance to see Zoom win the new users of videoconferencing. Much reporting has been done to describe why these choices were made. Their direct purchasing path has reduced even further the barriers to getting started with videoconferencing. From the time a person receives a link and consents to the invariable license agreement to become a registered user for free, an upgrade path is easy. (Jain, 2018; Lyengar, 2020).

Non-health specific videoconferencing software

There are reasons why small remote medical practices should be open to choosing mainstream video conferencing platforms. Patients and staff alike are more likely to have used the software. Icons and software functions are understood. Training and assisting patients can be time consuming. With Goldratt's constraint in mind, feedback from doctors and practice managers has indicated there are significant benefits in not having to train patients to use software chosen by their practice.

There is also an argument to support one or more videoconferencing applications to keep consultations flowing in the clinic.

Zoom

Zoom as a company has seen huge expansion since the start of the pandemic. The software and underlying infrastructure were able to expand with the demand placed upon it. Since significant scrutiny was place on the program, security features have been increased. A high level former Yahoo security expert and the purchase of an existing security firm has led to a more secure environment for videoconferencing (Hogde, 2020).

Zoom's call quality has been reported to be better than similar market products. This is a very difficult value to measure but from testing over NBN Sky Muster Plus, Zoom is the most reliable performer (Gilbert, 2020; pers. observation).

Cross-platform integration in Zoom means it can be installed in all mainstream computing environments include IOS, Android, Mac, Linux and Windows.

Zoom has introduced custom backgrounds to create a more private or decorative environment for videoconferencing. Users can use a chosen picture to share with patients or a background can be enabled. Backgrounds can be tailored for specific uses and contexts.

Zoom also has created filters to adjust facial blemishes, etc.

Meeting transcripts and recordings can be made. This is not recommended for clinical interactions as video files can be very large and the requirement to retain medical data will present issues with storage. Large video files may also slow down the operation of the database, depending on the clinical record system in use.

Zoom for Healthcare

Zoom has customised a paid version which is compliant with health standards (e.g. US Health Insurance Portability and Accountability Act (HIPAA)) and is specifically designed for telehealth. It has high-quality video, even in low-bandwidth environments, on-screen annotations to allow clinicians to explain health issues and can provide a consultation recording (not recommended for long consults as described above).

Facetime

Facetime is built into the Apple iPhone, iPad and MAC computers and is only usable between these devices. This system is secure but is also immediately eliminating just over half of smartphone users. It could represent an option in the situation where the practice thinks it will be an alternate connectivity solution, but this would require a practice mobile number. If using personal phones, patients would possibly have unscheduled access to the owner of the phone.

As Apple shares a dominant position in the smart phone industry, Facetime video calls are now an easy way to transition from a traditional phone call to video. The negative aspects are the screen is only small and the service is iPhone/iPad/Mac only. There have been a number of telehealth papers mentioning the use of smart phones to allow remote end doctors to direct patients to allow close-up views of wounds, skin conditions and other visible problems requiring remote diagnosis. Although these examples have clear benefit, the lack of an Android version of Facetime will always restrict use of this service.

Skype

Skype was bought by Microsoft and incorporated into their video conferencing software in 2011. Microsoft has a number of videoconferencing software platforms; the other main being Teams. Skype has held a leading market position in consumer videoconferencing for many years, with a solid customer base, it could be a viable alternate connectivity solution for patients who are familiar with its interface and environment.

Microsoft Teams

Teams is a business product that provides office communications, videoconferencing and integration into Microsoft Office 365. This product is similar to Slack in its social media based software for business approach, combining planning, meeting notes, communication channels and user groups. Microsoft has not clearly defined the reason why Teams and Skype still exist as separate products and suffers from this confusion. The researchers have found Microsoft Teams does not work reliably over satellite internet. This has been referred to NBN Co and they are working with Microsoft to resolve the problem.

2Vu

This produce provides multiple video stream access which allows a clinician to connect both a computer monitor and the output from a diagnostic tool such as an otoscope, retinal camera, ultrasound, ECG, pulse oximeter or blood pressure machines, etc. The product is also similar to BlueJeans and Pexip with the functionality to connect into high end videoconferencing environments such as Polycom and Cisco. Cost comparisons should be made prior to installing and purchasing these services. When implementing new software, users have a limited threshold for changes once installations have been made. It is recommended to install trial products only on a small group of users' computers. A thorough test is valuable, prior to a full installation across all users/computers.

Google Meet/Hangouts/Duo

Google has confused its users by consistently changing product names of videoconferencing software. Originally Google Hangouts was an automatic option when creating a Google calendar meeting. Then Google Hangouts Meet was introduced to the Google Office equivalent G Suite. Google Hangouts Meet then became Meet and Hangouts remained the free product available to anyone with a Gmail account. Google Duo is the Meet/Hangouts/Hangouts Meet videoconferencing application for smart phones.

Facebook WhatsApp

In 2014, Facebook bought WhatsApp and recently combined user authentication to allow Facebook account holders to use their usernames and passwords to log into WhatsApp. WhatsApp is now tightly connected to Facebook and may be a good alternate telehealth videoconferencing access for people with Facebook accounts. Facebook Messenger rooms have recently been introduced and provide time unlimited videoconferencing for up to 50 users. This compelling feature has been created to mark a significant difference with Zoom which limits free users to 40 minutes. A practice-based Facebook account is recommended to maintain individual clinician privacy if using WhatsApp for telehealth.

Pexip

This product is similar to BlueJeans and 2Vu with the functionality to connect into high end videoconferencing environments such as Polycom and Cisco. Cost comparisons should be made prior to installing and purchasing these services.

BlueJeans

The product is similar to 2Vu and Pexip with the functionality to connect into high end videoconferencing environments such as Polycom and Cisco. Cost comparisons should be made prior to installing and purchasing these services.

GoToMeeting

GoToMeeting by LogMeIn is a solid video-conferencing platform that performs adequately but has suffered from poor marketing and sales support. There was a complex billing environment which has improved since LogMeIn bought the product in 2016.

Slack

Slack is a similar product to Microsoft Teams focusing on business communications including videoconferencing, chat groups and direct messaging. The product has not seen expected growth during the pandemic. The combination of Teams and Microsoft Office 365 has taken the lion’s share of users in this segment of the market.

Health Specific Videoconferencing Software

National Telehealth Connection Service (NTCS)

Telstra Health provides a product to connect directly into high end videoconferencing systems such as Polycom and Cisco - TeleConsult. The software is customised to allow clinic administration staff scheduling of patient appointments. The product currently is connected to a number of state-based health services.

Coviu

Coviu is a telehealth specific software platform that has integration into a number of clinical records systems. It provides patient features including credit card billing support, secure document exchange that can include consent forms and other patient related templates. The waiting room facility can be configured with music or pre-recorded patient information. It uses WebRTC (Web Real-Time Communication) technology to provide real-time video consultations between healthcare professionals and their patients. WebRTC enables secure and high-quality video, audio, and data communication directly within web browsers, without the need for additional plugins or software installations.

Coviu leverages WebRTC to establish peer-to-peer connections between healthcare providers and patients, allowing them to conduct virtual consultations remotely. This technology ensures that the video and audio streams are transmitted with low latency and high quality, making it suitable for healthcare professionals who need to communicate effectively with their patients.

WebRTC's encryption and security features also contribute to Coviu's ability to offer confidential and secure telehealth services, which is crucial when dealing with sensitive medical information. WebRTC provides the underlying technology for real-time communication platforms. Coviu has user-friendly interfaces and additional features that have been built on top of WebRTC to create a seamless and user-friendly telehealth experience.

National Health Service Directory (NHSD).

Coviu has partnered with the National Health Service Directory (NHSD) operators Health Direct through several Primary Health Networks (PHNs) to offer limited, free (license paid by PHN) access to this service. This has been branded Video Call and is part of the information and directory services provided by Health Direct. Coviu's telehealth software platform integrates with Healthdirect Australia's Video Call service, using Amazon Machine Learning and AWS infrastructure to enhance healthcare consultations through integrated video and clinical tools.

During the COVID-19 pandemic, the demand for virtual healthcare consultations surged. Healthdirect Australia turned to Coviu's platform, which runs on Amazon Web Services (AWS), to scale rapidly and meet the increased demand. Coviu's flexibility, security features, and use of AWS services such as Amazon EC2, Amazon RDS, and Elastic Load Balancing facilitated the delivery of up to 6,000 video consultations daily, compared to an average of 150 before the pandemic.

Healthdirect Australia achieved an 85% (Coviu, 2022) satisfaction rate for patients who used video consultations compared to phone calls. The success of the collaboration has led Healthdirect Australia to expand and continue offering reliable and effective telehealth services to the Australian healthcare system.

1st Group

1st Group has partnered with Coviu in a similar way to Health Direct.

There are a significant number of Clinical/Patient Information Systems vendors who have created web-based videoconferencing additions to their products. These integrate and exchange information such as patient bookings, etc into the system software to allow for limited changes to work-practice when introducing telehealth into day to day operations.

The following is a shortlist of vendors who have created these additions:

- Medtech
- Medical Director
- Medclinic
- Platinum
- Health Engine (telehealth Integration into its online booking system)
- AutoMed (direct integration into Medical Director)

Other clinical system vendors continue to develop videoconferencing functionality.

Conclusions/Key Recommendations

From a technical perspective, there are a number of key choices remote health service providers should consider before establishing significant telehealth infrastructure in software, hardware and internet services. The following list outlines key considerations and recommendations in the Australian videoconferencing market for remote telehealth at the end of 2020. These recommendations will change as new vendors and functionalities are introduced to software, hardware and Internet services.

Beneficial features and functionality of healthcare focused videoconferencing.

Easy scheduling and initiation

Zoom has benefitted greatly from being an easy to use videoconferencing product primarily because the service allows users to establish a videoconference quickly without many questions, clicks or technical failures. Zoom also quickly responded to concerns about security maintaining trust as a new organisation to most technology users. The two Microsoft products: Skype and Teams were both more complex and were not clearly targeted to their market segments (i.e. home and business users). There are a number of telehealth specific videoconferencing tools that have gained market share by integrating closely into the work practice activities of the clinical environment. Products such us Coviu (now part of the Health Direct government supported solution) may not be as easy to use as Zoom.

Easy transition from phone to video.

Facetime phone to videoconference transition is an easy way to change a patient consultation from a phone conversation to a video call. This has been demonstrated to be valuable in gaining a differential diagnosis in the Laynhapuy Homelands of East Arnhem Land in the NT. Clinicians have been able to more accurately assess the severity of injuries, skin conditions and other key diagnostic indicators to inform ongoing treatment and/or the decision to evacuate the patient. This feature/functionality may be enabled through the generation of a SMS with a link to a

videoconference so the phone call could convert to a videoconference. This would require doctors to understand a new skill/capability/competency from the perspective of both the use of the software and changes to the consultation method.

High quality video rendering over low bandwidth connections.

Zoom also won the videoconference battle by providing more reliable and better-quality video images using a variety of internet services. Remote health services tend to rely on inferior internet services. The choice of videoconference software in remote settings must place priority on low bandwidth performance.

Multiple camera/video stream input

Telehealth is not just videoconferencing. It can take the form of remote monitoring. Videoconference software can display multiple video inputs. For example, a dental camera can be added to the videoconference so patients, doctors and the output of the remote monitoring device used to assess a particular condition can be viewed at the same time. As an education process and a way to ensure the patient understands the problem and the information being provided to them, this functionality facilitates better communication between the remote clinician and the local patient.

Remote end camera control

There are now several remote-control video conferencing cameras. For example, Zoom allows users to grant access to remote people to control camera direction and zoom into specific features such as a wound, eye, skin condition, etc. The Logitech PTZ Pro camera for example can plug into the computer's USB port and be controlled both locally and remotely. This functionality allows a remote clinic with limited staffing to be guided by a more experienced and qualified clinician as well as allowing remote clinicians to zoom into the area of specific interest.

Internet connectivity

One of the main problems reported by doctors wishing to commence using videoconferencing in their practice relates to poor experience with connectivity. The fundamental principle for remote health service connectivity is understanding the local network and the external connection. Both factors contribute to a high quality and reliable connection to the internet. The best way to ensure a quality experience when doing videoconferencing-based telehealth is to use a dedicated internet service for videoconferencing. There are many ways to achieve this. The easiest solution is to install an additional internet connection and run a separate Wi-Fi network to avoid competing with other local users on the network. Network users then agree to use the new Wi-Fi network for videoconferences only.

In respect to internet connectivity, new internet services are being established and will change the remote connectivity environment in the coming years. The NBN Sky Muster Plus service is a viable videoconferencing medium and therefore all Australian mainland based health services can do telehealth via videoconferencing from the perspective of external connectivity. The testing done by the project team indicates the Sky Muster Plus service is adequate for videoconferencing and telehealth with up to two connections operating concurrently. This is further supported by Laynhapuy Health Service's positive experience with the product and their purchasing of an additional four Sky Muster Plus services for their stores and community Wi-Fi after their initial purchase of 7 services for clinics.

Clinical patient data system integrations.

When clinicians are isolated from their patients through distance or other factors (e.g. pandemic), they need easy access to patient records, referrals and medications. This can be achieved through remote desktop access software which can allow remote doctors' access to centralised health records from their computers at home or other locations. This software presents a relatively easy choice as there are multiple providers in this software category, many of which offer reliable cloud-based services.

A supportive national health infrastructure with well understood integration end points, is a fundamental goal of the Federal Department of Health and the Digital Health Agency. Agreed and shared goals between health professions' peak bodies and government could generate the multi-disciplinary collaborative advantage needed to assist remote health services to use telehealth to its best application.

Web RTC protocol use and browser-based functional options.

When choosing videoconferencing software, access, privacy and convenience are key values to consider for patients. This protocol allows high quality videoconferencing applications to be run over current standards-based web browsers using the latest version of the HTML protocol. Thereby creating reduced technological barrier to connecting to a videoconference with few steps required by patients to initiate the consultation.

Wellness monitoring.

As technology advances, definitions and categories sometimes become blurred. The introduction and improvement of wellness monitoring devices such as the Apple iWatch and Samsung Watch have begun to blur the lines between wearable wellness and remote health monitoring devices. Currently, the Therapeutic Drugs Administration (TGA) legally

blocks these vendors from deploying their ECG watch-based functions. These functions have been enabled in other countries. The new version of the iWatch now supports a pulse oximetry function which does not breach TGA guidelines. The TGA was established in 1989. In 1973 the Health Insurance Act was established and prohibits the use of telehealth for screening/triage purposes under Medicare. There needs to be sensible adoption of useful technologies and mechanisms to adjust regulation in the telehealth environment guided by health industry recommendations and patient demand.

Below is a list of useful links in relation to videoconferencing software use.

Helpful Links

https://digitaltransformation.frost.com/expert-insights/viewpoints/top-5-reasons-why-zoom-winning-cloud-video-conferencing-wars/

https://edition.cnn.com/2020/06/02/tech/video-conferencing-zoom-facebook-google/index.html

http://medicalrepublic.com.au/telehealth-is-more-than-real-time-consults/35558

https://theconversation.com/telehealth-in-lockdown-meant-7-million-fewer-chances-to-transmit-the-coronavirus-141041

https://www.theguardian.com/commentisfree/2020/oct/14/there-is-a-poverty-of-body-language-in-telehealth-appointments-but-there-is-tenderness-too

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Chapter 5. Development of Telehealth Video System.

Testing, demonstration and user acceptance testing.

A range of equipment and has were tested in the first phases of this project and other equipment examined throughout the project. A list of components of the currently recommended TVS system is listed below. These components have been tested extensively in many areas and testing, demonstration and user acceptance testing has continued throughout the project.

Initially, the project team tested, demonstrated and did user acceptance of the TVS in Darwin Rural, Katherine and Alice Springs. Testing was done in Cairns (3 sites), Kununurra, Broome, Exmouth, Newman and Jigalong. It has been tested on a range of internet connectivity platforms including mobile phone hotspot (Vodaphone and Telstra), ADSL, NBN Sky Muster and Sky Muster Plus, NBN Fixed Wireless and Telstra mobile. User acceptance in demonstrations has been positive and is further supported anecdotally by the fact that a number of project partners and stakeholders have bought some of the TVS components (microphone/speaker, camera, Zoom, Sky Muster Plus) and report excellent results with these tools.

Testing of the system with a physician has further highlighted the benefits of the remote end camera control for the clinician. A video of a consult by a physician and one of the researchers was done and presented at the DH4B Forum in Alice Springs. This was found to be a very useful tool when educating clinicians.

A new and cheaper camera (approximately half the price of the currently recommended device) has come onto the market and was tested in a number of contexts and locations, but was found not suitable for telehealth.

The project team have demonstrated a number of diagnostic/monitoring devices including components of the Vision Flex System. These have received very positive feedback, especially when people can handle and test the devices themselves. The researchers purchased a mobile VisionFlex system with a number of peripheral devices for training and demonstration purposes. VisionFlex have loaned the researchers one of their otoscopes for training the Child Health nurse, PAMS.

Zoom continues to be the best performing videoconferencing tool and this is further supported by the case study research. Case study participants indicated Zoom was a preferred option for videoconferencing.

Summary of TVS testing:

During 2021 TVS testing, demonstrations and user acceptance research was done in a range of locations within the NT as well as Northern WA and Queensland. TVS testing was done over various types of internet sources including NBN Business grade satellite service, ADSL, NBN Fixed Wireless and mobile services.

A minimum requirement of 2 Mbps down 2 Mbps up and a ping less than 650 ms is required for videoconferencing. Where the internet was stable and met this minimum requirement the TVS worked. A number of locations and internet combinations were found to be inadequate for the TVS and videoconferencing (see Table 2.). At many sites mobile data (Telstra and Vodafone) were not suitable for videoconferencing. In general, it seems mobile services cannot be relied on for videoconferencing in regional and remote areas.

Table 2 Summary of TVS testing at various sites in Northern Australia.

Location	State	Internet source	Adequate for TVS	Comments
Aileron Roadhouse	NT	Mobile -Telstra	No	
Alice Springs	NT	Mobile -Vodaphone	Yes - good	Multiple sites
Banyan Farm	NT	Mobile -Telstra	No	Multiple sites
Brisbane	Qld	Mobile -Vodaphone	Varied	Multiple sites
Broome	WA	Mobile -Telstra	Varied	Multiple sites
Cairns	Qld	Mobile -Telstra	No	Very poor at all sites
Cairns	Qld	Mobile -Vodaphone	Varied	Adequate at some locations
Coodardie Station	NT	Mobile -Telstra	No	With antennae still poor
Cooktown	Qld	Mobile -Telstra	No	Very poor at all sites
Darwin Waterfront	NT	Mobile -Telstra	No	Suspect contention issues
Darwin Waterfront	NT	Mobile -Vodaphone	No	Suspect contention issues
Dundee Beach	NT	Mobile -Telstra	No	Highly contended
Dundee Beach	NT	Sky Muster	No	Installation issues and possibly contention
Exmouth	WA	Mobile -Telstra	No	Multiple sites
Gawa	NT	Sky Muster Plus	Yes - good	
Jigalong	WA	Mobile -Telstra	No	Very poor
Jigalong	WA	NBN Business	Varied	Adequate on non-networked devices
Jingili	NT	Mobile -Telstra	No	
Jingili	NT	Mobile -Vodaphone	No	
Katherine Rural	NT	Mobile -Telstra	No	Florina Road
Katherine Rural	NT	Mobile -Vodaphone	No	Florina Road
Katherine Rural	NT	Telstra ADSL	No	Florina Road
Katherine Town	NT	Mobile -Vodaphone	Yes - good	
Katherine Town	NT	NBN to premise	Yes - good	
Kununurra	WA	Mobile -Telstra	No	Multiple sites
Longreach	Qld	Mobile -Telstra	Varied	Multiple sites
Mt Isa	Qld	Mobile -Vodaphone	Yes - good	Multiple sites
Newman	WA	Business grade Vocus	Yes - excellent	PAMS Clinic
Newman	WA	Mobile -Telstra	No	Multiple sites
Parnngurr	WA	NBN Business	No	Possibly poor due to ICT infrastructure
Sandpalms	NT	Mobile -Telstra	No	Possibly contended
Townsville	WA	Mobile -Vodaphone	Yes	
Virginia	NT	ADSL	No	2 sites
Virginia	NT	Mobile -Telstra	No	Multiple sites
Virginia	NT	Mobile -Vodaphone	Yes, but can vary	Multiple sites
Virginia	NT	NBN Fixed Wireless	Varied	
Virginia	NT	Sky Muster Plus	Yes - good	2 sites

Testing at Simbani (35 kms Southeast of Darwin).

Random testing at various times of the day and night, weekdays and weekends was done on the Sky Muster Plus service. Typically, it was found a download of greater than 35 Mbps, upload greater than 9 Mbps and a ping of less that 600 ms. This is adequate for videoconferencing and using VisionFlex internet enabled equipment concurrently. The researchers have had 3 videoconferences concurrently on the single Sky Muster Plus service. Reducing movement within the field of vision was found to improve the quality of videoconferencing. For example, turning off overhead fans was found to improve the videoconferencing experience.

Impacts of adverse weather

Internet outages due to weather events do cause the service to fail. Typical outages range from 5 – 15 minutes during the adverse weather events and quickly recovers once the storm clears. These outages have not been seriously problematic other than when running national meetings or events. Fortunately, the researchers have access to mobile coverage (Telstra and Vodaphone) but these services can also be affected by adverse weather conditions and contention.

Power outages

Northern Australia is subject to frequent and, sometimes lengthy (eg days to weeks), power failures. This is more prevalent in remote Aboriginal communities which often rely on generator or solar power systems. Maintenance of these systems is sometimes lacking and there can be lengthy delays in repairs being done. For example, Gawa's solar power system was non-functional for over 12 months and, despite repeated requests and meetings by Traditional Owners with Ministers/Senators and their advisors, their service remained non-functional. They do have generator power, but fuel (diesel) for the generator is not always available. The lack of reliable power has resulted in the Community Wi-Fi established through this project functional only at times when power is available. Providing reliable and alternative power sources for internet is a major issue for remote areas to successfully implement telehealth. It may be useful to explore an independent solar power system for internet and ICT resources for telehealth in these contexts.

Consistency in videoconference quality

The Sky Muster Plus service is generally reliable with consistent download, upload and ping. Though the service is relatively reliable, there are still dropouts and freezing during videoconferencing. This is not a significant barrier to doing telehealth consultations as it usually resolves within a period of seconds. John Kelly (Senior GP, LHS) is confident in doing telehealth consultations and reports this service is much better and more reliable than the previous Sky Muster product. However, the freezing and dropouts, even if only for a few seconds, may render the service not adequate for telehealth under the new MBS requirement of continual audio and video streaming and will have a negative effect in the ability for remote people to access health services via telehealth (see Section: Impacts of Medicare changes as of 1st July, 2022).

Fundamental TVS principles.

The following is a summary of fundamental principles for TVSs

1. Must be easy to use from the clinician and patient's perspectives.
2. Best case scenario requires alternate internet connectivity for reliable telehealth clinical services.
3. Enough concurrent bandwidth is required to access a) Video conferencing session, b) Patient data (ie medical record and My Health Record Data) and c) Other internet resources required by the clinician.
4. A minimum of screens is recommended - one for patient data/resources, one for videoconferencing.
5. A high-quality video camera capable of remote control via remote clinician is required. The camera needs high quality pan tilt and zoom ability so the clinician can clearly see specific patient conditions to inform diagnosis.
6. High quality microphone and speaker with integration is required to eliminate feedback.
7. Videoconferencing software is required. Zoom is the current recommended product for small services but there is a clear use of multiple VC software with interactions with specialists, other healthcare providers and State and Territory Departments of Health. The patient end needs to be simple to use and reliable, preferably by clicking a link.
8. Network setup should employ multiple routers to isolate any untrusted devices such as security cameras, guest Wi-Fi access, smart medical devices, ECG's, smart door locks, remote blood testing equipment, etc. This setup is commonly known as the three-router system and deploys a Border Router connected to the internet and two internal network routers, one for secure devices and the other for unsecure and untrusted devices (see figure below).

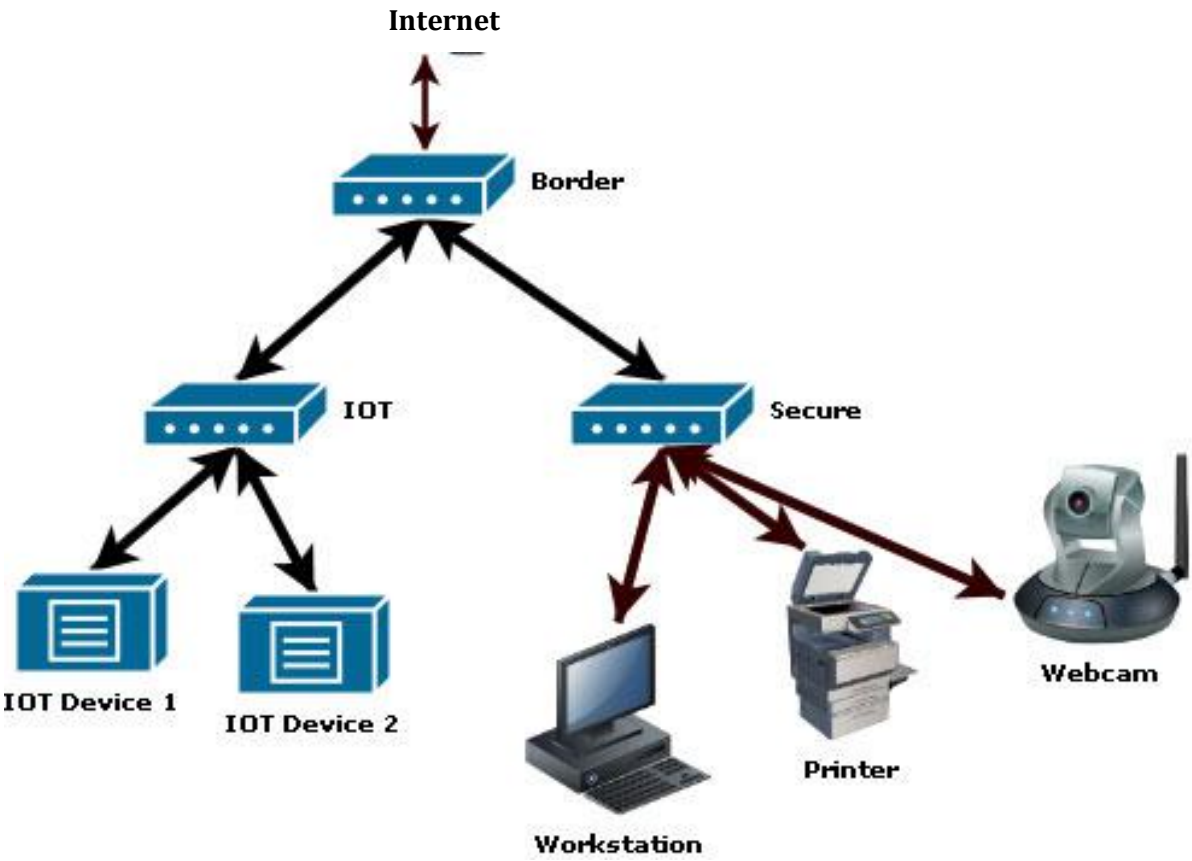


Figure 5 Three router security system.

https://pcper.com/2016/08/steve-gibsons-three-router-solution-to-iot-insecurity/

Current Telehealth Videoconferencing System (TVS) and indicative costs

Establishment costs: Estimated establishment costs for the current TVS is approximately $4,400 but when costed out as a per annum cost would be in the range of $2,500. A number of devices tend to fail in the harsh conditions of remote communities, so a conservative (prophylactic) approach includes replacing some components more frequently than required in an urban setting.

Annual subscription costs: Annual subscription costs are in the order of $2,530 which includes the costs of the Sky Muster™ Plus Service (approximately $200 per month) and Zoom annual subscription.

Access to My Health Record is free for both clinicians and patients. Costs for clinic specific patient data bases have not been included in these costs.

Rational for selecting TVS devices.

The researchers have described (see Table 3) a current 'best in class' set of devices that work effectively in combination to produce a high-quality videoconference. The researchers strongly recommend "shopping around" to get the best price and support local businesses if possible. The researchers often negotiate with vendors to get better deals for equipment and have identified key criteria for each device type.

Videoconferencing speakers and microphones need to be integrated to avoid feedback produced when the sound from the local speaker received by the local microphone and is re-transmitted. This technology can vary in quality and was a key factor in choosing the current speaker/microphone unit.

Optical lens quality is a fundamental aspect of the design of digital video cameras. The lenses used in video cameras can vary in size and manufacturing quality. This may limit the overall quality of the transmitted image. Digital cameras that have high quality lenses and digital image sensors can combine to create excellent video transmissions. When choosing digital video cameras for telehealth videoconferencing, trade-offs need to be made between lens quality, image sensor capacity and cost. The researchers have identified a further element specifically related to telehealth: Far end camera control. This feature has only recently become available in video cameras and videoconferencing software and represents an additional criterion for selecting a videoconferencing camera.

An uninterrupted power supply (UPS) is recommended for use in remote locations with variable quality power services. Power failures and voltage variations can cause videoconferences to fail and cause damage to hardware. There are broadly two types of UPSs. A standby power backup will sense a power failure and cut over to battery backup in this circumstance. An inline UPS maintains a constant power supply as well as ensuring voltage remains within specified ranges. These devices tend to be more expensive and are recommended for environments that experience regular power failures and voltage fluctuations (e.g. standalone diesel generator services). The researchers have chosen a UPS from a well know company within a reasonable price range. If power quality is poor, it is recommended to employ an inline UPS.

Internet connectivity for telehealth-based videoconferencing requires both an internet service available in the local area and high-quality network routing. In remote Australia the internet solution is most likely to be satellite based. These services will provide internet to a single point (ie RJ45 network plug). Generally, home and businesses use multiple devices requiring internet connectivity. They will require internal network routing solutions to allow all devices to connect concurrently. These configurations must be installed and designed to ensure reliable, secure and safe internet connectivity. The researchers recommend these installations be done by qualified technicians. The researchers have seen situations where an internet service is compromised by the network equipment to which it is connected. The assumption was made the internet service was faulty but upon inspection the internal networking equipment was either installed incorrectly or had experienced hardware failure due to age and environmental factors. The researchers have worked with NBN Co to develop the following troubleshooting guide:
https://www.nbnco.com.au/content/dam/nbn/documents/support/nbn-co-video-conferencing-guide-2021.pdf

Telecommunications technology and especially videoconferencing technologies are constantly improving and changing. Therefore, the table below represents the current 'best in class' solution.

Table 3 Current TVS and connectivity systems and costs

#	Item	Indicative cost ($)		Estimated Life	Expected
		Per Annum	Establishment		Cost Per Annum
1	Zoom Video Conferencing Software	130			
2	Computer – either Mac or PC with integrated camera*		1000	2 years	500
3	Camera – Logitech PTZ Pro		1200	2 years	600
4	Jabra 710 integrated conference microphone and speaker		300	2 years	150
5	NBN Sky Muster™ Plus Plus service (including Satellite Dish and NTD)**	2,400			
6	NighthawkWiFi Access Point		100	1 year	100
7	2 x Router Ubiquity Unifi Security Gateway @ approximately $500 each		1000	2 years	500
8	Netgear Prosafe Switch		500	1 year	500
9	Uninterruptible Power Supply (UPS) – eg Power Shield Defender 1600		300	2 years	150
10	Remote access to patient's clinical record (highly recommended) ****	0	0		0
	Totals	**2530**	**4400**		**2500**

NB: Links to devices and software have been included as examples, however, the researchers are not advocating or recommending any particular provider. The researchers strongly recommend "shopping around" to get the best deal and shop to support local businesses if possible. The researchers often negotiate with vendors to get better deals for equipment.

*Devices tested: Mac Book Pro, Mac Book Air, Mac Mini, HP Envy Laptop and HP all in one, ACER Spin Laptop

Range in costs $400 - $4,000, a figure of $1,000 is used as an example with minimum specifications:

- Storage space: 250 GB
- CPU: i5
- RAM: 8GB
- Graphics: Onboard is adequate

**The establishment and maintenance costs are borne by NBN Co and not the consumer. NBN Sky Muster™ Plus Service is approximately $200 per month

*** Estimated life expectancy relates to the anticipated life expectancy 'in the bush' which can be subject to severe weather events, lightning strikes, dust, high humidity, etc. This figure is based on the researchers' personal experiences in regional and remote areas as well as ICT support staff in a number of roles over the last 20 years.

**** Patient's records may include My Health Record and/or the clinical database used by that practice/clinician. My Health Record is free, other database access costs vary significantly and have not been included in these cost estimates.

It is important to note, the Sky Muster™ Plus service can fail in storms and power failures but recovers quickly when the storm has passed or the power returns. It is recommended to switch power off to all unprotected equipment as the storm approaches to prevent damage to equipment. It is also recommended all networking equipment is connected to the Uninterrupted Power Supply (UPS). Telehealth consults can continue if power and internet are still available on power protected devices (UPSs).

The researchers have used two Jabra speakers for over 3 years and transported them thousands of kilometres by road and plane (including small aircraft). Both speakers are still functioning perfectly which demonstrates the robustness of these devices.



Figure 6. Jabra speaker recommended for videoconferencing and telehealth. This speaker microphone combination uses computer algorithms to improve sound quality and provide noticeable audio performance during telehealth consultation.

Chapter 6. Training and support material summary.

The training and support materials have been developed by the project team and partners during the course of the project. The project team's resources as well as other useful links have been provided on the project website and these are presented in this chapter. The project team's resources have iteratively been updated based on feedback and have been made generic (that is, not listing specific clinic or community details) so they can be accessed, downloaded and modified as required.

There are an extensive range of issues associated with operator capacity. These are outlined in Chapter 9: Key findings from research. This project focused on providing support materials for the two ACCHO project participants. Many of the issues identified through the project's activities are clearly inhibitors to the uptake of telehealth. Training and support implemented for the Laynhapuy Homelands provided adequate resources for the health service to use telehealth via videoconferencing as a "Business as Usual" tool. Puntukurnu Aboriginal Medical Service staff used the resources produced by this project but, due to issues with connectivity, still experienced difficulties in doing videoconferencing reliably. The general support tools have been made widely available to the general public and cohorts such as cattle producers and forestry and forest product trainers through the Australian Timber Trainers Association.

These resources are available on the project website:

https://simbani.com.au/resources/

Introduction.

Following are a list of posters based on consultations over the course of the project and informed by the researchers' experience and use acceptance testing. There are some Guidelines for Clinicians which are based on 12 years of experience working in telehealth and extensive input from healthcare providers.

The posters and guidelines were initially tested virtually (due to pandemic travel restrictions) and then in person consultations with several stakeholders (Aboriginal people, remote people, clinicians, ICT providers, administration staff). When the resources were considered robust, they were distributed more widely. The resources continue to be promote through the project and B4BA networks. The initial Guidelines for Clinicians are based on a workshop the researchers ran as a component of the original Laynhapuy Telehealth Project (2016-2018) and Telstra Reconciliation Action Plan Telehealth Project (2015-2018). These have been further refined during this CRCNA Project.

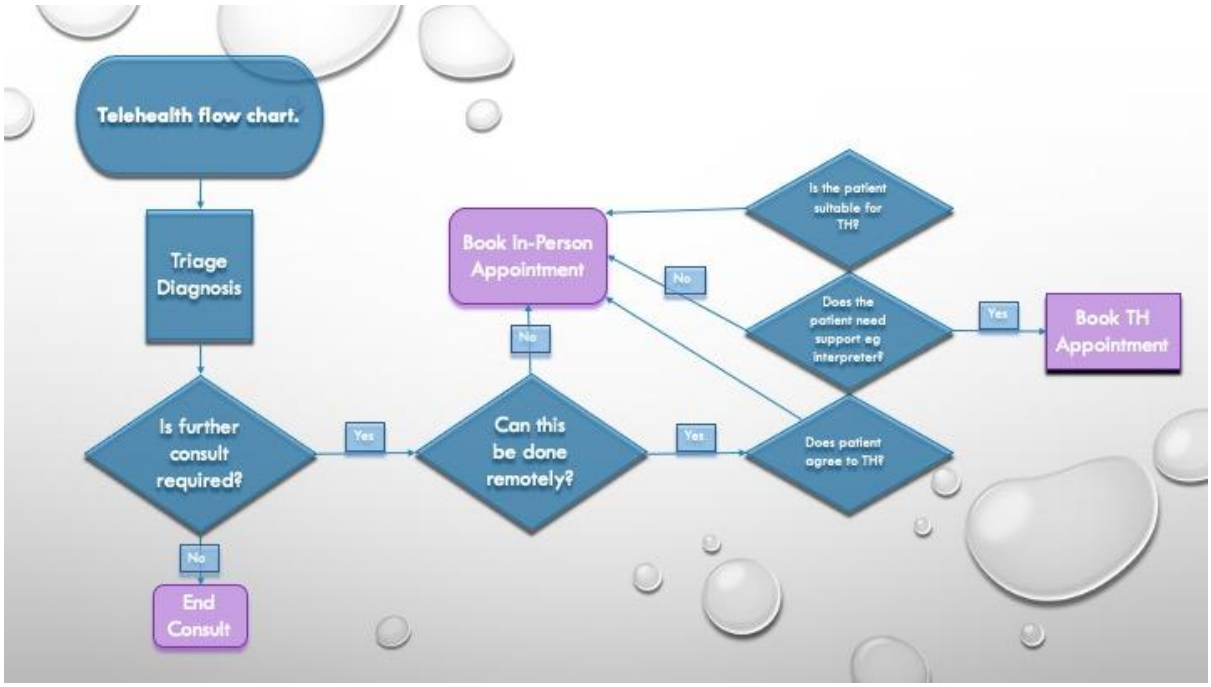
The posters include:

- Instructions for installing and using the Jabra 710 Speaker.
- Instructions for installing and using the Logitech PTZ Pro camera.
- Instructions for using Zoom (driven by invitation from clinicians) including management of voice and video controls.
- Telehealth flow chart.
- Poster for general community members for getting assistance via telehealth.
- How to do an Ookla speed test.
- How to set up a videoconference with VisionFlex Tablet.
- How to do a Zoom call.
- Internet (Sky Muster and Sky Muster Plus) Trouble Shooting Guide.
- Guidelines for Clinicians.
- Telehealth Training Links
- How to access services through the Telehealth for the Bush Trial.
- What can you do if you telecommunications provider does not resolve your fault?
- Project Partner Resources.

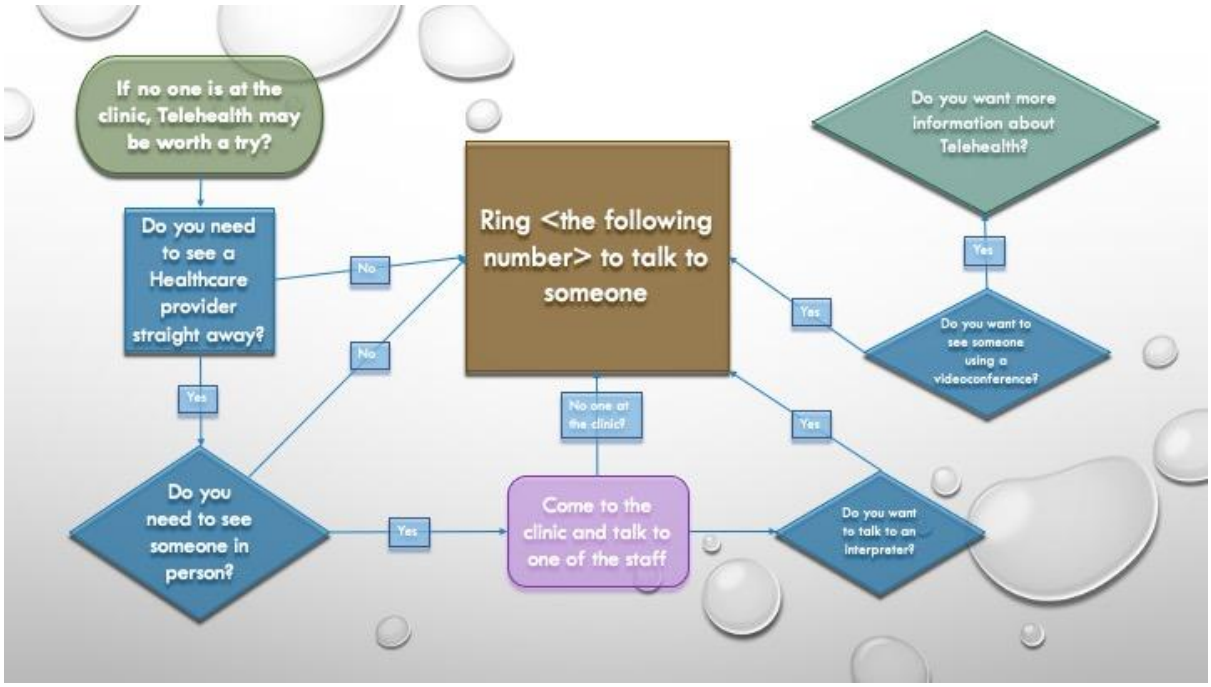
By trialling these resources in real-life situations it was necessary to produce additional posters tailoring posters for different settings. For example, some of the communities have a clinic where a clinician is usually available, some have no clinic at all, while others may have clinician visits once a week or fortnight for a few hours or more regularly, eg 2-3 time a week for half a day or whole day. Therefore, the posters were tailored for specific scenarios.

Posters

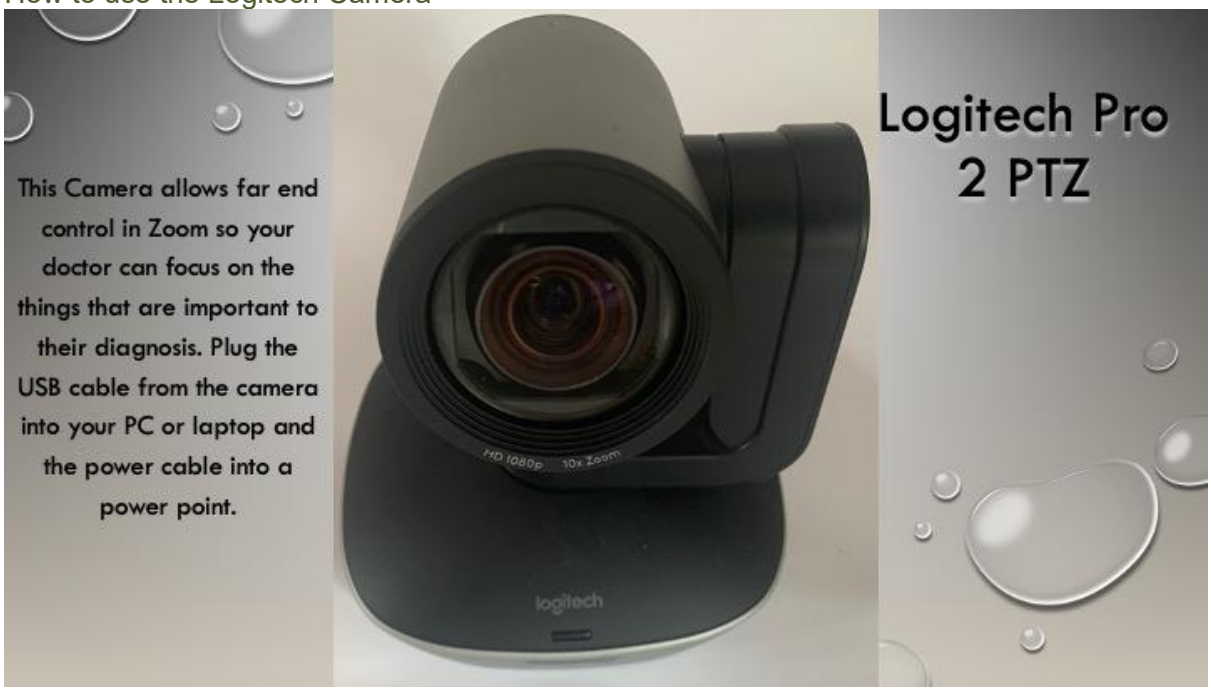
Patient attends clinic



Patient contacts clinic



How to use the Logitech Camera



How to use Jabra Microphone and Speaker

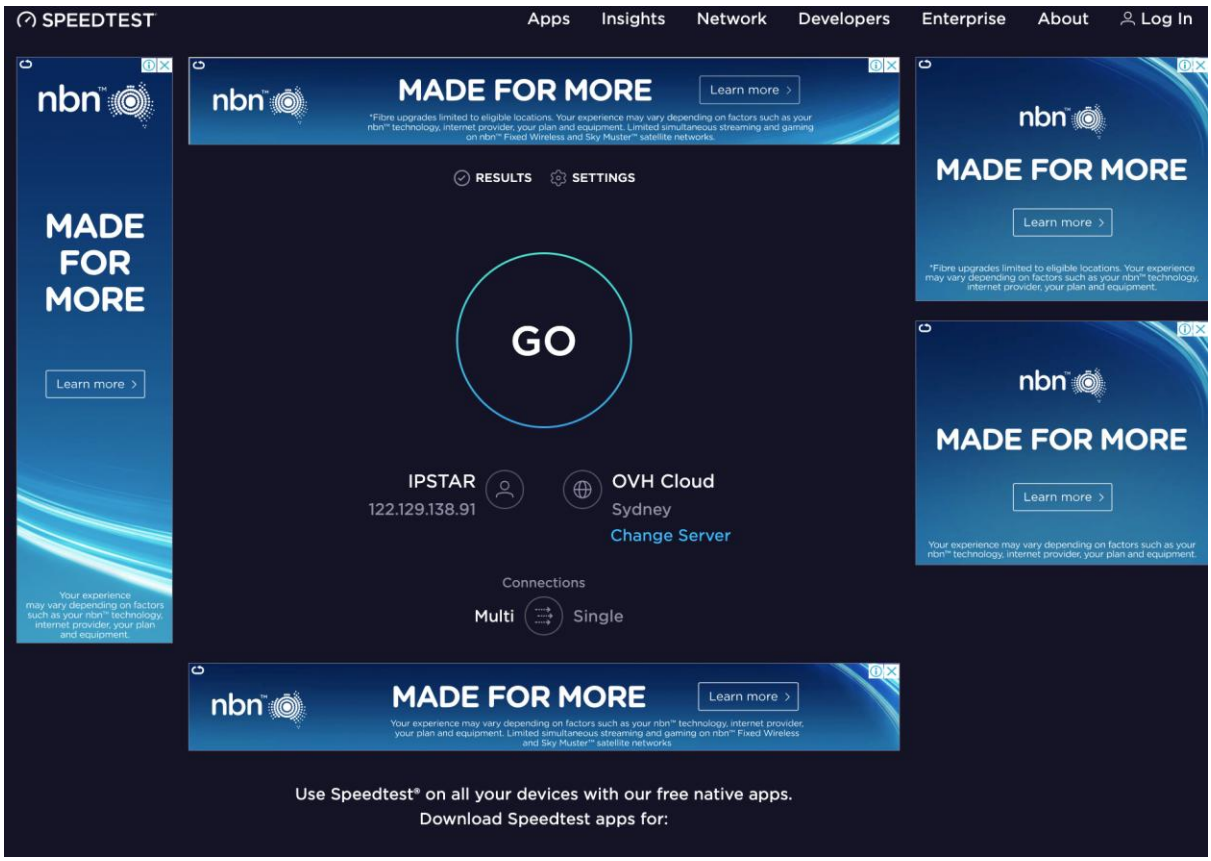


How to do an Ookla speed test.

In your web browser.

Go to: https://www.speedtest.net/

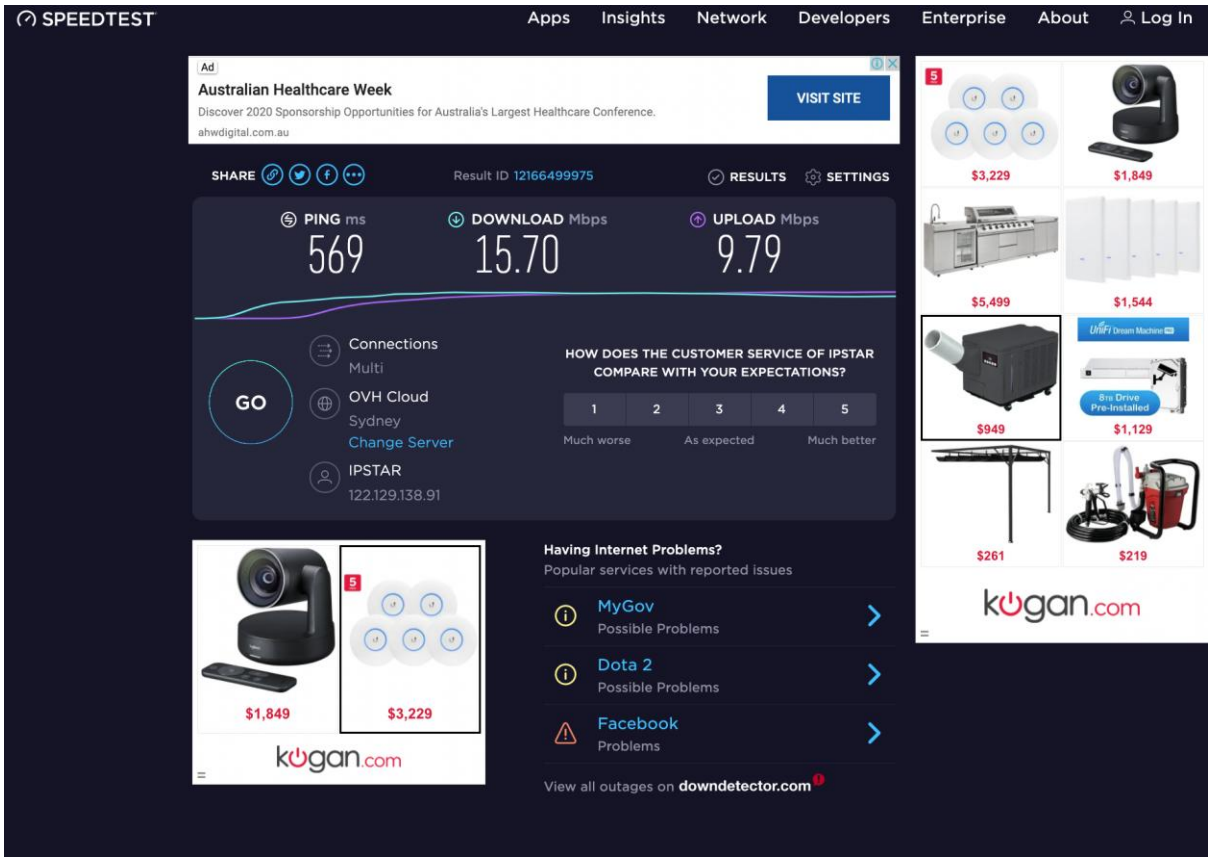
Or google Ookla speed test and click the link



A screen will appear with a circle with “Go” inside it. Click on the Go button.

The speed test will start.

When the speed test has completed some numbers will appear and the Go button will appear to the left of the screen.



The numbers we are interested in are:

Ping (ms – milliseconds) – the delay due to the signal having to travel 35,000 kms to the satellite.

Download (Mbps – megabits per second) – the download speed.

Upload (Mbps – megabits per second) – the upload speed.

Minimum requirements for video conferencing.

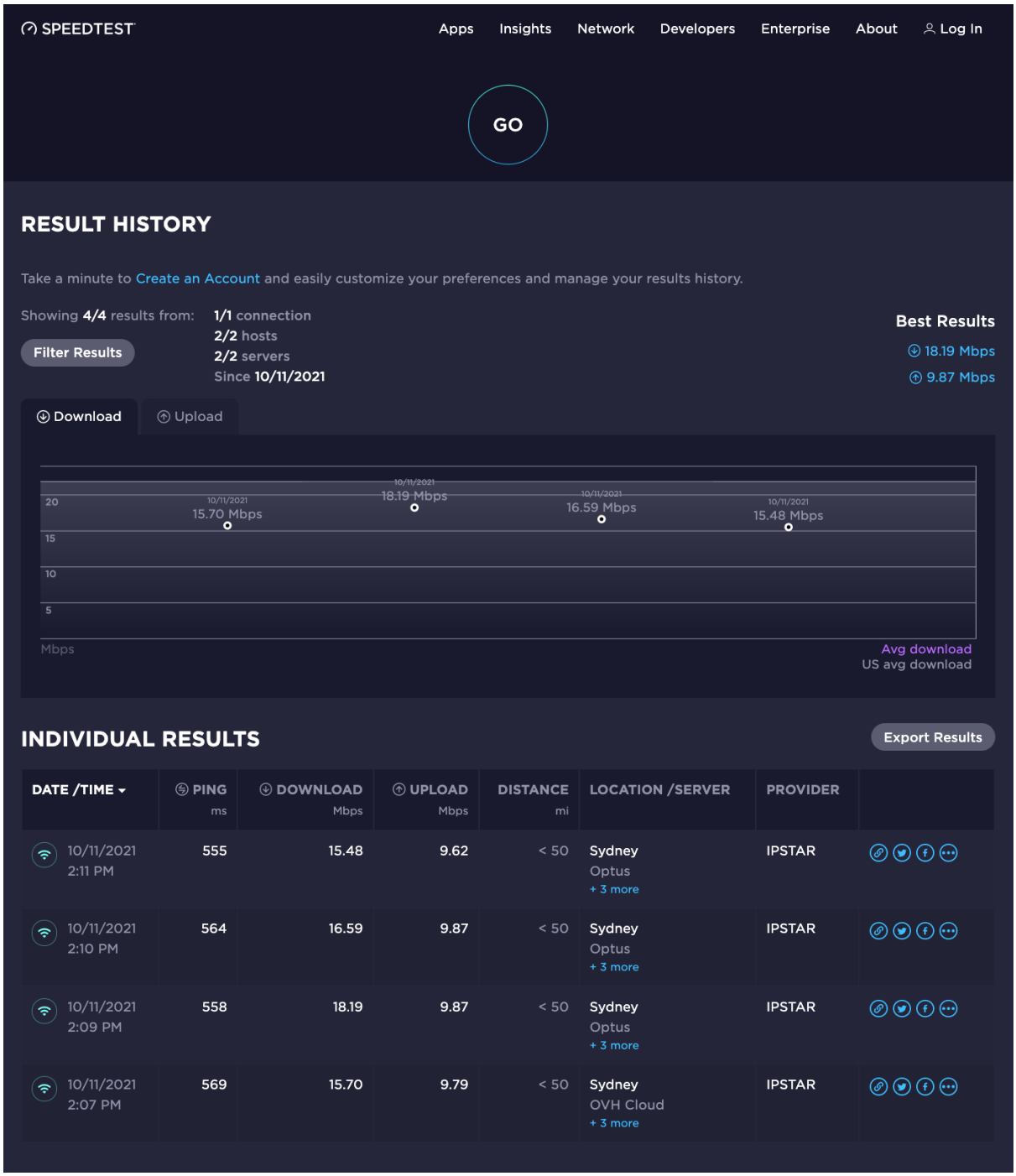
The longer the ping, the longer the delay in signal. For SkyMuster satellite a ping of about 600 ms is expected and adequate for video conferencing.

Download and upload speeds need to be a minimum of 2 Mbps to be able to do video conferencing.

Error messages: If the speed test does not complete you will get an error message. It is useful to take a photo of that error message and keep on file. If you can't take a photo or screen shot, just note the message type and record the time of the failed test.

You can do additional speed tests by hitting the Go button repeatedly.

Collecting your results: You can collect your results by clicking the Log in button in the top right-hand corner. Select Results History and hit the Export button on the left hand. The file will be downloaded to your downloads folder. It will be a .csv file which you can open with Excel and save as and Excel worksheet. It is best to save this file with the name of the location and date and any other relevant details such as which internet service you are using and which device.

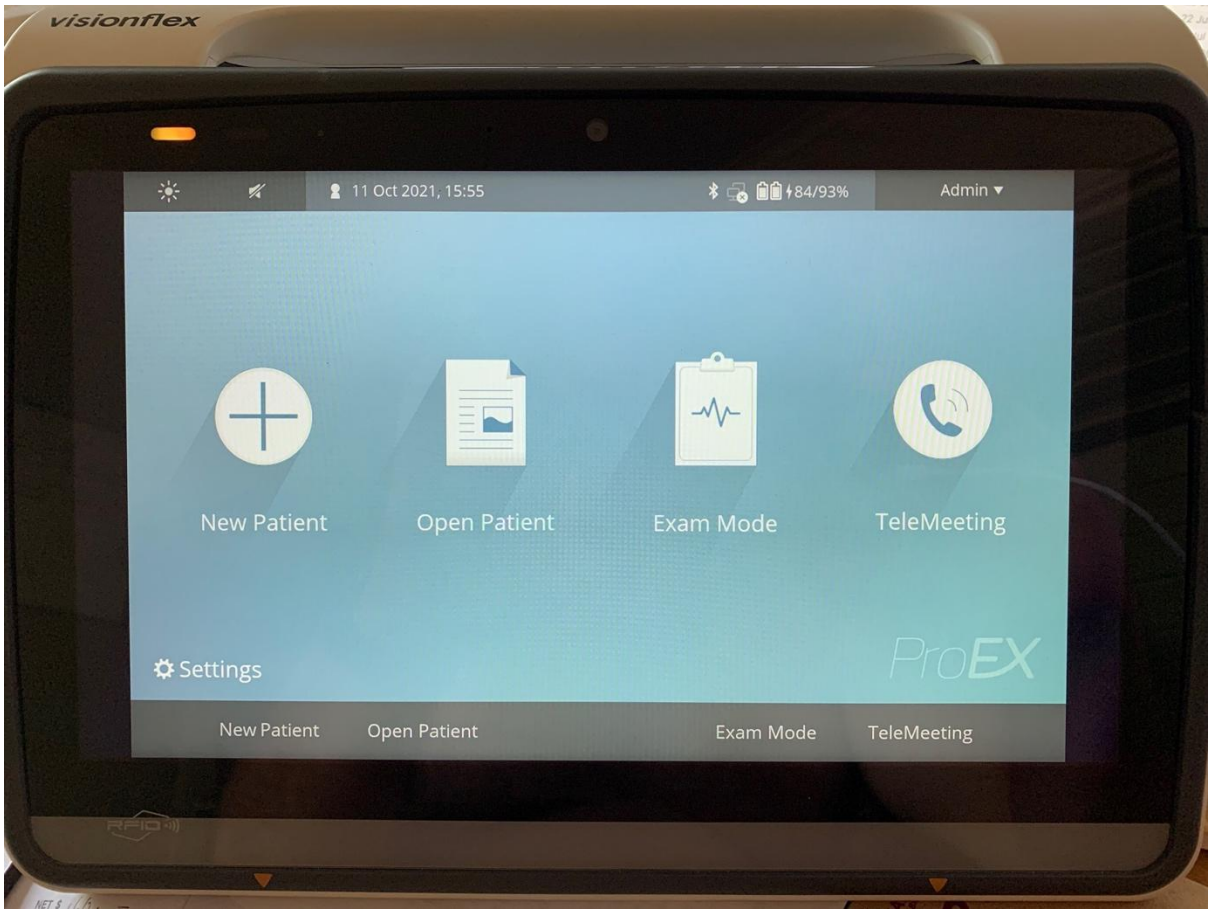

SPEEDTEST
Apps
Insights
Network
Developers
Enterprise
About
Log In
GO
RESULT HISTORY
Take a minute to Create an Account and easily customize your preferences and manage your results history.
Showing 4/4 results from:
1/1 connection
2/2 hosts
2/2 servers
Since 10/11/2021
Filter Results
Best Results
18.19 Mbps
9.87 Mbps
Download
Upload
10/11/2021
15.70 Mbps
10/11/2021
18.19 Mbps
10/11/2021
16.59 Mbps
10/11/2021
15.48 Mbps
20
15
10
5
Mbps
Avg download
US avg download
INDIVIDUAL RESULTS
Export Results
DATE /TIME
PING ms
DOWNLOAD Mbps
UPLOAD Mbps
DISTANCE mi
LOCATION /SERVER
PROVIDER
10/11/2021 2:11 PM
555
15.48
9.62
< 50
Sydney
Optus
+ 3 more
IPSTAR
10/11/2021 2:10 PM
564
16.59
9.87
< 50
Sydney
Optus
+ 3 more
IPSTAR
10/11/2021 2:09 PM
558
18.19
9.87
< 50
Sydney
Optus
+ 3 more
IPSTAR
10/11/2021 2:07 PM
569
15.70
9.79
< 50
Sydney
OVH Cloud
+ 3 more
IPSTAR

How to set up a video conference with VisionFlex Tablet.

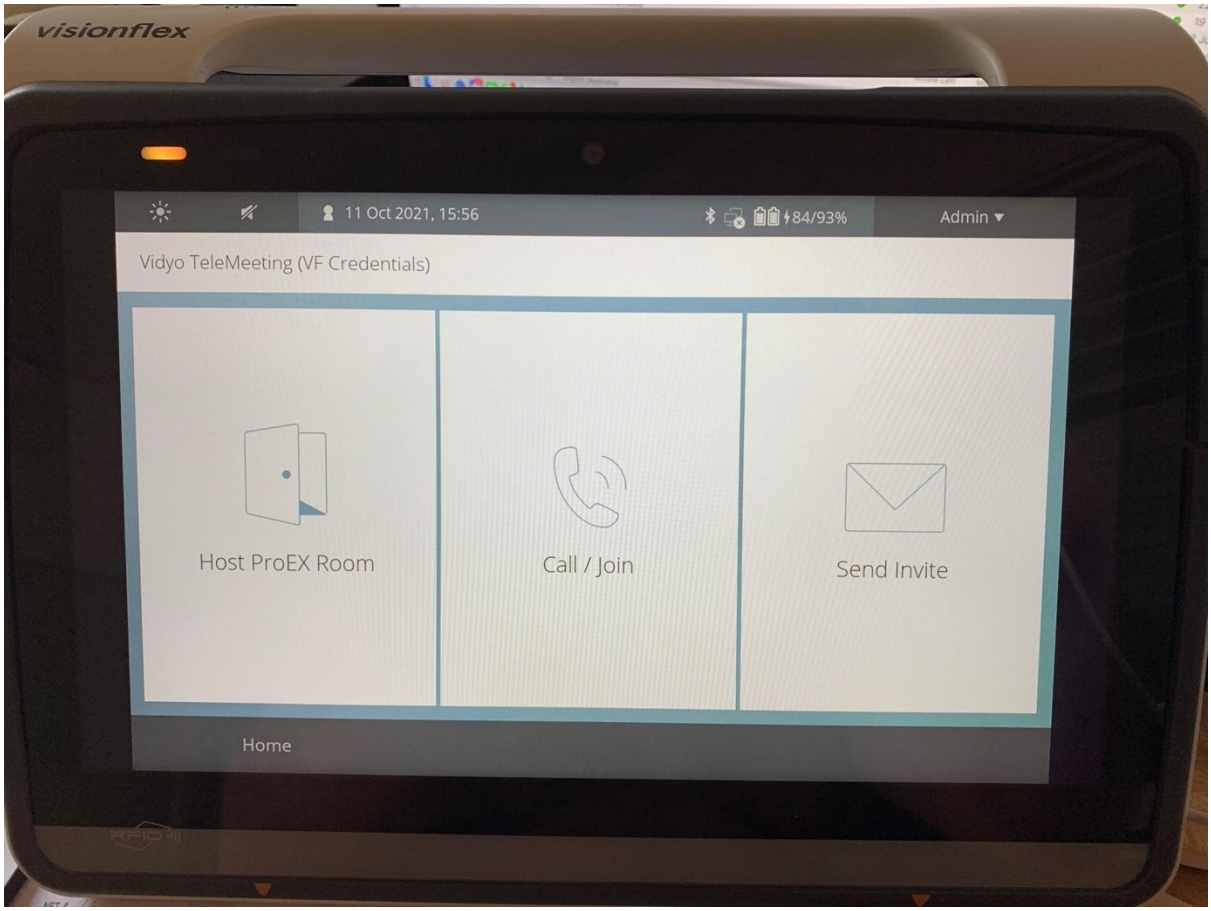
If you are unable to establish a video conferencing session on you laptop or desk top, you can use the Vision Flex tablet to initiate a video conference.

If you're invitees are on a Mac, it doesn't like Safari so we suggest using Google Chrome.

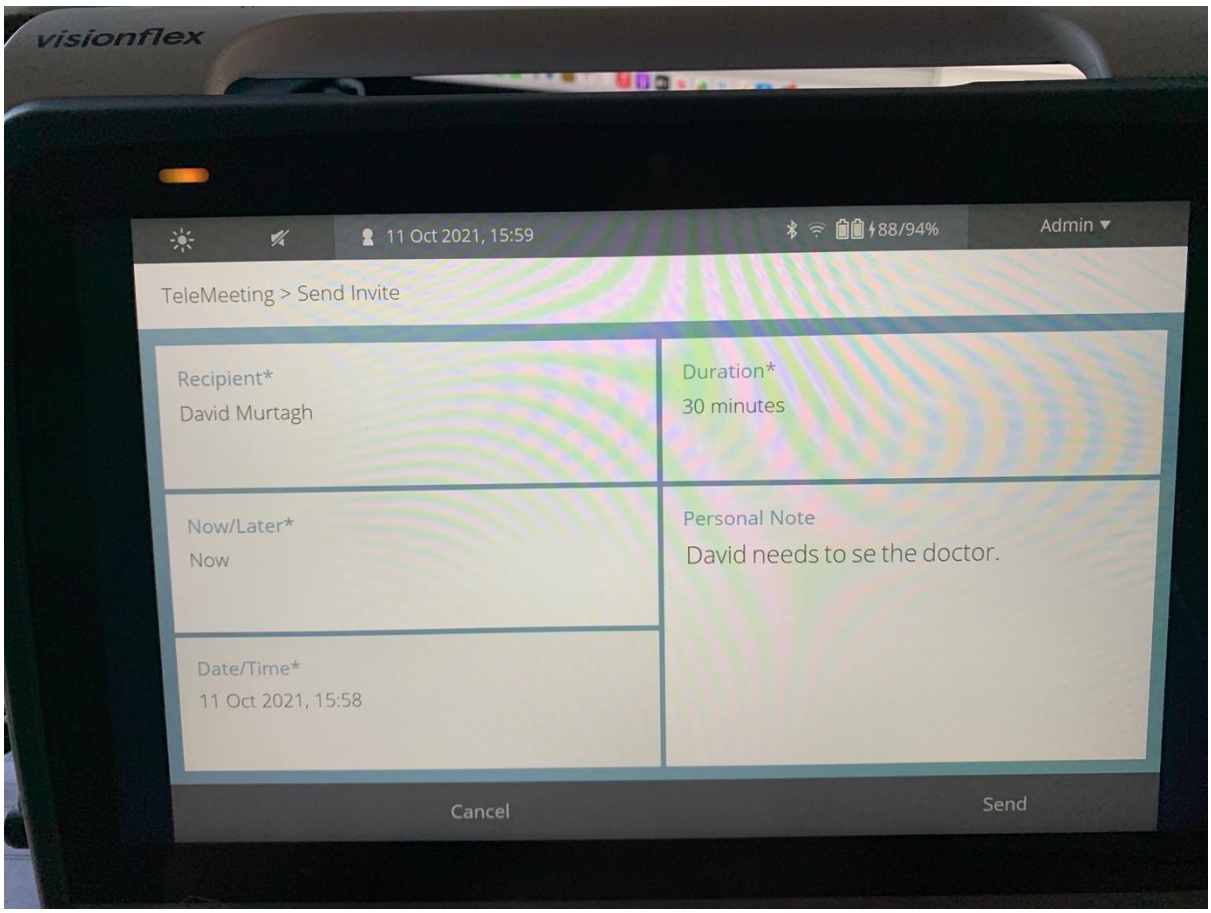
Click on "Telemeeting".



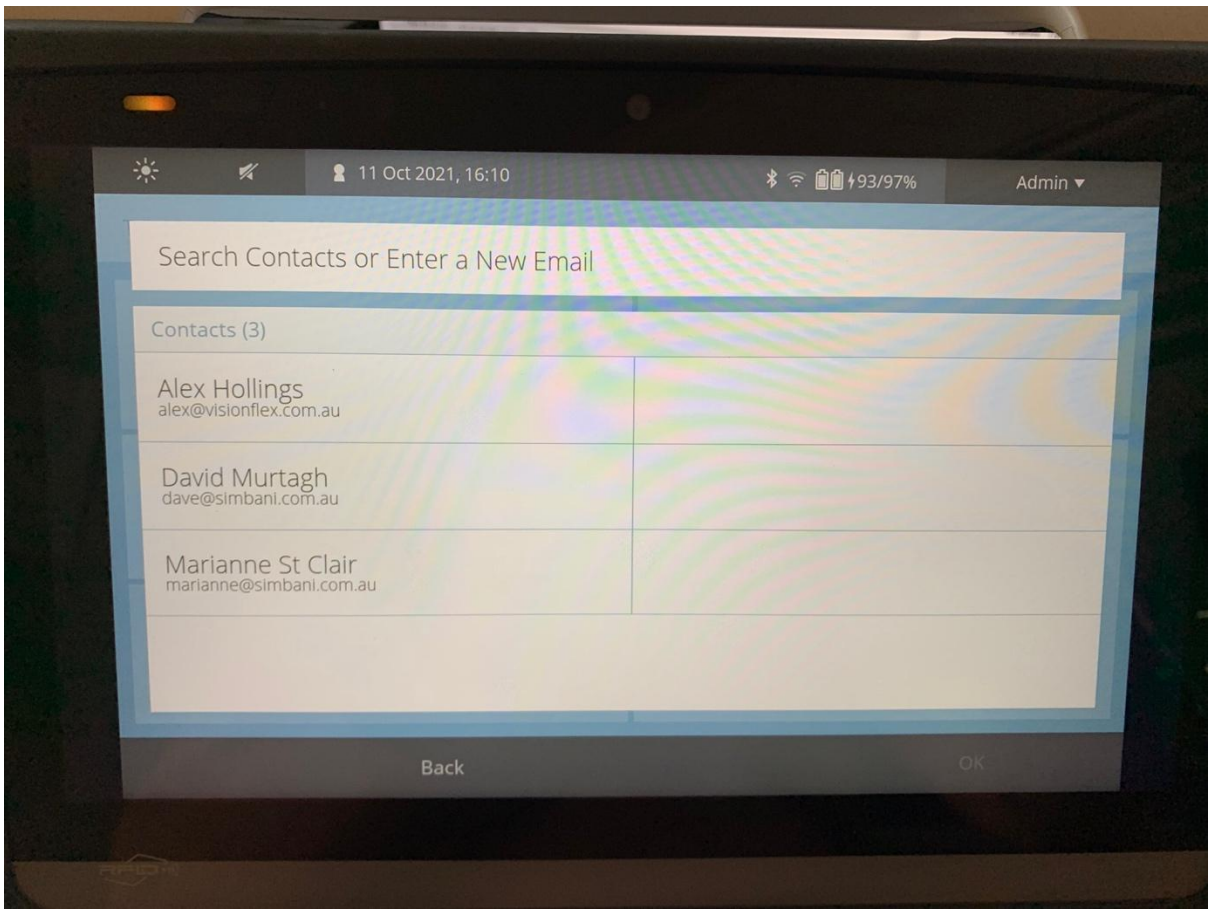
Click on “Send invite”.



Complete the form.

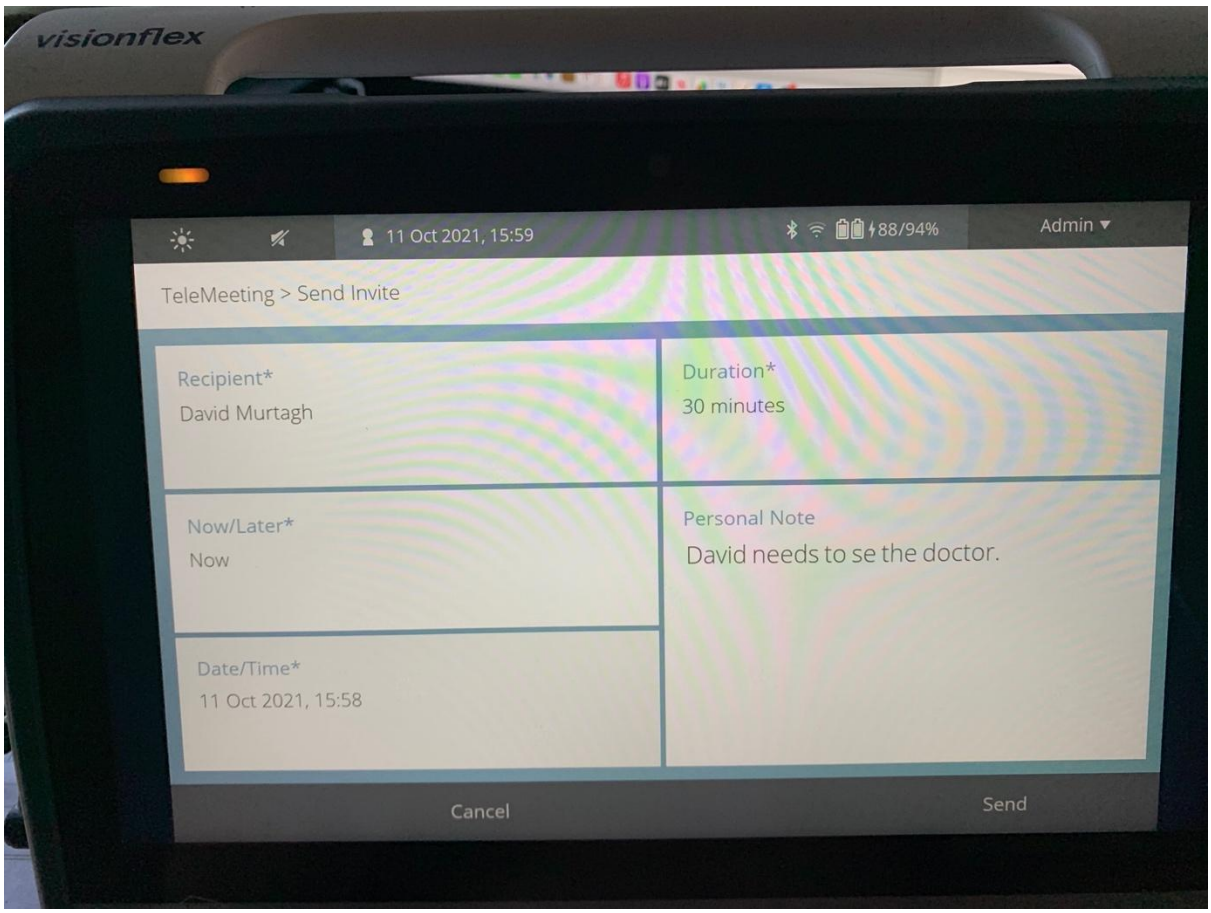


Click “Recipient” and select “Existing email address” or “New”



Click “Ok”.

Select “Now” or “Later” and then select date and time.



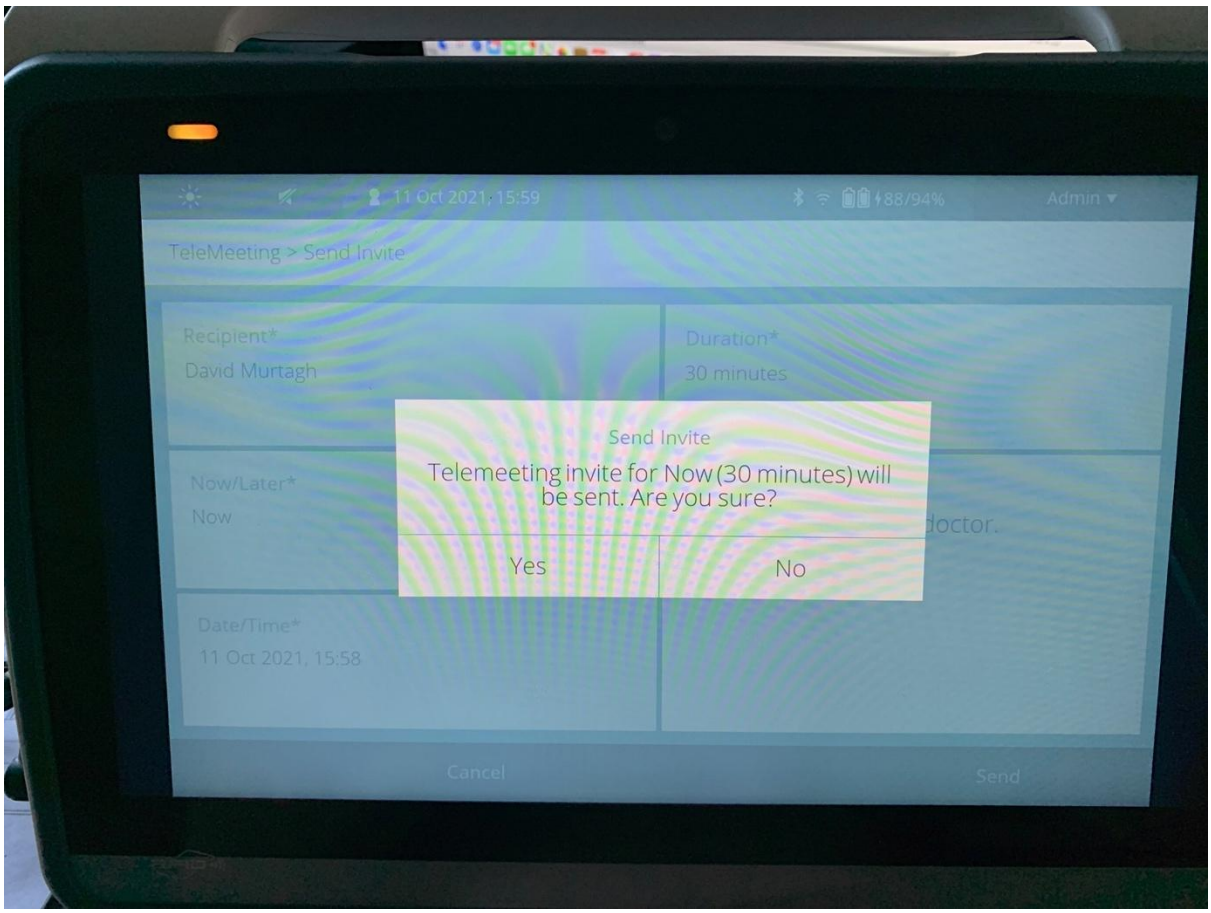
If you’ve clicked “Now” it will start the meeting.

Select “Time required”. It is better to over-estimate the time required, eg if you’re expecting a video conference to go for 30 mins, select 60 mins/1 hour to allow for over-run of time. The session will terminate at the selected time, so its best to over-estimate the time required.

Click “Ok”.

Add a note to invitees and include relevant information which will be included in the email sent to invitees.

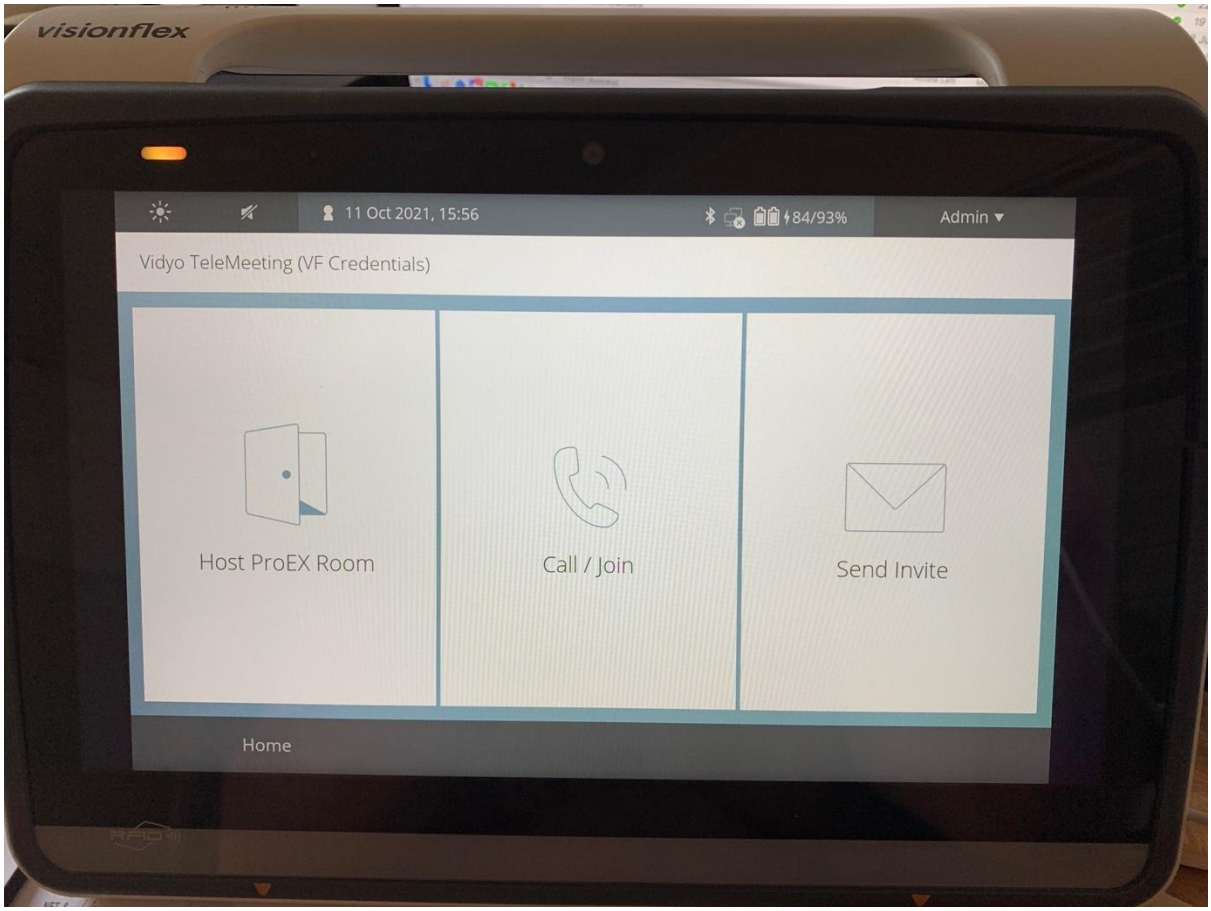
Acknowledge “Yes” or “No” to the prompt send the invitation.



The screen will then indicate it is sending the invitation and also show the invitation list.

Click “Ok”.

Click “Host ProEx room”.



Wait for recipients to join.

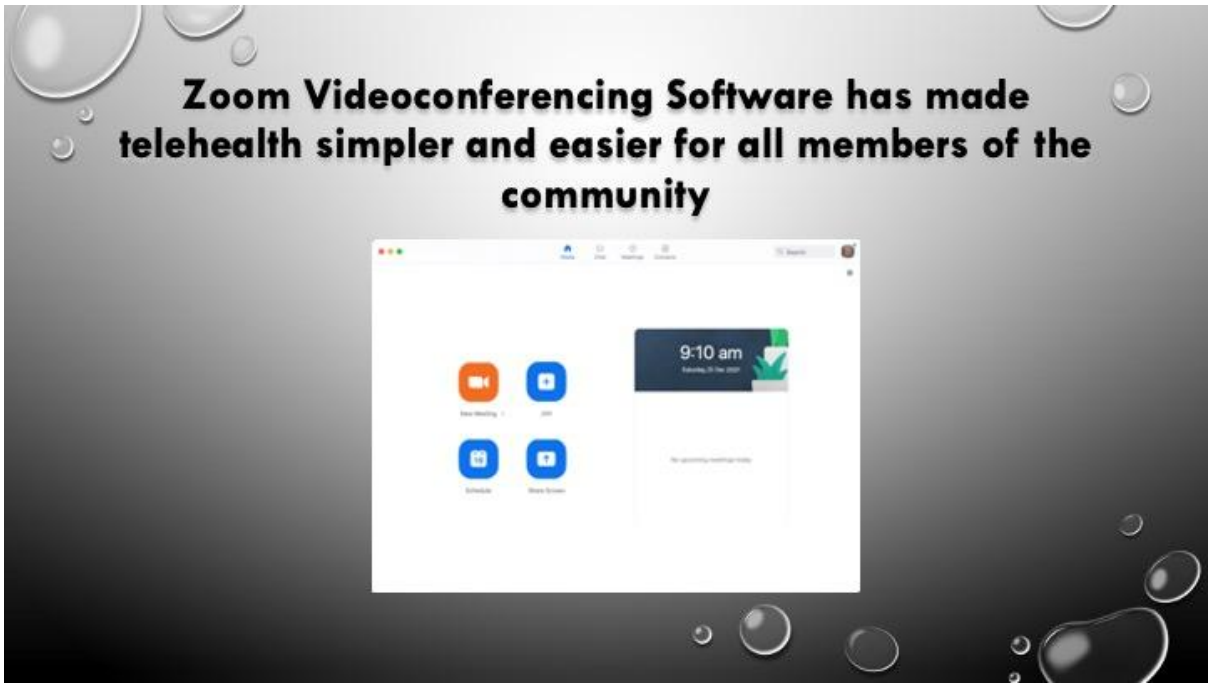
You may need to advise recipients to check their emails and look for an email labelled “Admin” from: telemeeting-invite@visionflex.com.au.

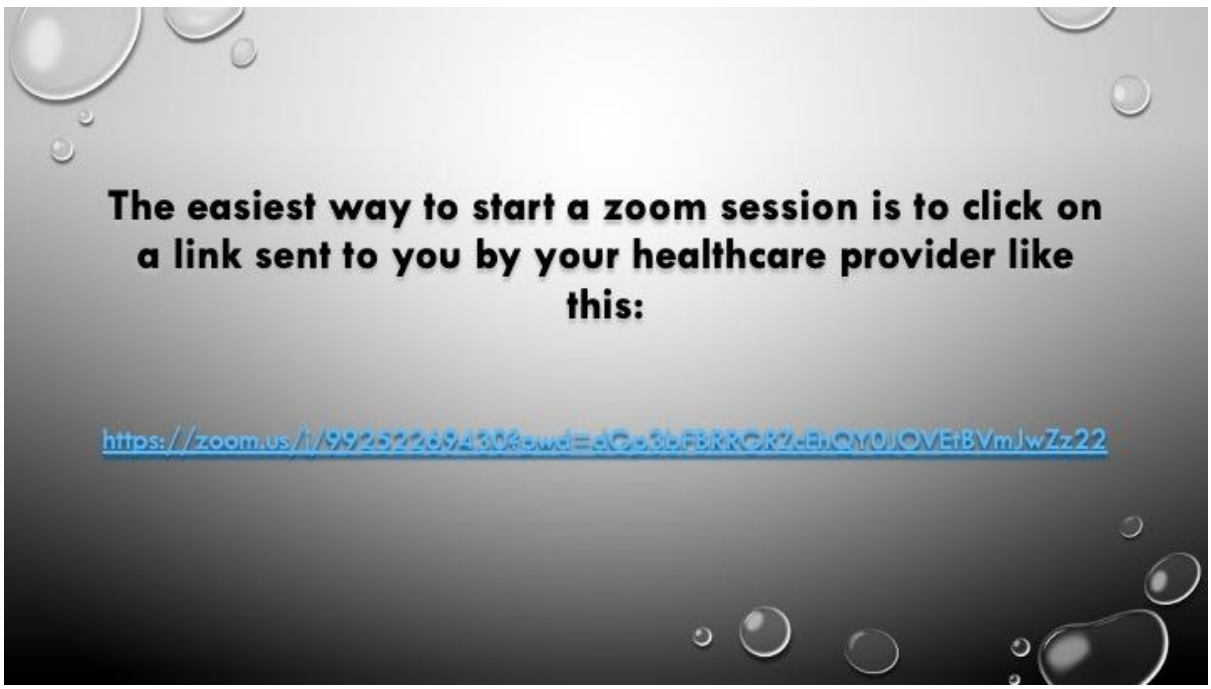
Invitees can join via their browser or download the app.

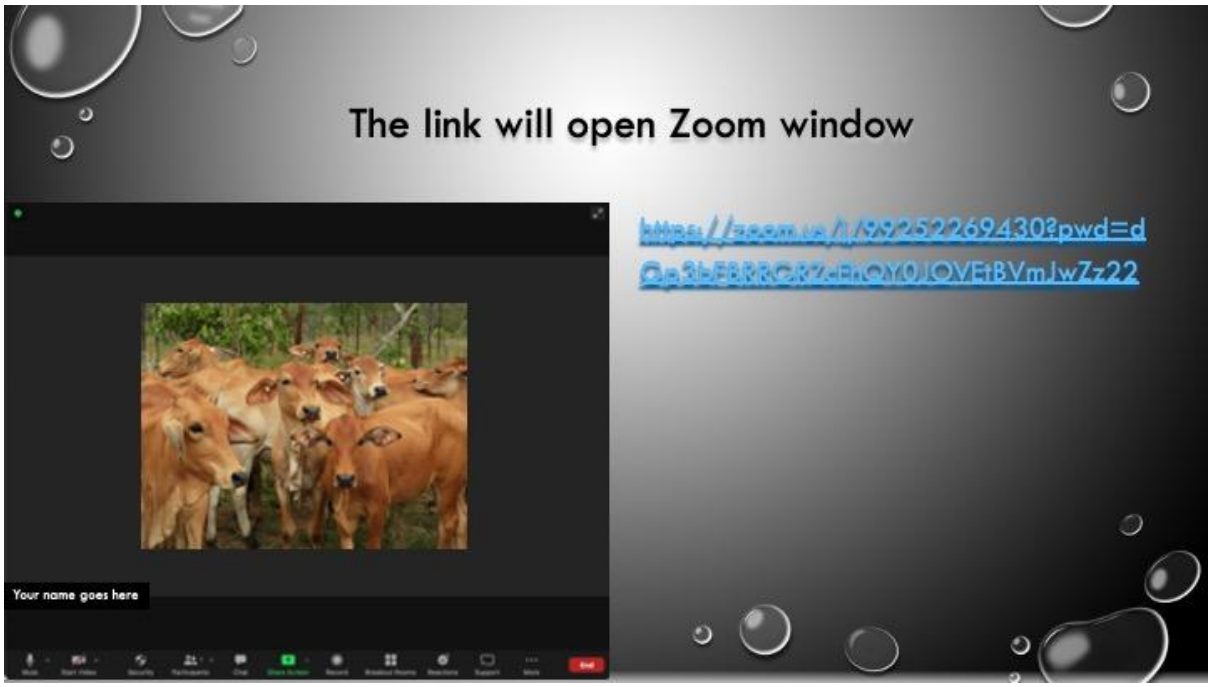
Invitees need to insert their name and then click the “Join” button.

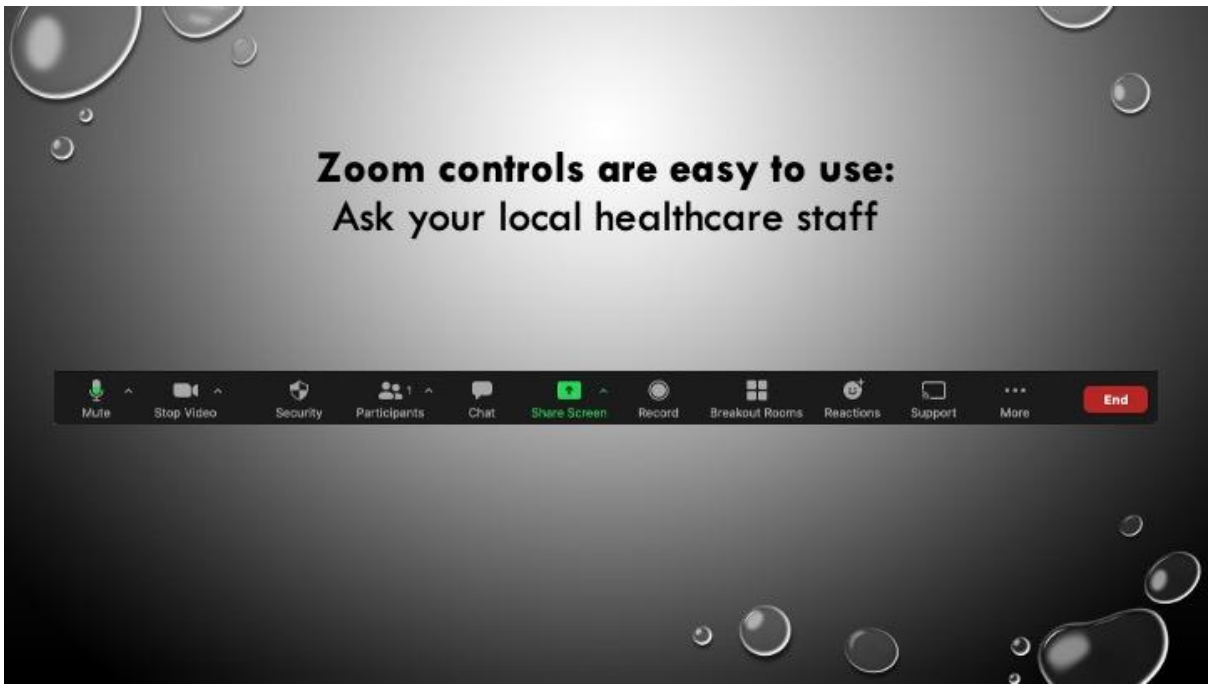
Invitees and host can click the red phone icon to end meeting participation.

How to do a Zoom call

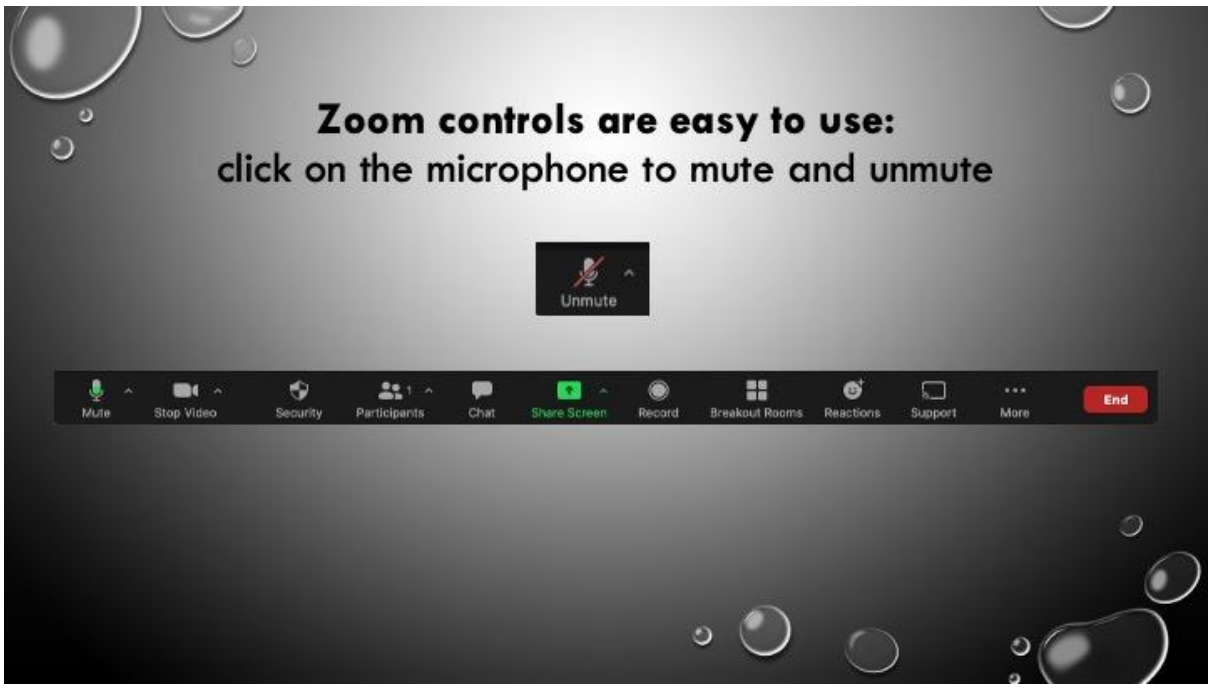





The link will open Zoom window
Your name goes here


Zoom controls are easy to use:
Ask your local healthcare staff
Mute
Stop Video
Security
Participants
Chat
Share Screen
Record
Breakout Rooms
Reactions
Support
More
End


Zoom controls are easy to use:
Use the up arrow to choose the microphone
Mute
Mute
Stop Video
Security
Participants
Chat
Share Screen
Record
Breakout Rooms
Reactions
Support
More
End

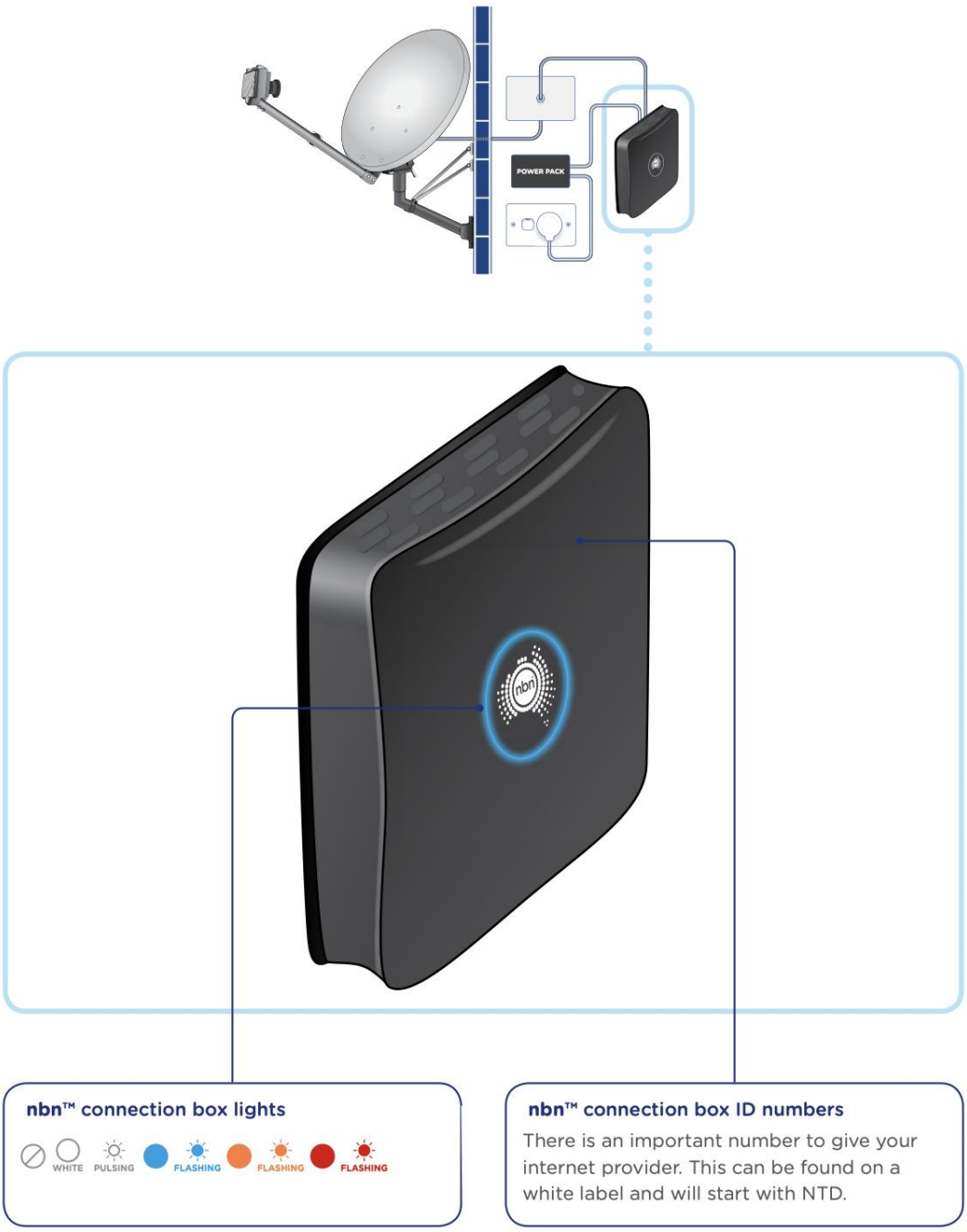

Zoom controls are easy to use:
click on the microphone to mute and unmute
Unmute
Mute
Stop Video
Security
Participants
Chat
Share Screen
Record
Breakout Rooms
Reactions
Support
More
End


Zoom controls are easy to use:
Click on the Stop Video/Start Video to turn the camera on and off
Start Video
Mute
Stop Video
Security
Participants
Chat
Share Screen
Record
Breakout Rooms
Reactions
Support
More
End

Internet (Sky Muster or Sky Muster Plus) Trouble Shooting Guide.

If your internet is not working, please try these steps:

1. If there's really bad weather or heavy rain wait until the storm passes and try again.
2. Check power is on to the UPS and the NTD (see pictures below).
3. If it is not working. try plugging the NTD it into another power point – maybe with an extension cord.
4. If that works, plug the UPS into the same power point and plug the NTD back into the UPS.
5. If this does not work, you may have a problem with the UPS, so plug the power back into the NTD.
6. If this fixed the problem, let the office know so they can fix that power point and the UPS if it's not working.
7. If there is still no power, ring the office and advise them the power is out.
8. If there is power, check the NTD to see if it's a steady blue colour.
9. If it is a steady blue colour, it should be working, so check to see if there's a problem with the router (Step 10). If it's not a steady blue colour go to Step 15.
10. Check to see if the internet/WAN and Wi-Fi lights are on.
11. If they're not, they may not have power, so try plugging the router into a different power point.
12. If that fixes the problem, let the office know so they can fix that power point.
13. If the router lights are both on, check to see if the cable running from the NTD is plugged into the Internet/WAN socket in the back of the router. If it's slipped out, just plug it back in.
14. If this does not work, ring your service provider to see if a technician can help you. If that is too difficult, ring the office and ask for assistance.
15. Turn the power off to the NTD. Wait at least 5 minutes.
16. Turn the power back on. It may glow white for up to 5 minutes. It should then turn orange (stand-by mode) or blue (working mode).
17. If the light stays white or turns red, or is flashing, ring your service provider to see if a technician can help you. If that is too difficult, ring the office for assistance.



NTD Box (Network Termination Device)

Note the Blue circle – This is the area to watch for colour changes.

(Photo supplied by NBN Co.)

Guidelines for Clinicians

Checklist before the Telehealth Consultation

Is a remote consultation clinically appropriate for this patient, currently, in their present location?

Do you have a private, well-lit room?

Does the patient have a private, well-lit room?

Make they do not sit in front of a bright window (draw curtains).

For video decide on the platform to be used e.g., Healthdirect, Skype, Zoom, Facetime, WhatsApp etc. (What is easiest for the patient?)

Take the patient's phone number and provide the patient with information on video or phone alternates if the first mode of communication fails.

Does the consult cost more?

Do you have access to the patient's health information before, during and after the consult?

Setup equipment and test before the consult – ideally dual screen.

Do a speed test to ensure there are no issues with connectivity on the day of the consult.

Have your alternate plan in place such as rescheduling or using the phone or if the patient is seriously ill, arrange an evacuation.

Contact (call, SMS) the patient an hour before the consult to confirm it's still appropriate for the appointment time.

Steps during the Telehealth Consultation

Initiate the consultation by connecting online or calling the patient.

Confirm the patient can hear you and use the chat or phone to troubleshoot with the patient and position screens, microphones and cameras so you can both be seen clearly.

Introduce yourself and have the patient confirm their name and consent for the consultation to continue

Confirm anyone else on the call with either you or the patient.

Ask if your patient can hear and see you.

Ask your patient if there is anyone in the room.

Inform your patient you will phone them if there are any technical difficulties during the consultation.

Confirm the phone number you have is correct.

Prepare your patient before you begin the consultation to ensure a good interaction will ensue.

If necessary, ask them to adjust their camera, re-position themselves or the person accompanying them, turn on the light, or close curtains behind them.

If both patient and clinician have agreed, start to record the consultation.

Once you are satisfied that you can communicate effectively, begin the consultation

Remind the patient what the plan B is if the technology fails

Revert to your plan B if the technology isn't working.

Don't put personal health information in the chat but do use it for demonstrating and explaining procedures and conditions.

Provide instructions on how to capture visual information – come close to the camera or take a photo.

Explain what can or cannot be done on a remote consult.

Let the patient know when you are taking notes or reading something – silence is OK.

Ensure adequate clinical notes are in the patient medical record and the National My Health Record.

Be aware that remote consults are new for patients and communication may be harder for you and them.

Towards the end of the consultation summarise key points and what happens next – who will do what & when.

Ask the patient if they need anything clarified.

Confirm and record if the patient is happy to have a remote consult again.

Tell the patient you are going to close the call.

Send a patient evaluation form to get their feedback on having a remote consultation.

Telehealth Training Links

Telehealth Training and Education Links

Australian Telehealth Society – Telehealth Guidelines

https://www.aths.org.au/resources/guidelines/

University of Queensland Centre for Online Health – Quick guides to Telehealth

https://coh.centre.uq.edu.au/quick-guides-telehealth

University of Queensland Centre for Online Health – Key MBS Statistics

https://coh.centre.uq.edu.au/telehealth-and-coronavirus-medicare-benefits-schedule-mbs-activity-australia

Australian Primary Healthcare Nurses Association – Telehealth for COVID-19

https://www.apna.asn.au/product/detail/6e2eed54-086f-ea11-80d9-005056be66b1

Australian Digital Health Agency – Telehealth Program

https://www.digitalhealth.gov.au/healthcare-providers/initiatives-and-programs/telehealth

Australian Digital Health Agency – Digital Health Resources

https://specialist-toolkit.digitalhealth.gov.au/printable-guides

Royal Australian College of General Practice – Telehealth Resources

https://www.racgp.org.au/clinical-resources/covid-19-resources/telehealth

Australian Department of Health – COVID Telehealth items guide

https://www.health.gov.au/resources/publications/coronavirus-covid-19-telehealth-items-guide

Australian Department of Health – Prescriptions via Telehealth

https://www.health.gov.au/resources/publications/prescriptions-via-telehealth-state-and-territory-rules

Charles Darwin University – Short Course

https://www.cdu.edu.au/files/2020-05/HLTSS00043%20Telehealth%20Administration.pdf

Charles Sturt University - Three Rivers University Department of Rural Medicine Telehealth Resources

https://threerivers.csu.edu.au/telehealth

American Psychological Association – Telehealth Education Resources

https://www.apa.org/ed/ce/telehealth

Rural Health Information Hub – Implementing Telehealth Programs

https://www.ruralhealthinfo.org/toolkits/telehealth/4/resources-needed

National Committee for Quality Assurance – Taskforce on Telehealth Policy Education Resources

https://www.ncqa.org/programs/data-and-information-technology/telehealth/taskforce-on-telehealth-policy/educational-resources/

Stroke Foundation – Telehealth Resources

https://informme.org.au/News/2020/03/26/COVID-19-Telehealth-resources

Australian College of Rural and Remote Medicine – Telehealth Handbook

https://www.acrrm.org.au/docs/default-source/all-files/acrrm-handbook-for-telehealth-online-education-module.pdf?sfvrsn=cdc6f18f_2

Australian College of Rural and Remote Medicine – Telehealth Services in your Practice

https://www.acrrm.org.au/docs/default-source/all-files/organising-telehealth-services-in-your-practice-factsheet-final_v3.pdf?sfvrsn=2a5d74a_2

ISfTeH - International Society for Telemedicine & eHealth – Training Program

https://www.isfteh.org/files/media/ISfTeH_Telemedicine_Training_Programme_2August_07.pdf

Digital Health CRC - Telehealth Hub

https://digitalhealthcrc.com/telehealth/clinicians/online-modules/

NSW Agency for Clinical Innovation - Telehealth Resources

https://aci.health.nsw.gov.au/resources/telehealth

NSW Health Telehealth Services for your Mob

https://mk0ahmrchvhy3q0clf.kinstacdn.com/wp-content/uploads/2021/01/AHM_COVID-Telehealth_Online.pdf

NACCHO Communique - Telehealth

https://nacchocommunique.com/category/telehealth/

Videos

CNBC Television – Is Telemedicine The Future Of Health Care?

https://www.youtube.com/watch?v=PLp6U5mUMQQ

What can you do if your Telecommunications Provider does not resolve your fault?

Our research has found many consumers have long term difficulties in having their telecommunications faults resolved to their satisfaction. There are layers of contractors between the wholesaler (i.e. NBN Co) and the customer, which can lead to faults not necessarily being resolved as expediently as possible.

Below are some links to organisations which may assist in having telecommunications issues resolved.

Regional Tech Hub

The Regional Tech Hub provides independent advice and support and can be contacted on 1300 081 029 or via their website: https://regionaltechhub.org.au/about/

Australian Communications Consumer Action Network (ACCAN)

https://accan.org.au/

Phone: 02 9288 4000
SMS: 0457 606 600

info@accan.org.au

Telecommunications Ombudsman

Complaints can be lodged through the Telecommunications Ombudsman and the Ombudsman can assist with resolving serious or long term telecommunications issues.

https://www.tio.com.au/

1800 062 058

Australian Competition and Consumer Commission (ACCC)

https://www.accc.gov.au/

Federal Elected Members of Parliament.

Senators and Members of the House of Representatives have direct communication channels with Telstra and NBN Co. In many cases, a complaint made to a local Member of Parliament should be resolved within a few days. However, rectification of issues for remote areas may involve much longer timelines. Members of parliament are listed on the Parliament of Australia Website:

https://www.aph.gov.au/senators_and_members/members



Only 500,000 people live in Australia's most remote locations[1] but they have disproportionate access to health services and consequently, poorer health outcomes. That is, the further away from health services, the poorer the health outcomes.

Evidence indicates there is a lack of access to health services (including allied health) for regional and remote people. There are often long waits to access services, and in some cases, people are unable to access the services they need.

Telehealth may be part of the solution to this long-term problem.

Synapse Medical in collaboration with Simbani Research have been trialling a new model of service delivery for remote areas where there is limited access to services.

Initial Telehealth for the Bush Trials: The initial trail has been in the Northern Territory, in collaboration with experienced local stakeholders and partner organisations. The trial has offered telehealth services to remote communities and people. In one very remote Aboriginal community, 17 health checks were done via telehealth over community Wi-Fi, identifying a number of community members needing further follow up. One cattle producer could not believe they had their very first consultation with a professor at the ripe old age of 50! These initial patient consultations, and others, have been a resounding success so we are looking to expand the trial to include a wider range of remote areas and more services.

How it works: Synapse Medical is a leading Australian MedTech company, that has been providing mobile technologies to help doctors with medical appointments, Medicare billing, and other administrative tasks since 2010.

Synapse has a mobile phone app which is a complete medical billing system known as the ***Synapps MBS***. It's a one-of-a-kind app that lets doctors bill to Medicare from their mobile phones, and it connects specialists, GPs and nurses just like Uber connects drivers and riders.



This means we can use the app to connect primary healthcare providers, specialists, and patients for telehealth appointments.

1. Modified Monash Model (MMM) Regions 6 & 7

synapsemedical.com.au

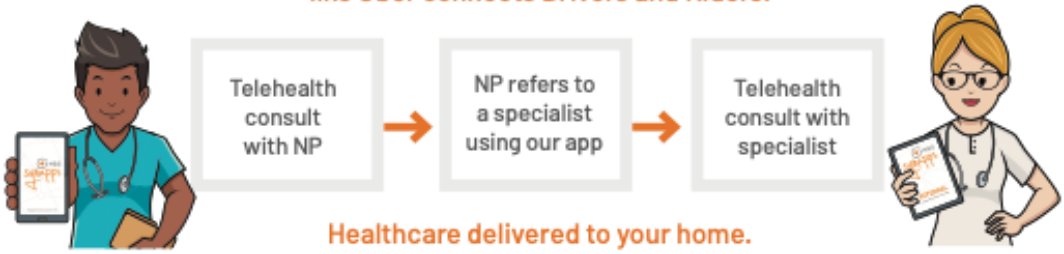
Telehealth for the bush trial for remote areas

An untapped part of the primary care workforce is Nurse Practitioners, who are highly qualified Registered Nurses, educated and authorised to work independently. They diagnose and treat patients in collaboration with medical practitioners, and national standards ensure they provide high quality, patient centred care working much like GPs.

Nurse practitioners can:

- ✓ Provide telehealth services in all states and territories in Australia.
- ✓ Provide patient rebates through Medicare.
- ✓ Provide prescriptions and access to PBS medicines.
- ✓ Refer patients to specialists.
- ✓ Order x-rays and diagnostic tests.

We connect Nurse Practitioners and Specialists, like Uber connects Drivers and Riders.



Healthcare delivered to your home.

You will also receive the benefit of Synapse's patient concierge, who will coordinate your care at every step of the way to ensure appointments are made and everything runs smoothly.

In terms of privacy, it is central to everything we do. Synapse is the only ISO certified medical billing provider in Australia, using bank level security across its app and IT infrastructure. Our participating practitioners will also upload your clinical records to your My Health Record account if that is what you would like. Just let us know.

Synapse has nurse practitioners, specialists and allied health practitioners waiting at the end of their app for an appointment with you.

And best of all, all specialist appointments will be bulk billed to Medicare – yes, it's true!

How to access telehealth services now:

If you or members of your family would like further information, or would like to participate in the trial, please contact us using any of the following options:

Email: th4b@synapsemedical.com.au

Call: 1300 510 444

Chat: www.synapsemedical.com.au and click on the blue chat button in the bottom right-hand corner of the home page to start chatting with our wonderful team.

All you need is a phone, and we will get you healthcare.

synapsemedical.com.au

Project Partner Resources.

Some project partners and network participants have developed resources. Links to those resources are below. The researchers worked with NBN Co to develop the videoconferencing guide.

nbn™ video conferencing connectivity guide

nbn™ Sky Muster™ satellite services connectivity guide

Regional Tech Hub Videoconferencing tips

Australian Communications Consumer Action Network Consumer Resources

VisionFlex training guides

Synapse have a number of videos available on the website:

https://synapsemedical.com.au/

The Australian Institute of Medical Administration and Compliance have a wide range of on-line resources including courses. These are available at:

https://aimactraining.com/

Nurse practitioners – Adding Value to Australian Health Care

What exactly is a Nurse Practitioner?

A minute with Margaret – Who are we? The first of the Minute with Margaret Series

Medicare Schedule Fee Explainer – Dr Margaret Faux

New 'paternalistic' telehealth changes may be unconstitutional, warns expert – Dr Margaret Faux

Claiming and compliance under the Medicare Benefits Schedule: Dr Margaret Faux's PhD thesis

Advance Health: Data Driven Care – The Digital Promise

Chapter 7. Site visits, TVS testing and telehealth demonstrations.

Below are summaries of TVS testing as well as some results from VisionFlex and telehealth demonstrations and training sessions. Additional data measuring download, upload and ping (latency) has been recorded at some sites. Some of these data are summarised below. There were instances where the internet performance was so poor connections failed completely.

Training and support materials developed are provided in Appendix A. These materials have been developed based on practical experience with users and refined iteratively in response to users' feedback. Some additional site-specific materials have been developed and provided to the relevant ACCHO. The generic training and support materials are available on the project website: https://simbani.com.au/crcna-telehealth-project/

Dundee Beach.

August 24th, 2021 and 13th March, 2021

Summary: TVS and VisionFlex system testing: The TVS and VisionFlex system were tested on a Sky Muster Service. However, the connection was not stable (frequent image freezing, unclear image and drop-outs), and poor sound quality. Subsequent testing of the mobile service in the Dundee Beach, Dundee Downs and Sandpalms areas was so inadequate that speed tests failed so testing of the TVS and VisionFlex systems was not done. The progress association bought two VisionFlex systems to use for telehealth during the pandemic. It was agreed the NT Health Department could provide access to the Business Grade NBN Satellite service installed at the First Aid Station for Dundee Beach residents to access telehealth services. However, this did not eventuate despite the researchers offering to provide and install a router to facilitate Wi-Fi access for telehealth.

Background

Dundee Beach and its surrounding areas is a remote community of approximately 500 people serviced by a number of microbusinesses and limited government support infrastructure or services such as healthcare. Situated 130kms from Darwin by road, the community endures challenges so many remote and regional communities experience in the North of Australia. These are magnified when disaster level circumstances occur. There is a large proportion of retiree residents and, prior to the COVID-19 pandemic, it was a popular tourist destination that supported many thriving micro-businesses. However, with the advent of COVID-19, all tourism activity completely ceased. Even normal economic activity has significantly reduced, resulting in many residents and businesses losing income.

This situation is exacerbated by the lack of reliable high bandwidth communications infrastructure to support alternate business modes and other community and social services such as medical services on-site. Indeed, the lack of on-site medical services (in a day and age of high speed internet service) in this community is a stark reminder that the North of Australia has many such communities that lack basic medical services, reliable initial care systems as well as basic telecommunications services. Counterparts in other areas have access to these services.

Snapshot summary

- Approximately 130 kms from Darwin (via Fog Bay Road).
- Resident population 462 (2016 Census) – an underestimate due to growth. Possibly 800 plus (NTPHN, 2018). Estimated to be over 2,000 on weekends and holidays. Some suggested estimations approach 5,000 people at peak holiday periods.
- Large proportion of residents over 55 and many retirees.
- Many of the older population also have co-morbidities such as heart conditions, cancer, diabetes, multiple sclerosis, stroke and hernia (NTPHN, 2018).
- Popular recreational fishing locations with large influxes of people on weekends, school holidays and the dry season.
- Recognised as a national and international tourist location for both river and reef (blue water) fishing.
- Increasing numbers of grand-parents caring for grand-children (NTPHN, 2018).
- Limited government support infrastructure or services e.g. no health care service and limited telecommunications.
- Suffers challenges as do many remote and regional communities in Northern Australia.
- The need for services in the area has been flagged by a number of government documents including the Finniss Land Use Structure Plan 1990 and the Namarada Area Plan, 1996.

Infrastructure

- Limited mobile phone coverage in the area.
- Two small Telstra Mobile towers (highly contended), often they can be non-functional for some days due to lightning strikes or wires being severed.
- Road is fully sealed but can be closed in the wet season due to flooding.
- Power is available but power failures are common.
- Is in the NBN's Sky Muster footprint.
- Airconditioned de-mountable (First Aid Station) with power, air-conditioning and a back-up generator owned and maintained by NT Health. There is a helipad at the site. However, the helipad is apparently too small for the new Careflight helicopter.
- There is no cyclone shelter in the area.

Telecommunications services available and perceived performance

NBN: Sky Muster and Sky Muster Plus services vary due to a number of factors including weather events and contention.

NBN Business Grade was installed on the 24th August, 2020 at the First Aid station but has not been made available to the community despite requests for access for telehealth.

The researchers offered to install a router so the community could access the Wi-Fi for telehealth purposes at the community facility next to the First Aid station, but the NT Health Department declined that offer.

Mobile coverage is limited with 2 small under-configured towers – Dundee Beach (highly contended and therefore very poor performance) and Dundee Downs (highly contended when functioning, on a number of visits was non-functioning).

Landlines: Very few landlines in the area – these may be radio (high capacity radio concentrators (HCRC)) phones.

Health Services

- No health services provided.
- Closest health service was the GP service at Berry Springs – 90 kms from Dundee Beach. This service closed in June 2023. The next closest GP service is at Humpty Doo – approximately 110 kms and 1.25 hours distant.
- With the older population (with a range of co-morbidities) and the high risk of accidents, it is clear the area needs access to some form of health services (see Health Needs Assessment done in 2018 by NTPHN).
- The community have a large number of medical evacuations via helicopter and ambulance.

Communities in the region which have NT Government health services (with population indicated).

- Belyuen (174, 2018) – closed Aboriginal community.
- Adelaide river (353 (2016 census))
- Daily River 127 (2016 census) – Primarily Aboriginal
- Batchelor 507 (2016 census)
- Pine Creek 328 (2016 census)

Issues raised by the Dundee Beach and surrounding community

The researchers met with a number of residents of this area throughout the project and attended a number of Progress Association Meetings. These issues are a combination of issues reported through these communications.

- Much of the area does not have access to mobile coverage.
- Lack of reliable telecommunications.
- High levels of contention on the existing telecommunications services (mobile and satellite) rendering services often unusable.
- Lack of redundancy in telecommunications services.

- The mobile service available is Telstra, other services are not available.
- Lack of health service both for primary and emergency care.
- Consider having a telehealth solution imperative.
- Have repeatedly requested the NT Health Department provide some level of health service.
- Very concerned about safety in severe weather events and fires. The community are under the Darwin Counter Disaster Plan – which depends on telecommunications infrastructure.
- There are no cyclone shelters in the area.
- At least one of the towers is 'second hand'. The new tower which was destined for Dundee was sent to Wadeye and Dundee received the old tower from Wadeye.
- Difficulty in getting services repaired when there is a failure eg outages are frequent and may last for many days. The Dundee Beach services was off-line for some days after a lightning strike in March 2021 and all the community was without mobile coverage in July, 2023 for several days.

Impact of COVID-19, the need for effective telehealth & the community's investment.

- Tourism supported many thriving micro-businesses until the pandemic.
- During the pandemic all tourism activity completely ceased.
- Many residents and businesses lost income.
- The residents were so concerned about lack of access to effective telehealth they invested $32k of their own funds for two portable VisionFlex telehealth systems including some smart diagnostic devices (eg ECG, temperature, pulse oximetry, weight, blood pressure and glucose).
- When training for telehealth was delivered for the community, it was found their internet was too poor to use the equipment to full advantage.
- Business and community recovery was hampered by the lack of reliable high bandwidth communications infrastructure to support alternate business modes and other community and social services such as medical services.

Implementation of telehealth for the Dundee Beach Community

During the pandemic the community requested assistance from the researchers to implement telehealth. A number of virtual demonstrations and meetings were held with the community and demonstrations of the VisionFlex System were done. Based on the demonstrations, the community bought two portable VisionFlex systems – one system for the Dundee Beach area and one for the Sandpalms area.

Situation in 2021

The community were keen to access telehealth services and use their VisionFlex systems. However, lack of adequate internet was a barrier to them accessing services via telehealth. With the Telehealth for the Bush Trial, community members could access a wide range of services via telehealth if they had adequate telecommunications. On a number of occasions, the telecommunications were so inadequate, the community could not successfully make a 000 call. Further discussions with the NT Health Department have resulted in the department agreeing to the researchers doing a telehealth demonstration and test using the TVS and VisionFlex systems at the First Aid station (using the NBN Business Grade satellite internet) at a date in the future. The researchers would need to provide a suitable router and other equipment for the demonstration.

Dundee Beach Update 30th September, 2021.

The community were still very keen to get a fully equipped and staffed clinic to cover 24 hours and 7 days a week. The Telstra Business Grade Satellite was still connected to the First Aid Station and NT Health advised they were still paying for the service. After a number of discussions with NT Health, it was agreed Simbani would do a Telehealth demonstration at the First Aid Station at an agreed time in the future.

Gawa

Background

Gawa community is a small, very remote Aboriginal homeland community on Elcho Island approximately 600 kms from Darwin by air. There are approximately 20 Adults and 46 children living in the community. The children attend the Gawa Christian School which was founded by the Senior Traditional Owners Dr Kathy Gotha Guthadjaka AM and her husband Mr Colin Baker in 2004 (Our Story).

Gotha and Colin did a presentation at the Digital Health for the Bush Forum 2020 (DH4B) and described the impacts of poor communications on the community – particularly the young people. This situation came to the attention of Gavin Williams, Chief Development Officer – Regional and Remote, NBN Co who was facilitating the DH4B Forum. Gavin, who has had a long association with Broadband for the Bush, offered NBN Co's assistance to provide Gawa with community Wi-Fi as part of a collaborative effort to improve services for the Gawa community.

Below are some summaries of site visits, activities and reports.

Site Report: Site Visit 4-5th May, 2021.

Community Wi-Fi and Telehealth demonstration Gawa Community Wednesday 5th May, 2021.

Community Wi-Fi installed: On the 4th May, the installer Perryn Kember (Great Northern Communications) and Marianne St Clair (Simbani Research/Broadband for the Bush) travelled to Gawa with the NBN SkyMuster Plus installation equipment, Wi-Fi and telehealth equipment. The installation was professionally done in very difficult conditions and the offsite support was outstanding. The NBN Sky Muster Plus service and associated managed Wi-Fi services were successfully installed and tested. The community were very excited to have managed Wi-Fi services available across a large part of the community. The managed service was made available as the community initially requested – from 3 – 6 pm daily. At a later stage, this was extended to 2 – 8 pm.



Figure 7 Telehealth demonstration with diagnostic tools at the Old School House, Gawa.

Telehealth demonstration and trial: The community had its first telehealth demonstration and consultations. A number of community members came to see the telehealth equipment and how it worked. The school children were sent to the Old School House (where the community Wi-Fi was installed) in rotation so all the children and teachers could see the telehealth equipment in action. Seventeen members of the community had health checks done by a remote Aboriginal Nurse Practitioner based in Cairns.



Figure 8 Gawa Community Wi-Fi cabinet, NTD and UPS supplied by NBN Co and EasyWeb.

Next step for Gawa?

The Gawa community are keen to increase access to a wider range of health and allied health services via telehealth to supplement the services provided by the local Aboriginal Community Controlled Health Service (Marthakal Homelands Health Service). It is well known there is a significant shortage of health professionals in the Northern Territory, and this is especially true for remote locations. The community are keen to see their local community health clinic manned by

local people possibly as telehealth technicians in the first instance. In the longer term the community are keen to have Aboriginal Health Practitioners located on site to support health service delivery.

Longer term plans

The community have expressed their desire to have a functional health clinic (with on-site clinicians – Aboriginal Health Professionals) to establish pro-active primary health care and also support the community in emergencies. It is suggested that at least one male and one female local community member be trained as Aboriginal Health Practitioner in the longer term. There is a clinic on the community run by Marthakal Homelands Health Service. Miwatj Aborginal Medical Service provides a health service to the community of Galiwin'ku, the main town on the island. However, Marthakal have limited resources and there is no accommodation for additional people in the community. It is suggested at least 2 additional dwellings would be required to provide accommodation for these professionals.

The benefits of collaboration briefing for the Gawa Community

The installation of the Community Wi-Fi and telehealth consultations were a team effort involving a number of organisations and people working collaboratively to implement the Community Wi-Fi and do the telehealth consultations. The researchers acknowledge and thank all those people and organisations for their collaborative approach to providing Gawa with Community Wi-Fi and access to telehealth. In particular, the project team acknowledge the support of NBN Co, Great Northern Communications, Gawa Christian School, EasyWeb, Territory Air Services, JFC Charter and all those people who contributed to these achievements. The researchers especially thank the community members who welcomed Marianne and Perryn into their community and made them feel 'at home'.

In April, 2021, at the request of the Gawa Traditional Owners, the researchers produced the following briefing for NT Government Ministers:

Briefing re Gawa Community and Telehealth – on behalf of Colin Baker and Dr Kathy Gotha Guthadjaka AM.

Population: Approximately 20 Adults and 46 children.
Set up their own school – partnering with NT Christian Schools Association.

Current status: No Wi-Fi available in the community, children climbing tower to get reception (see Digital Health for the Bush transcript below). NBN Co are providing a Sky Muster Plus Service to the community for a period of time so they have access to telecommunications and telehealth and negating the need for the children climbing the 16 m tower. The community is very keen to closely monitor the internet use and have thought through which types of sites will be accessible, and what times the internet service will be available. This internet service will be protected by a firewall capable of restricting dangerous sites – this will be provided by NBN Co in the first instance.

Short term plans: Marianne St Clair & David Murtagh (Simbani Research/Broadband for the Bush – volunteering their time) will fly out with the NBN Installer to liaise between the installer and community members. They then plan to spend the week training local people how to use the Wi-Fi and access telehealth on their smart phones and tablet devices. They will take telehealth equipment with them. A very experienced, high level physician and his wife (formally a nurse) have volunteered their time to do an initial clinic on site – flying in on the plane that will pick up the researchers. The researchers will support the clinicians for the day with their on-site clinic whilst continuing to train local people. The team will also demonstrate some smart diagnostic tools to community members to aid in diagnosis and patient assessment by off-site clinicians.

Longer term plans: The community have expressed their desire to have a functional health clinic (with on-site clinician – Aboriginal Health Professional) to commence pro-active primary health care and also support the community in emergencies. It is suggested that at least one male and one female local community member be trained as Aboriginal Health Professionals. There is a clinic on the community run by Marthakal Homelands Health Service which provides regular site visits, primarily to dispense medications. However, there is no accommodation for additional people in the community, so at least 2 additional dwellings would be required.

The community feels the current service does not meet their health needs and primarily deals with emergency situations. ***Many community members are not treated until they become very, very ill. In some situations, this has dire consequences for the patient.***

The community is keen to:

- Have access to, and use of, the health clinic.
- Have at least 2 dwellings for health workers.
- Have at least 2 local people trained as Aboriginal Health Professionals.
- Have a primary health care service in a similar model to Laynhapuy Homelands.

Ideally, it would be best if local people were trained by a local builder/trainer to build the dwellings and also provide maintenance in the longer term.

Possible innovative business model: With the telehealth item numbers coming on-line, and clinicians gaining more experience doing remote diagnosis and assessment, it is possible, delivery of services to a remote community such as Gawa may be, in part, supported by private GPs and specialists – supplementing the current shortage of clinicians seen in the NT. It is also possible, the Aboriginal Health Professionals could get their own provider number and bill to Medicare. This would provide some additional income into the Gawa Community Health Service. That is, it may be possible to develop an innovative business model to provide a wider range of primary health and emergency care services to remote communities such as Gawa. **This model would also provide sustainable, local jobs for community members.**

Marianne and David have worked with the Gawa community members for approximately 8 years and would be happy to provide any further information or assistance as needed.

Marianne St Clair: marianne@simbani.com.au; 0427 555 484 David Murtagh: dave@simbani.com.au; 0458 501 580

Transcript from the Digital Health for the Bush Forum, Darwin, December, 2020:

Colin Baker and Dr Kathy Gotha Guthadjaka AM – **Gawa Community** (a very remote community off the coast of the Northern Territory:

Our approach to health has been on the preventative side. We have a small community and the health of the children is excellent. They are physically good, happy, safe, and safe within the community. We have regular visits by Health workers, but not doctors, and sometimes doctors are needed. We have a need to access telehealth in the community. But we have very poor access to telecommunications. When children want to contact their friends, the children climb a 16 m tower with their mobile phones. There is a problem with the way things are and the way they are headed. Even small children are into video games, on the internet, on the phone. Kids at Gawa don't have that access except in some lessons at school. They all have their own ipads – the education website is very, very slow.

For kids to live in Gawa, they switch off their mobile phones, they don't have connection to their friends in town. Now we have a generation with children that are happy now, doing what things kids should be doing, which is very different from town. There are different health problems in town.

Things are looking great now, but 10 years down the track, those kids will be grown up and married, and a new generation of kids coming in are not going to want to live without mobile phones or telecommunications. So, we're going to see a population drop in remote homelands. Which means, we'll have increased pressures in regional centres, which we don't need. We have difficulties with communications in remote homelands – we've been struggling for 30 years, but so far so good. But we can see that it's not going much further. We really need to have reliable telecommunications for our people in Gawa.

Transcript from the Digital Health for the Bush Forum, Darwin, December, 2021:

Colin Baker and Dr Kathy Gotha Guthadjaka AM – **Gawa Community**

Hello, thank you for giving us some of your time today. Okay, first of all, we would like to say that we are very keen to see a couple of young people at Gawa trained up as telehealth technicians, and we're starting on this pathway. We're very keen to break through all the hurdles that there are at the moment. We look forward to the day when that service will be functioning well out there. Even just having the Wi-Fi out there has made a tremendous difference in the area of health at Gawa.

My wife, Gotha, is here in Darwin. We're stuck here as she relies on renal dialysis - we're here for health reasons and we can't really get away. Now we're making use of the new renal unit at Galiwinku for extended breaks out there. But it was such a wonderful relief to be able to talk to people back home, to talk to family, and keep up to date with what's going on. One of the first, of course, urgent calls that we got was in relation to COVID-19 vaccination. The people out there - you could imagine if you are living remote and without communication with the outside world, and you hear all these stories. You're going to have a lot of questions before you decide to go ahead and let someone jab you in the arm with something you don't know anything about.

So, communication has been a really a big help in that situation. The first call we got was from the Old Man of the community who wanted to know the story. People go out there from government to try to encourage people for vaccination, which is a good thing, but they (government workers) are unable to answer the key questions that the people have. Government policy actually forbids their workers from really handling those questions in a proper way.

We were able to tell the people at Gawa "You know the mob at Marparu have all been vaccinated with AstraZeneca - no problems whatsoever - the whole community!". That little piece of information that came through the Wi-Fi network – it wasn't there six months ago. It really set people at ease and answered a lot of their questions. We've been able to talk to people and encourage them to go ahead and get prepared for the crisis that's approaching. That's a health crisis and the people out there are relieved to be able to get on the telephone and talk with trusted sources outside of the community. What a difference - this has been amazing!

Thank you very much. We look forward to the day when we can talk a lot more about telehealth and about our technicians are going now.

Transcript from the Digital Health for the Bush Forum, Darwin, December, 2021:

Dr Kathy Gotha Guthadjaka AM. & Mr Colin Baker
It's great to be able to talk to everyone here at the forum. And we just like to express our concerns to have trained telehealth technicians on site in our little homeland community at Gawa. Kathy Guthadjaka, my wife here, is well known, I'm Colin Baker, probably not so well known. We brace that community together and they are very much in our hearts. The welfare of our Gawa community, and who we are really very keen to see telehealth up and running in the community. There's a great need for it. So that's my wife. If she can make a few comments she'll probably speak in Wadamari - that's the local language - which is an important point to consider. Communication is very important between

doctor and patient and to have a Wadamari speaker in the middle who's proficient in English also is a fantastic advantage.

Dr Guthadjaka spoke in Wadamari and Mr Baker provides the translation.

Yes, I think it's really important to have your Yulŋu language speakers working one female and one male.

Mr Baker asked his wife: Why did you say one female and one male. Was that important?

It's important because men don't talk to women about their health problems and women don't talk to men about their health problems in Yulŋu society. So having the right telehealth technicians on site to work with doctors in remote locations is a fantastic advantage.

Also the community members feel safe with people they know. And this is very important for even getting a session started. Even for somebody coming to seek help when they need it, rather than putting it off until it's too late. This would be a great advantage because today, most of the time, people put things off until they need a medevac and we just don't want to see that continue.

We want to see people coming to get help when they have the first symptoms of any problem, to feel comfortable enough with their helpers, with their telehealth technicians on community to be able to go and say “Hey, I've got this issue. Can we talk to the doctor about this? I'd like to know what's going on.” You know, and people will talk to their telehealth technicians in an informal way in the camp. And the technician will say “Yes, well let's set up a session and find out what your problem really is.”

This will avoid a lot of medical evacuations. Things that happen just too late at the last minute - we just need to get past that. We need to really overcome that. That issue is not getting any better out there.

Thank you.

Gawa Site Report July, 2021.

The community identified issues with the current level of health service provided to the community by Marthakal Homelands Health Service. As this was an internal issue the researchers did not feel they should interfere with the situation. However, they did meet with the NT Health Department and asked their advice as well as discussing the situation with AMSANT (Aboriginal Medical Service Alliance of the NT). Neither of these organisations were able to assist. The TO’s requested a meeting with the NT Health and NT Infrastructure Ministers. The Researcher’s were able to organise a meeting for the TOs with the NT Infrastructure Minister’s (Chansey Paech’s) Senior Advisor. The TO’s reported the meeting was very positive and are looking forward to receiving assistance from that Minister’s Office in establishing a dialogue with the Marthakal Homelands Health Service.

Gawa Site Report September, 2021.

The researchers have continued to liaise with the Gawa TO’s and community. The community requested the community Wi-Fi be extended from 3 – 6 pm to 2 – 7 pm which the researchers facilitated. There have been some outages to the community Wi-Fi which the researchers were able to have rectified. The community have also reported the Wi-Fi was on after the allocated hours twice and, through negotiations with NBN, this situation was rectified. It seems the service provider found the internet was not working 24 hours and, assuming it should be working 24hrs a day, “fixed it”. Subsequently, NBN have arranged for the community Wi-Fi to permanently be set to 2 – 7 pm unless a further modification was requested.

Gawa update June, 2022.

The community are successfully using the community Wi-Fi when power is available. The solar power generation system has been non-functional for over 12 months. The community Wi-Fi installed as part of this project only works when the diesel generator is operating. This can be infrequent depending on the availability of diesel. The researchers have liaised with the relevant NT Minister’s office and Senator McCarthy’s office and organised meetings with Gawa’s Traditional Owners. Despite a number of letters being sent and received between the two politicians, the department and Marthakal Homelands Resource Centre, the issue remains unresolved.

The researchers continue to support the community in relation to their community Wi-Fi. Periodically, the community requires changes to the hours the community Wi-Fi is available. For example, over the school holidays they requested the hours to be extended. The researchers liaised with NBN to allow the Head Mistress 24 hour secure access.

If the community want a change made to the system or the system fails, a community member contacts the researchers and the researchers liaise with NBN to rectify the situation and meet the community's needs.

On one occasion, a community member contacted the researcher and advised the Community Wi-Fi was not working. After doing some trouble shooting it was found the weather was impacting the Wi-Fi performance. The community members did not understand the impacts of adverse weather events on the performance of the satellite internet. The researchers provided some training to upskill the community's knowledge about the effects of adverse weather on satellite internet services. This led to the researchers including a section regarding the impact of weather on the Internet (Sky Muster or Sky Muster Plus) Trouble Shooting Guide (Appendix A*).



Figure 9 Gawa community as seen from a light plane.

Laynhapuy Homelands Health Service.

The background below is derived from the Laynhapuy Homelands Aboriginal Corporations Website (https://www.laynhapuy.com.au/) and personal observations. Marianne St Clair commenced work with the Laynhapuy Homelands Aboriginal Corporation in approximately 2002 and David Murtagh in approximately 2001. The work roles varied over time but both researchers had a long association with the organisation.

In the decades prior to 1970, the Yolngu people in the East Arnhem region were congregated in various missions, the most easterly of which was Yirrkala on the Gove Peninsula.

In April 1972, senior Yolngu leaders and their extended families began moving away from the Yirrkala mission and the expanding mining town, back to their traditional clan land around Arnhem Land.

The homelands movement was a Yolngu initiative, instigated before any government support for such movements. Yolngu cleared land for airstrips and built their own houses using timber from their land, with the help of Ngapaki (non-Indigenous people) from the Mission.

The clan elders aspired to determine their own future, conduct their affairs according to Yolngu law and live and raise their children on their traditional land. Their vision was to develop sustainable, self-sufficient homelands for themselves, their families, and future generations. That vision is still strong and relevant today.

In 1985, Laynhapuy Homelands Aboriginal Corporation (LHAC or 'Laynha') was established to assist in supporting these communities.

Today, Laynhapuy services have 30 homeland communities with a population of approximately 1100 Yolngu residents across the region, and approximately 300 regular visitors.

It is a member-based association of the Yolngu, with no statutory or other powers.

Laynha supports homeland communities through:

- Yirrkala Rangers
- Health Services
- Community Services
- Homeland Services
- Ganybu Housing Aboriginal Corporation
- Partnerships with organisations in the region with shared interests to support employment and training opportunities, culture and community, and economic development
- Representing and promoting Laynha homelands

The philosophy behind the Laynhapuy Homelands is outlined in the words of Dr Gawirrin Gumana https://www.laynhapuy.com.au/our-homelands/ :

"My name is Dr Gawirrin Gumana AO of Gangan, and I am one of the old people who fought for our Land Rights.

I will not lose my culture and my tribe to your games like a bird moving from place to place, looking for its camp or to sleep in other places, on other people's land that is not our land.

I do not want my people to move from here and die in other places. I don't want this. We don't want this. I am Aboriginal from mud, red mud. I am black, I am red, I am yellow, and I will not take my people from here to be in these other places."



Figure 10 Map of North East Arnhem Land

The map shows the location of the Laynhapuy homelands in East Arnhem Land (SOS Health Foundation http://soshealth.org.au/ne-arnhem-land/). The homelands are approximately 6,500 square kilometres in area and are home to approximately 1,100 Yolngu people .

Laynhapuy Health Service.

Laynhapuy Aboriginal Community Controlled Health Services is the sole provider of health services in twenty very remote Homeland communities located through 6500 km² of East Arnhem Land.

Laynhapuy Health works to enhance the health and wellbeing of Yolngu people by providing holistic quality primary health care delivered in homeland communities by culturally competent staff in partnership with people and their communities.

The health service has its administrative base in Yirrkala and outreaches to deliver primary health and wellbeing services to twenty of the homeland communities.

Teams of staff outreach four days per week up to 220 km travelling by 4WD or light aircraft from Yirrkala to deliver planned, prioritised health care, follow up on previous telephone triage and deal with “walk in” appointments and emergencies.

Laynhapuy employs Aboriginal Health Professionals who reside in their respective homelands and provide valued cultural and community connections and liaise with health staff between visits.

List of Laynhapuy Communities.

- Balma
- Barraratjpi *
- Barrkira
- Bawaka
- Baygurrutji
- Bukudal (Balaybalay)
- Bunhunura
- Burrum
- Buymarr
- Dhalinybuy
- Dhambaliya
- Gulungurr (Dhoyndji)

- Dhamiyaka
- Dhupwamirri
- Dhuruputjpi
- Djarrakpi
- Gangan
- Galkila
- Garrthalala
- Gurkawuy
- Gurrumuru
- Gutjangan
- Mirrngatja
- Nalyindi
- Raymangirr
- Rurrangala
- Wandawuy (Boruwuy)
- Yalukun
- Yangunbi
- Yilpara (Baniyala)
- Yuduyudu

The following communities have been visited by the project team:

Yirrkala (Home Office), Dhambaliya (Bremer Island), Dhalinybuy, Gan Gan, Garrthalala, Gurrumuru, Wandawuy (Boruwuy) and Yilpara (Baniyala).

Gan Gan, Wandawuy and Yilpara are sites the research team have done extensive work since 2016. Not all communities have clinics, but clinic staff visit on a regular basis and also provide emergency support when required.

Previous telehealth implementation with Laynhapuy Homelands.

This project was supported by a grant of $407,540.10 from the NT Government's Regional Economic and Infrastructure Fund and an additional $50,000 each for 4 sites (Yirrkala, Wandawuy, Yilpara and Gan Gan) from Telstra (see below) and was nominated for the Chief Minister's Award in 2017.

This project was done as a collaboration between:

- Laynhapuy Homelands Health Service.
- Northern Institute, Charles Darwin University.
- Aboriginal Medical Services Alliance Northern Territory.
- Broadband for the Bush.
- eMerge.
- Telstra Health.

Background: A number of clinics in the Laynhapuy Homelands previously lacked adequate internet to access eHealth systems, telehealth or diagnostic services such as internet connected electrocardiography (ECG). The NT previously led the country in the use of standards-based secure messaging for clinical information (eg specialist referrals, hospital discharge and pathology reports), shared health patient records and other internet connected diagnostic devices such as the iStat machine (blood analysis).

Funding was obtained to install 3 mining-grade (Gilat) satellite services and connectivity costs for 12 months were included. The 3 communities chosen for telehealth implementation by the Laynhapuy Homelands Health Service were Gan Gan, Yilpara and Wandawuy (largest and most distant communities).

There was additional support for the project by Telstra Health (Telstra Reconciliation Action Plan (RAP)). As part of the Telstra RAP, additional equipment was provided including a video end point, uninterrupted power supply (UPS), network switch, installation, video camera and 12 months connectivity to Telstra Health's National Telehealth Connection Service for each of the 3 clinics as well as the Laynhapuy Health Office in Yirrkala. The value of the equipment was approximately $50,000 at each site totalling approximately $200,000 and the value of the software approximately $430 per month per site totalling approximately $21,000.

A fundamental component of the underlying technology that supports telehealth in remote areas is high bandwidth network connections over satellite internet. Twelve months connectivity for three remote clinics in the Laynhapuy Homelands provided an opportunity to demonstrate the value of telehealth and video conferencing prior to the service incurring costs. Towards the end of the project, staff regularly used video conferencing for telehealth. Diagnoses were aided by Facetime, ie iPhone 5 and later model camera optics and digital capabilities provided adequate video quality to do triage and significant diagnostic assessment.

The project demonstrated telehealth could be successfully done via high grade satellite internet.



Figure 11 Kim Winter, Comcat with Satellite Dish.

Satellite service installation contractor Kim Winter was secured by eMerge. The satellite dishes were approximately $40,000 each and connectivity via the Gilat satellite was approximately $100,000 pa. The Laynhapuy vehicle can be seen in the background.

The Gilat satellite for this service is based over Vanuatu so a clear line of site to the East was required to obtain connectivity. The project team acknowledges support for the project by Laynhapuy Health Service and the provision of vehicles throughout the project.

John Kelly, GP/Physician, Laynhapuy Homelands Health Service was based in Sydney for the majority of time. Typically, between 3 and 8 consults were done daily using telehealth. In addition to videoconferencing, the internet was used to share images and videos with patients, family and staff in the homeland clinics to address diagnostic and

treatment issues. Video clips from the internet were used to demonstrate examination and treatment techniques. Access to video conferencing changed the way Laynhapuy Homelands deliver services to their remote clinics (Jeff Cook, pers. comm.).

The use of video conferencing as part of service delivery in the remote Laynhapuy Homelands was a “game changer” in remote Indigenous Health service delivery. Face-to-face consultation and direct supervision and observation of patient examinations delivered better health outcomes for patients. By showing patients and families pictures from the internet the supervising GP can demonstrate clearly what the problem is and the treatment required.

“A picture says a thousand words…especially when it’s the patient’s 3rd language.” John Kelly, Physician and GP, Laynhapuy Health Service.

Telehealth implementation has been shown to reduce costs associated with patient travel, minimise time spent away from community and provide improved patient satisfaction eg the use of remote diagnostic systems for identification of cardiac issues can improve patient care and save lives.

Telstra’s Telehealth System.

The video conferencing system deployed as part of the Telstra RAP was found to be difficult to establish video conferencing sessions, unreliable and would have incurred significant costs (approximately $430 per month per site). However, it was used a number of times for specialist consultations as well as triage and support for emergency events.



Figure 12 Telstra Health’s video conferencing equipment in Gan Gan Clinic.

Note the camera at the top of the screen. The network box housing the router, firewall and UPS and the control panel (iPad looking device) mounted on the pin board (see above).

Integration of telehealth into day-to-day clinical practice.

The benefits of telehealth were demonstrated in the Laynhapuy Homelands Health Service (LHS) and are seen as a way to improve service delivery in remote Aboriginal communities as well as reducing costs of health care. Uptake of telehealth in the NT has been limited, for a variety of reasons e.g. inadequate access to broadband internet. Through collaboration, this project demonstrated the value of uncontended and unlimited internet access in implementing telehealth. The initial question for the LHS Management was: Do we really need high quality internet connectivity to

improve health service delivery? At the end of the project the question is was: How do we afford the cost of high quality internet connectivity to maintain the quality of service?

Post Project.

At the conclusion of this project, LHS decided to continue paying the connectivity costs for the high-grade satellite connectivity as they had become dependent on telehealth and it was clear significant financial savings were made by using telehealth. There were other benefits of telehealth including being able to implement treatments much more responsively due to the ability to facilitate group decision making through video-conferencing (St Clair and Murtagh, 2019). It was decided not to maintain the Telstra Health videoconferencing system due to cost, difficulty in use and lack of reliability. This led the researchers identifying the need to develop a simple, robust and affordable TVS.

Location of project sites.

The 3 project sites were located in a very remote area of East Arnhem and health services are provided by the Laynhapuy Health Services, a service provided by the Laynhapuy Homelands Aboriginal Corporation.

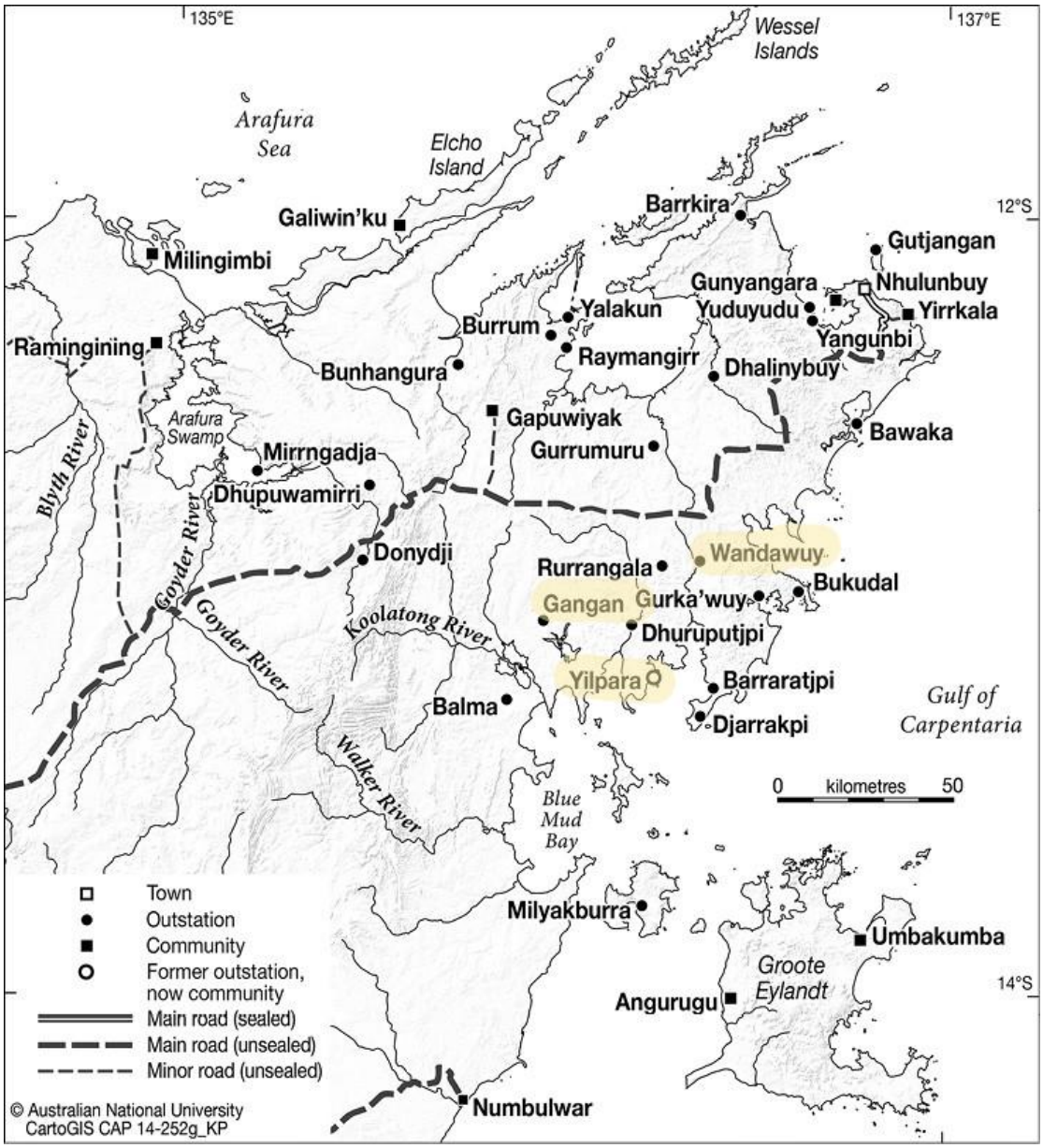


Figure 13 Map of East Arnhem. The 3 project sites are highlighted in yellow. (Map 15.1 Yilpara and the Laynhapuy homelands are, norther-east Arnhem Land, ANU Press http://press-files.anu.edu.au/downloads/press/p331981/html/ch15.xhtml)

General Comments.

Road Conditions.

The road from Katherine to Nhulunbuy is frequently affected by rains and flood damage. Road repairs are frequently required and many of the communities can be isolated for many weeks at a time with air transport the only option for travel. The minor roads to Gan Gan, Yilpara and Wandawuy are rough and frequently have significant damage, so care must be taken when traveling these routes.



Figure 14 Road sign at the Mainoru turn off. Note the conditions of the road in the dry season.



Figure 15 Main Road to Nhulunbuy with road damage following the wet season

Airstrips.

All 3 of the project communities have well maintained and serviceable airstrips.



Figure 16 Wandawuy Air Strip

NBN Services: The new NBN Satellite services were installed at each of these 3 sites in approximately 2017 but there were significant commissioning issues. Testing of the NBN service during the project period yielded varied results. At that stage it seemed the NBN service would be unsuitable for telehealth consults due to reliability issues. Further testing of the NBN services at each site was done on future visits post project, yielding similar results. Often these services were malfunctioning for months at a time.

Layout of clinics

All three clinics were the same design (ie floor plan) but different orientation, therefore, the direction and location of the satellite dishes varied. In consultation with clinical staff, local health workers and the Clinic Manager, Treatment Room 3

was deemed to be the most suitable location for the telehealth consultations and associated equipment for each site.

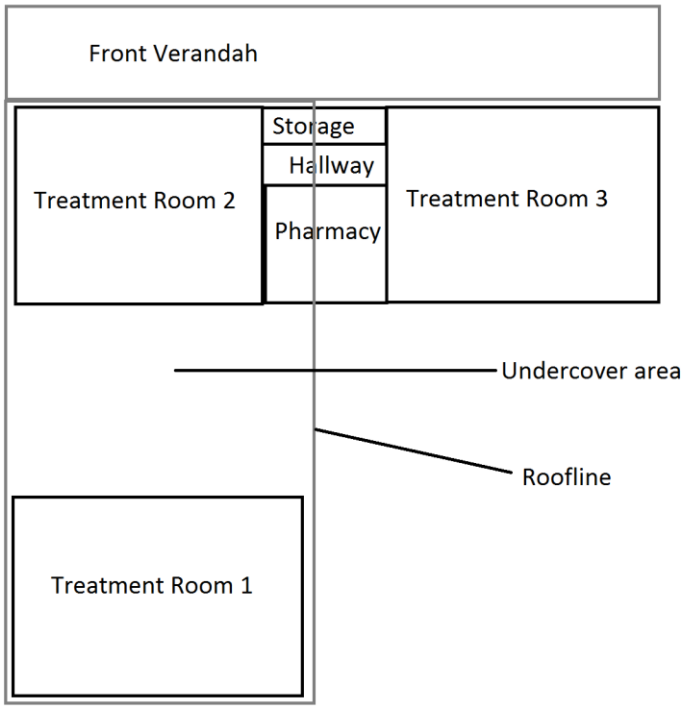


Figure 17 Layout of LHS clinics. All three clinics had the same layout although different orientation. Treatment Room 3 was deemed the most suitable room for telehealth.

Location of Telehealth Video System (TVS)

The disused TVS system was located in the same location at each site (see figure below). At each of the clinics this wall was facing the treatment bed, had space for the screen, camera, cabinet (housing video end point, etc) and UPS. This room had a phone, and, where there was computer equipment, this was also located in the same room. The other 2 external walls of this room had non-transparent louver windows that can be closed and therefore meet privacy and lighting requirements.

The NBN & communications hub was on the opposite wall in the corner and a double power point was located to the below right of the hub.



Figure 18 Location of disused Telehealth Video System.

Cabinet housing switch, modem and video end point: A cream box (similar to the Yolgnu radio box) was installed in the corner on the same wall (internal front clinic wall) at a minimum of 2 m height. This box could have been be re-used in this project to house the switch, modem and video end point. However, with limitations to travel due to the pandemic, this equipment was not re-purposed. The UPS was mounted on top of the cabinet and the cabinet secured on the outside of the building with bolts through the wall.

Phones: Each clinic had two landlines connected via microwave link to Nhulunbuy (the second line was previously used for a fax machine). These phones were non-functional for many weeks at a time demonstrating the difficulty in getting telecommunications faults in remote areas rectified.

Wind shear: While visiting the clinics substantial wind gusts were noticed at Wandawuy. Apparently, the areas can be exposed to winds of up to 35 knots during non-cyclone periods, so satellite installation needed to factor the wind shear into planning. Cyclone activity needed to be considered as part of the management of the satellite service and all satellite dishes should be inspected and tested after a cyclone has affected their location/s.

Gan Gan

Population size: Approximately 100.

Aboriginal Health Practitioners: Two Aboriginal Health Worker Practitioners were located at Gan Gan. However, they may not always be on site due to escort escort, evacuation duties or other commitments.

IT & communications resources: Computer present in the office, land line with handset, IT & NBN Hub (same location in all clinics) in place. At the start of the pandemic, the results of testing the new NBN Sky Muster Plus satellite service was provide to the Clinic Manager. The project team worked collaboratively with the satellite installer, the Senator and the Chief Ministers office to have the service installed and commissioned in May, 2020 as a component of this project.



Figure 19 Gan Gan Clinic



Figure 20 External wall of clinic room 3



Figure 21 Internal layout of Clinic Room 3. Note the patient bed location which was directly opposite the wall housing the disused video and camera equipment.

Yilpara

Population size: Approximately 100.

Aboriginal Health Practitioners: Two Aboriginal Health Worker Practitioners are located on community. However, they may not be on site due to escort and escort, evacuation duties or other commitments.

IT & communications resources: NBN Sky Muster Plus satellite service installed and commissioned in April, 2020 as outlined above.



Figure 22 Yilpara Clinic.

Note the location of trees which needed to be consideration in determining location of satellite services. It was agreed trees were not to be removed to install infrastructure.

Wandawuy

Population size: Approximately 100.

Aboriginal Health Practitioners: Three Aboriginal Health Worker Practitioners were located on community. However, they may not be on site due to escort, evacuation duties or other commitments.

IT & communications resources: No computer base station present in the office, but screen and keyboard located on desk, land line with handset, IT & NBN Hub (same location in all clinics) in place. NBN Sky Muster Plus satellite service installed and commissioned in May, 2020 as outlined above.



Figure 23 Wandawuy Clinic.

Site Report September, 2020.

The NBN Sky Muster Services in many of the communities were not functional. The three mining-grade services had failed by March, 2020 and, at the start of the pandemic, LHS did not have reliable access to internet to do telehealth on a number of their communities.

The Laynhapuy Homelands had a number of communities with health clinics. From the work in 2016/17 the LHS used videoconferencing telehealth as a “Business as Usual” strategy. The phones were often non-functional in those communities for weeks at a time, and the voice quality was very poor. Good quality internet was required for telehealth service delivery and it was predicted the NBN Sky Muster Plus service would meet this need.

In the early stages of the project, the researchers distributed the summarised data from testing the Sky Muster Plus service over the 2019-20 wet season in February, 2020 (see Sky Muster Performance Report). In March 2020, the Clinic Manager contacted Marianne St Clair to clarify if the Sky Muster Services would provide adequate internet for telehealth and requested assistance as a matter of urgency to install NBN Sky Muster Plus internet services for 7 of their remote clinics.

Simbani Integrated Research, in collaboration with NBN Co, SkyMesh, Emerge IT, SkyBridge and JMAC Comms fast tracked the processes to install 7 new Sky Muster Plus services for Laynhapuy Health Service so they could have access to telehealth. There was also assistance provided by the NT Chief Minister’s Office and Senator McMahon’s

Office. The Clinic Manager expressed his concern regarding the pandemic and indicated access to telehealth via videoconferencing was critical, particularly with the escalating COVID-19 situation.

The installer, Johnathon McCartney (JMAC Comms contracted by SkyBridge) submitted an application to the Northern Land Council and the NT Government for a permit to travel to the Laynhapuy Homelands on Monday 11th May. There were some delays but the permit was provided and Johnathon McCartney drove through Katherine and collected additional equipment from eMerge IT Solutions in Katherine (Routers, UPS, cables, etc.) to install the Wi-Fi equipment. The Clinic Manager, met the installer on the Homelands and travelled with him to assist with the installations.

The installer also commissioned Wi-Fi and UPS equipment. These installations were done on a volunteer basis as well as providing some technical education to the Clinic Manager.

Travel was approved for the following communities. Seven NBN Sky Muster Plus services, Wi-Fi routers and UPS were installed and to ensure the systems worked correctly:

- Gan Gan
- Dhalinybuy
- Wandawuy
- Yilpara
- Garrthalala
- Gurrumurru
- Dhuruputjpi.

The installer posed no risk to the communities from a COVID perspective as he had been in the Darwin Region since the initial COVID lock down.

The Clinic Manager was so pleased with the performance of the Sky Muster Plus services, he ordered another four NBN Sky Muster services for their community stores – which further confirmed the researchers' findings that Sky Muster Plus was adequate for videoconferencing and videoconferencing via telehealth.

Site Report September, 2021.

There were some minor issues at times with the NBN Services, but these were resolved as required. The Clinic Manager often resolved the issues with support from David Murtagh, SkyMesh and NBN Co.

LHS purchased a VisionFlex digital stethoscope but there were some difficulties in using this particular device.

Puntukurnu Aboriginal Medical Service

The information presented about Puntukurnu Aboriginal Medical Service PAMS) is derived from the PAMS website, personal communications with PAMS or BIZ365 Staff and a number of site visits.

Background.

Puntukurnu Aboriginal Medical Service (PAMS) is a leading not-for-profit organisation highly regarded by clients, funders and donors. It plays an important part in building strong communities and families. PAMS is an Aboriginal Community Controlled Health Service located in the East Pilbara region and delivers services in communities located in the Great Sandy, Little Sandy and Gibson Deserts. PAMS provides comprehensive health services supported by visiting clinicians and allied health practitioners to the Martu people in the four communities of Jigalong, Parnngurr, Punmu and Kunawarritji. There is a GP based at the Jigalong Clinic with Nurses providing most of the services at the other more remote clinics.

PAMS has a passionate team comprised of qualified and experienced health professionals including GP's, Nurses and Aboriginal Health workers who work alongside an inspiring group of administrative staff.

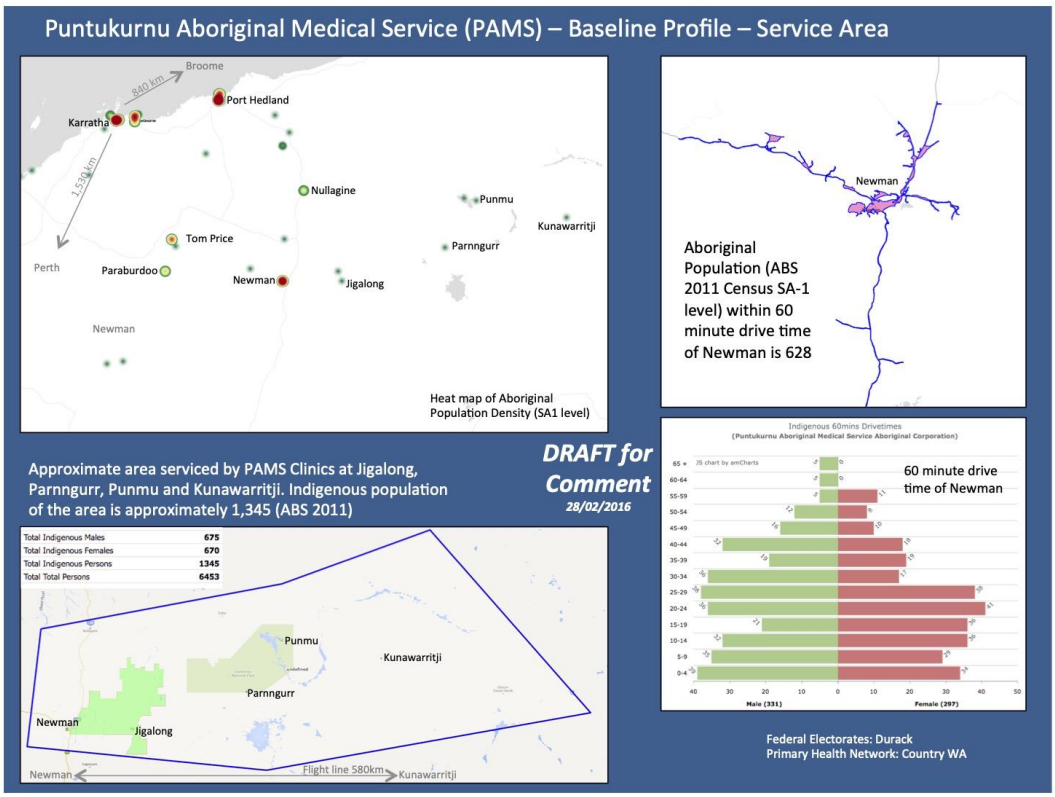


Figure 24 NACCHO Member Service Baseline Profile (https://www.naccho.org.au/member-services/member-service-baseline-profiles)

NACCHOs (National Aboriginal Community Controlled Health Organisation's) Baseline Profiles are based on publicly available data. The profiles form a template to enable Member Services to add data from their own information systems. These localised templates are available for use in reports for service planning and to provide evidence of performance, as well as for communications with community, funding bodies and policy makers. A critical aspect of planning is "access to services", for both existing services and for identifying areas where there is no access i.e. gaps.

The Baseline Profiles use drive times (the time it takes to drive to an ACCHO) as a way of determining accessibility to health services, building on the work of the Australian Institute of Health and Welfare (AIHW) and the Queensland Aboriginal and Islander Health Council (QAIHC).



Figure 25 Newman from the air, source Google Earth

(https://earth.google.com/web/@-23.36194793,119.73361011,546.76316404a,8592.31953287d,35y,360h,0t,0r)

Newman Healthcare Hub

On the 30th July 2020, PAMS and the community of Newman officially opened the newly built Newman Clinic and Administration building.

This development was an extension to the services provided by PAMS and is a clinical hub for Indigenous clients in Newman and surrounding areas. It was the first primary healthcare facility of any type to be constructed in the town.

PAMS has its administrative hub based in Newman. The administrative hub provides the overall management of the organisation, undertakes the operational activities associated with logistics and travel and supports the clinical services in the communities.

Newman was established in 1966 (originally called Mount Newman) and is located approximately 1,200 km north of Western Australia's capital, Perth. Newman has a population of approximately 4,500 people (2016 census) and is the closest town to many of the Western Desert communities of WA. The town was established by Mt. Newman Mining Co. Pty Ltd as a company town to support the development of iron ore deposits in the nearby Mount Whaleback. The mining company developed into the company BHP and mining is an important industry the town of Newman, with BHP being the major employer.

(The following images are curtesy of ABC Rural News https://www.abc.net.au/news/2020-08-01/remote-indigenous-health-centre-opens-in-newman/12499876)



Figure 26 On the 30th July 2020, PAMS and the community of Newman officially opened the newly built Newman Clinic and Administration building.



Figure 27 Another view of the newly built Newman Clinic and Administration building.

Jigalong Community

Jigalong is the clinical hub for Puntukurnu Aboriginal Medical Service and has the largest number of clinical staff, apart from the new Newman clinic. A GP and 2 Remote Area Nurses provide services in the community as well as a Nurse Practitioner. The GP travels from Jigalong to Parnngurr, Punmu and Kunawarritji each fortnight to provide an outreach service to the more remote and less populated communities. Visiting services such as Ear Science Institute Australia, Hearing Australia, Lions Outback Vision, Obstetrics and allied health services provide outreach services to all four communities.

Jigalong is located approximately 165km east of Newman and is perched on the edge of the Little Sandy Desert. Roughly 450 people live in Jigalong and the community has a school that provides education from kindergarten to year 12, a shop and a swimming pool.

Jigalong was originally established in 1907 as a maintenance and rations store for workmen that were constructing the rabbit-proof fence. In the 1930's it was also used as a camel breeding site but this was abandoned when the motor car was introduced as the main mode of transport. In 1947 the Apostolic Church was given the land and used it as a Christian mission. Some buildings remain from this era but the current Jigalong community has been established a few kilometres away from the old mission site.

Parnngurr Clinic.

This clinic was initially established in the 1980's when groups of Martu people decided to move back to their country. The community is located 370 kms from Newman and access is via a reasonably well maintained unsealed road. The community has had up to approximately 130 people, but at the time of the site visit the population was approximately 20-40. The new clinic is large and spacious and is a one nurse station. It has large consulting rooms including facilities for visiting clinicians. There is staff accommodation on the community.

Punmu Clinic.

The Punmu community is in the northern part of the Karlamilyi National Park on the edge of Lake Dora, 377 km from Newman. The population is approximately 140 and is a one nurse station with accommodation and clinic space for visiting clinicians.

Kunawarritji Clinic.

The Kunawarritji community is approximately 1,531 kms from Newman and is the most remote of the PAMS clinics. The population is approximately 76 and is a one nurse station. The community is 5 kms north-west of Well 33 on the Canning Stock Route.

Site Report January, 2021: Trial of VisionFlex System at Jingalong.

Previous discussions with PAMS staff resulted in a decision to trial the VisionFlex System at Jingalong.

It was initially decided to trial a cart system but with an additional screen (therefore having 2 screens available). The clinic was serviced by 3 nurses, 1 GP, a receptionist (full time), Aboriginal Health Professionals and a Driver. Space was very limited. As the equipment would need to be re-located to take to the patient's location, the cart option was chosen. A speaker and additional camera were also required.

PAMS staff wanted to use the VisionFlex System for telehealth, diagnosis and for staff meetings via video conference. The staff also indicated they wanted to access digital professional development both within PAMS and by external providers. PAMS did have some older workforce members who were challenged by technology.

PAMS staff indicated they were keen to link in with the RFDS trial and work closely with RFDS.

Status at January, 2021: The project team worked with PAMS staff to obtain funding for the VisionFlex system plus additional peripherals.



Figure 28 VisionFlex Pro Ex Hub on cart. This was the initial system PAMS were considering purchasing from VisionFlex.

Site Report 12-13th May, 2021: Newman and Parnngurr.

On 12th May, 2021 at the Newman Main Clinic, the researchers met with all clinical staff in the morning and provided a brief introduction to the project and the associated research. The staff provided a visiting specialist room for the researchers to demonstrate the TVS and VisionFlex equipment. The internet at this site was a Vocus Business Grade fibre to the premise. The performance of the internet was very good (see Table 4) with a ping (delay) typically of 19 ms, download speeds were between approximately 64 – 92 Mbps and upload 37 – 57 Mbps. Video conferencing on a number of devices was successfully done concurrently using the researchers' equipment including the VisionFlex tablet and smart diagnostic tools.



Figure 29 David ferrying the VisionFlex, videoconferencing and computer tools into the visiting clinician's consulting room. All the gear is packed into cases with foam and o ring seals to protect against vibrations on rough roads, dust and moisture.



Figure 30 Demonstrating the VisionFlex Geis Camera with its extension device at the Newman Clinic.

The Geis Camera allows the user to take photos or videos e.g. of a lesion with the camera maintained at a consistent distance. This allows the remote clinician to monitor the size of the lesion over a period of time. The photos can be stored in the patient's file on the VisionFlex tablet and/or emailed to a remote clinician from the device.

These tests indicate the internet service at Newman is more than adequate for video conferencing and good quality videoconferencing should be the norm at the Newman Clinic.

Table 4 Ookla speed tests Newman Clinic, 12th May, 2021

Computer	Time	Ping	Mbps Down	Mbps up
Mac Air	1135	19	92.15	57.49
Mac Air	1300	19	64.24	41.6
Mac Air	1311	19	73.75	53.91
Mac Air	1328	18	82.85	36.82
Mac Air	1330	19	92.15	57.49

Site Report Parnngurr Clinic.

The researchers visited Parnngur Clinic on the 13th May at the request of PAMS's CEO. His main objective was for the researchers to test the VisionFlex equipment to see if it worked adequately at one of their remote clinics. This also gave the researchers the opportunity to work with the Acting Clinic Manager, who was a Nurse Practitioner. The VisionFlex smart diagnostic tools and video conferencing were tested and demonstrated with very positive feedback from the Acting Clinic Manager. The researchers did some videoconferencing and internet speed tests. The NBN Business Grade

Satellite service did not perform to expectations with very patchy connectivity (see Table 5). The clinic manager could see uses for the mobile tablet and smart diagnostic tools and requested a quotation for the mobile VisionFlex system.



Figure 31 Parrngurr Clinic, Parrngurr

This is a one nurse station with ample area for visiting clinicians. It is a very large and well-designed new clinic. It is approximately 450 Kms southwest of Newman.



Figure 32 Rear view of the Parnngurr Clinic providing an appreciation of the size and layout of the clinic.



Figure 33 The IT Hub, the NBN NTD (Network Termination Device) for the NBN Business Grade Satellite service and one of the desktops at Parnngurr Clinic.



Figure 34 Packing up equipment in the Parnngurr Clinic after doing telehealth demonstrations with the Activing Clinic Manager.

Results of speed tests at Parnngurr clinic 13th May, 2021.

Several Ookla speed tests were done at the single nurse station at Parnngurr community (see Table 5). The weather was clear, sunny, not windy, dusty or smoky. Most of this testing was done when the nurse was not using the internet. This was a business grade NBN service and consistently did not perform as well as the Sky Muster Plus service in the Darwin Rural Area (please see discussion below). Staff reported the internet was very unreliable and they often saw the "coloured spinning wheel of death".

Video conferencing on a number of devices was moderately successful using the researchers' equipment including the VisionFlex tablet with some freezing, delays and failures. It was concluded the NBN Business Grade Satellite service should provide a much better quality of service than was evidenced by this testing. This issue was referred to NBN Co.



Figure 35 NBN Satellite Dish. Note the position and proximity to the metal veranda which may cause signal interference.



Figure 36 Another view of the NBN Business Grade Satellite Dish. Note the proximity to the metal veranda. It is possible the proximity to metal may cause attenuation and diminish bandwidth.

These results indicate the internet service may be not be adequately reliable for videoconferencing. Previous work by the researchers has found a stable minimum of 2 Mbps down and 2 Mbps up are required for successful videoconferencing.

Table 5 Ookla speed tests Parnngurr Clinic, 13th May, 2021.

Computer	Time	Ping	Mbps Down	Mbps up
HP	1130	629	18.6	4.65
HP	1132	629	4	3.6
Mac Air	11.32	630	6.25	N/A Failed test
Mac Air	11.35	613	11.09	2.36
HP	1150	629	4.04	3.6
HP	1154	600	18.07	4.78
HP	1158	603	14.71	4.78
Mac Air	1202	645	12.26	4.68
Mac Air	12.04	611	13.18	4.72
Mac Air	12.09	599	15.79	4.73
Mac Air	12.28	604	16.14	4.68
Mac Air	1230	601	13.06	4.78

These results indicate the internet service may be not adequately reliable for videoconferencing. Previous work by the researchers has found a stable minimum of 2 Mbps down and 2 Mbps up are required for successful videoconferencing.

Outcomes and findings from the May 2021 trip to PAMS Clinics.

TVS Systems & internet: Each of the four remote clinics had a Telehealth Video Conferencing System installed and NBN Business Grade satellite service. However, the TVSs were not the devices recommended by the researchers, but more expensive systems. The TVS had a camera with integrated directional microphone speaker. This solution has a high-quality camera but inbuilt microphone and speakers. Testing has demonstrated integrated microphone, speakers and camera tend to produce a lower quality experience. They do not automatically manage feedback and echo and are highly directional. During patient consultations healthcare workers tend not to face the microphone at all times. With a high-quality microphone and speaker system, healthcare workers voices are captured very efficiently even when facing away from the microphone. The TVSs were either mounted to a wall or on a trolley. Feedback from staff indicated the TVS was too hard to use, not accessible and the internet was not adequate for videoconferencing. The screen was also too large making moving the TVS very difficult.

The Clinic Manager and other staff complained the internet in the clinics was intermittent and was not reliable.

After examination of the ICT infrastructure, the researchers suspected the workstation system set up was suboptimal. Communicare (ie, PAMS Patient Records System) backups were being done manually by the nurse (one nurse station). These Communicare synchronisations are bandwidth intensive and can reduce the quality of videoconferencing when run concurrently.

The VisionFlex Mobile system was tested at Parnngurr Clinic as requested by CEO. The VisionFlex system diagnostics worked well and videoconferencing worked, despite intermittently inadequate internet with some lag and freezing.

Discussions with the CEO after the testing indicated he was keen to find funding to purchase the VisionFlex system. The researchers approached WA Health and LotteryWest but were unable to acquire funding through those sources for PAMS.

Following the site visit, the researchers contacted the ICT Service Provider (Biz365) and raised the issue of poor internet connectivity. This was not welcomed (the researchers have known the service provider for 7 years). The researchers then approached NBN Co and asked them to assist PAMS and their ICT provider in improving performance from their Business Grade Satellite Service.

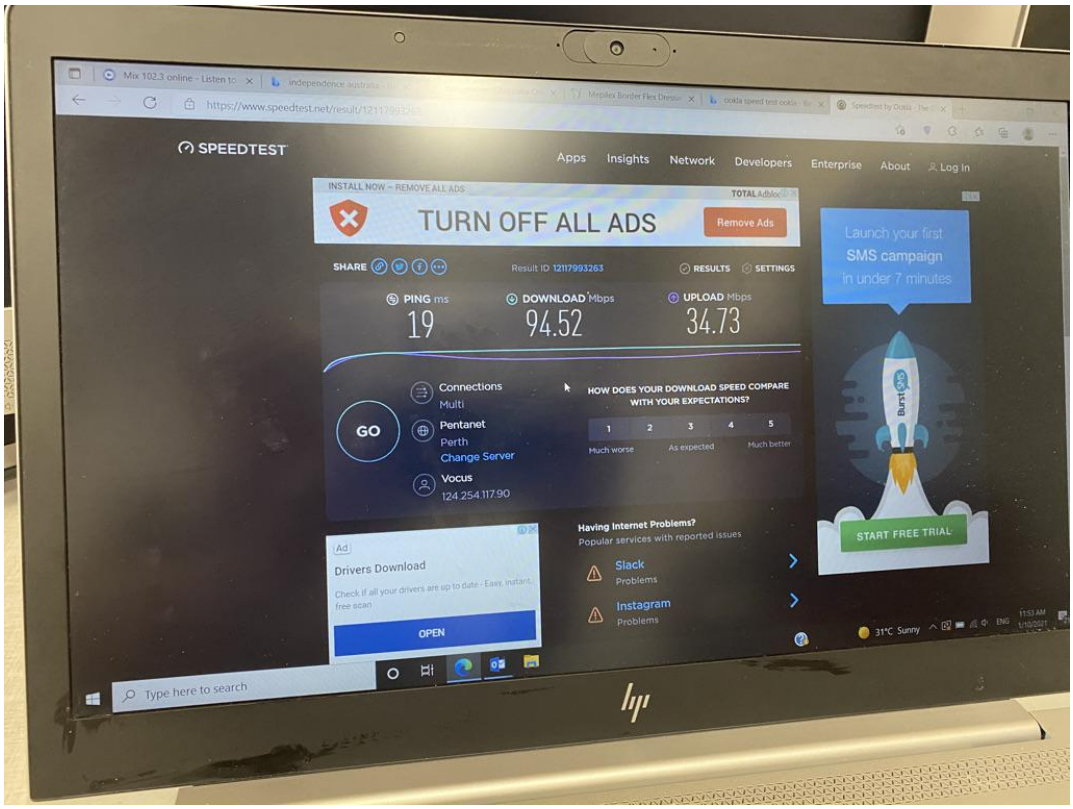


Figure 37 Speed test done on a staff member's laptop at the Newman Clinic. Note the ping of 19 ms, download of 94.52 Mbps and an upload of 34.73 Mbps.

Summary and conclusions:

Key points:

- The ICT setup at Parnngurr is an inhibitor to the implementation of telehealth.
- The lack of reliable internet is also a barrier to reliable videoconferencing and therefore telehealth.
- The staff expressed frustration with the lack of ability to do telehealth reliably although keen to use telehealth to supplement their limited access to health services, particularly specialists and allied health professionals. PAMS requested access to specialists for FASD patients, paediatrics and an ENT (ear, nose and throat) for a 5 yo child with serious ear issues and does not speak.

The researchers approached Synapse Medical to secure suitable specialists.

Work done with PAMS between the May and September, 2021 visits.

Some PAMS staff participated in the case study component of the research.

At the request of PAMS staff, a number of VisionFlex demonstrations were done in collaboration with VisionFlex. The researchers assisted the Child Health Nurse to gain more confidence with video conferencing on her laptop, however, there remained some issues with the performance of her laptop. Biz365 worked on the laptop, but the Nurse was still having issues in getting videoconferencing (Zoom) working. As this consultation was done by phone and videoconference, it was difficult to assess whether the problems were user-skill related, or technical issues with the laptop (either hardware or software). It was agreed the researchers would work with the nurse on their visit in September. VisionFlex included the Jabra speaker/microphone with the VisionFlex system supplied to PAMS. It was anticipated this would improve the Child Health Nurse's videoconferencing experience whether using the laptop or the VisionFlex equipment.

Site Report 28th September – 1st October, 2021: Newman and Jigalong.

The researchers visited PAMS Newman Clinic and the Jigalong Clinic approximately 165 kms east of Newman. There were a number of meetings with staff including the CEO, the Clinic Manager, GPs and administration staff.

Newman Clinic 29th September and 1st October, 2021.

Three days were spent working with PAMS staff. In particular, the researchers did training with the Child Health Nurse and the NDIS Coordinator. The researchers and the Child Health Nurse visited Jigalong on the 30th September with the intention to do child health consults with patients. It was originally intended to do consultations with a Nurse Practitioner and a specialist based in Sydney, however, there were two deaths recently in the community and these consultations were postponed.



Figure 38 TVS in Clinic Manager's Office at the Newman Clinic. Note the combined speaker and camera are positioned at the top of the screen and the system is on a cart so it can be moved from place to place. However, it is not easily transported from room to room due to its bulk and weight.



Figure 39 Training the Child Health Nurse and the NDIS Coordinator at Newman Clinic (Clinic Manager's Office) in the use of VisionFlex equipment.

In preparation for the trip to Jigalong community the following day training was provided to the Child Health Nurse. All the VisionFlex equipment worked well (excellent internet was available at the Newman Clinic) but the Child Health Nurse had some issues with doing videoconferencing (Zoom) on her laptop.

From the previous visit in May and a number of discussions (videoconferences and phone calls) with PAMS staff, it was identified many children were not being diagnosed by specialists after PAMS staff had referred patients into the WA Health System for diagnosis and treatment. Staff advised there were very high rates of FASD (Fetal Alcohol Spectrum Disorder) and many patients could receive assistance through NDIS if they were formally diagnosed and a treatment plan developed. The researchers were asked to specifically work with the Child Health Nurse and NDIS Coordinator to enhance health service delivery for their child patients via telehealth.

After a number of discussions/demonstrations facilitated by the researchers between VisionFlex and various staff members, the researchers were asked by the CEO to test the VisionFlex System on a remote community with the Business Grade NBN Satellite service. This was done on the May trip to the Parnngurr Clinic and the VisionFlex system was found to work, although the internet was not adequate for reliable videoconferencing (see Table 5). Based on this testing, a number of further discussions (videoconferences) and demonstrations with PAMS staff and VisionFlex, PAMS decided to purchase a full VisionFlex mobile system for the Child Health Nurse (see Figure 35 and Tables 6 and 7).



Figure 40 Marianne demonstrating the VisionFlex digital stethoscope using the Jabra Speaker.

At the time of this visit, the equipment had not arrived, so the researchers used their VisionFlex equipment to do training with both the Child Health Nurse and the NDIS Coordinator. Both of these staff became confident with doing video-conferencing on their laptops if the internet was adequate and using the VisionFlex Mobile Telehealth System. The researchers trained both in the use of the Jabra speaker/microphone. It should be noted, that over the last seven months, both KAMS (Kimberly Aboriginal Medical Service) and the RFDS (Royal Flying Doctor Service) have purchased VisionFlex Telehealth Systems. KAMS have purchased five complete sets as well as the ultrasound device. KAMS and PAMS work closely together which was possibly a contributing factor in PAMS deciding to purchase the VisionFlex system.

This represents a significant investment in telehealth equipment and smart diagnostic tools ($24,292.45 including GST). VisionFlex provided 11% discount on the hardware to ensure PAMS had enough funds to cover the synching process of data from the VisionFlex mobile device into PAMS patient information system (Communicare).

Table 6 List of equipment purchased by PAMS from VisionFlex.

ProEX-Mobile Tablet Telehealth Hub: 11.6" sunlight readable Touch Screen Control with Gorilla glass, Intel 7th Gen processor with 512GB SSD, HIPAA ready & HL7 Compliant, 4G/LTE SIM card slot, Dual hot-swappable batteries, 2 x USB, WiFi, BT & RFID reader, speaker, dual front/rear HD cameras, twin smart-card readers, connection for Desktop Docking Station and Vehicle Docking stations, Integrated Patient Database, 12v Medically Approved PSU	
GEIS General Exam Camera : Full HD Camera Handpiece Integrated LED Illumination Universal USB2 Interface Tongue Depressor Attachment Dermatology Hood Carry Box with Foam Insert	
Video Otoscope 100 Speculae (2.5mm) LED Illumination USB2 Interface	
Digital Stethoscope USB Interface with 3m Cable FDA Approved Filter Set. Compatible with ProEX & ProEX-Mobile	
Blood Pressure Cuff - Bluetooth Compatible with ProEX & ProEX-Mobile 4 Cuff sizes available	

Table 7 List of equipment purchased by PAMS from VisionFlex 2.

Pulse Oxymeter - Bluetooth Compatible with ProEX & ProEX-Mobile Live Data Stream	
ECG Single Wire & Three Wire Simple to use, large display, battery operated, Bluetooth connection to the ProEX. Four measurement patterns. Single channel: palm, leg, chest and optional 3-lead for chest/torso. Compatiable with ProEX & ProEX-Mobile	
Contactless Forehead Thermometer. Fast and simple to use, Bluetooth connection to ProEX and ProEX-Mobile. CE approved and accurate	
On-Ear Headphones - Bluetooth, with built in microphone and AUX compatibility. Ideal for use with digital stethoscope. Compatible with ProEX & ProEX-Mobile.	
Backpack with wheels - Very high quality build, suited to hold ProEX Mobile and a full kit of supporting peripherals.	



Figure 41 Demonstrating the VisionFlex ECG. Note the pulse oximeter and temperature gauge in Marianne's hands. All these devices are simple to use and can be used by non-clinicians under the supervision of a remote clinician.



Figure 42 Marianne demonstrating the VisionFlex digital otoscope.



Figure 43 Telecommunications infrastructure at Radio Hill overlooking Newman

There is a microwave link between Newman and Jigalong which is used to allow clinicians to access the live patient records systems. In other remote clinics, synchronised patient records software is used rather than having live access. These services are updated periodically.

Site Report 30th September, 2021: Jigalong Clinic.

The researchers and the Child Health Nurse travelled to Jigalong with the intention of doing some consultations with patients using the VisionFlex equipment. However, for various reasons the planned sessions did not eventuate. The clinic was very busy and the Child Health Nurse was able to contact the mother of a new baby who required follow up. This took several hours and was a very important intervention that was required for the child's welfare. It was planned to do some training with the Nurse Practitioner/Remote Clinic Manager, but he was busy with patients. This clinic normally has 3 Nurses and a GP. However, at the time of the site visit one nurse was on leave which left only 2 nurses on site, compounding the situation.



Figure 44 Jigalong Clinic front entrance. This is a very busy clinic usually manned by 3 nurses, a GP and an administration person.

The researchers had the opportunity to meet with one of the nurses and administration staff and did some training with them. The researchers did some analytics which identified a number of ICT related issues which were referred to PAMS ICT Provider (BIZ365).

Videoconferencing at Jigalong Clinic on the NBN Business Grade Satellite internet service and Telstra 3G Mobile service: The researchers did a number of Ookla speed tests on two internet systems – the PAMS Business Grade Satellite (the fail over service used by Jigalong Clinic) and the Telstra 3G Mobile service. Error messages were received when attempting to do speed tests on the Telstra Mobile (3G) Service (see Table 9 for the results). As it can be seen from the results, the Telstra 3G service is not adequate for videoconferencing.

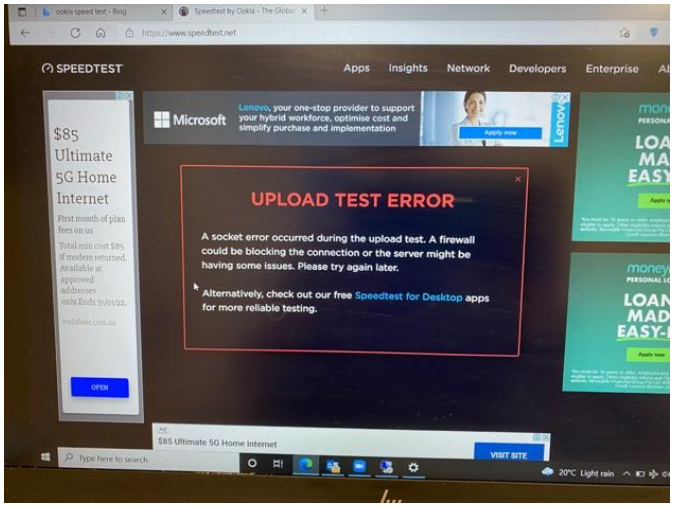


Figure 45 Upload error messages received when attempting to do speed tests.

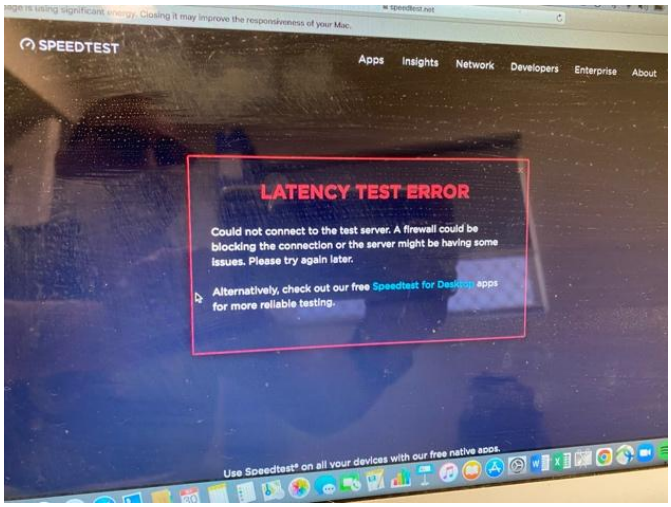


Figure 46 Latency error messages received when trying to do speed tests.

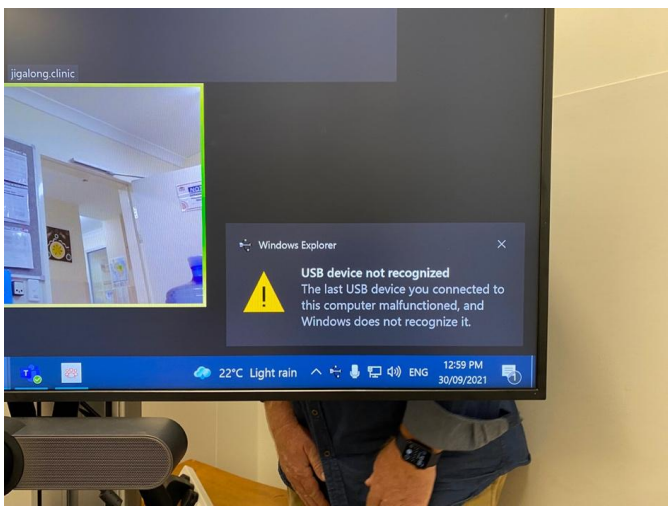


Figure 47 When checking the TVS it was found the camera/microphone/speaker were not working. Note the error message.

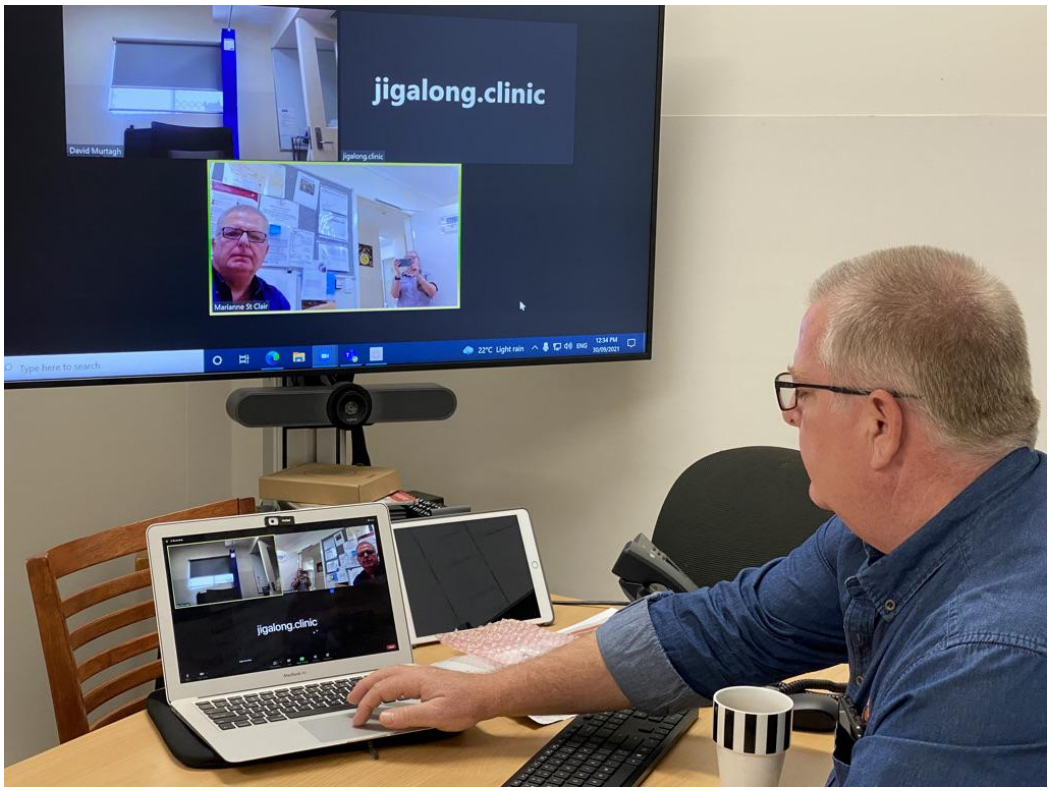


Figure 48 Attempting to establish a videoconference in the tearoom at Jigalong Clinic. David in the tearoom



Figure 49 Attempting to establish a videoconference in the tearoom at Jigalong Clinic. Marianne in consultation room attempting to establish a videoconference between Marianne's Mac Book Pro and the PAMS TVS in the tearoom at Jigalong Clinic. David had the Mac Air in the tearoom. Both Mac devices were able to do videoconferencing, but PAMS TVS was not able to do videoconferencing.

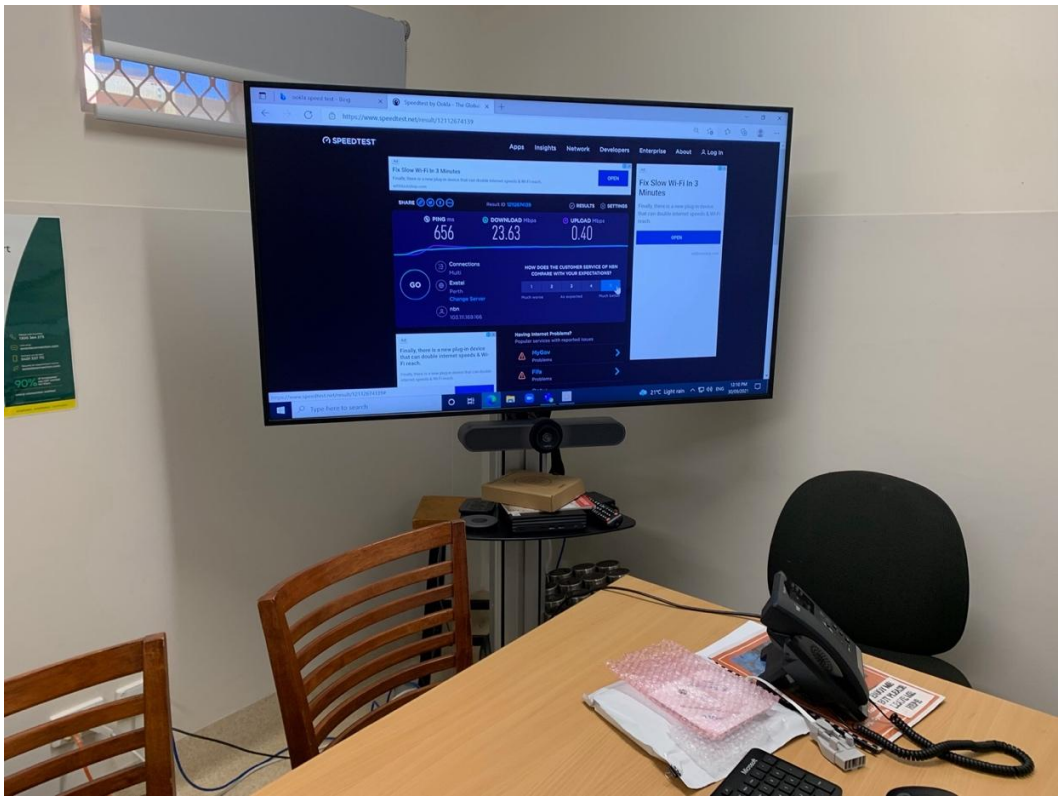


Figure 50 TVS System at PAMS Jigalong Clinic mounted on trolley apparatus, stored in Tea Room. Not the significant ping (656 ms), good download (23.63 Mbps) and poor upload (0.4 Mbps). The poor upload ability renders the system unable to be used for videoconferences and therefore is not adequate for telehealth.

The results summarised below indicate the number of speed tests done on the various devices, the mean and standard deviation of those tests for each of the following: Ping (delay, milliseconds), download speed and upload speed (Megabits per second Mbps)). It can be seen from the data the upload on all managed PAMS devices was not adequate for videoconferencing. The ping is longer than expected, the download is adequate for videoconferencing but the upload speed was not. The download and upload on the researcher's Mac Book Pro was of adequate quality for video conferencing and video conferencing was demonstrated on a number of the researchers devices (Mac Book Pro and Mac Air).

Table 8 Summary of results of speed tests on PAMS Jigalong WiFi (NBN Business Grade Satellite) at Jigalong clinic (approximately 165 Kms east Newman) 30th September, 2021.

PAMS		**Ping (ms)**		**Download (Mbps)**		**Upload (Mbps)**	
Devices	**n**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Laptop 1	24	658.33	11.69	19.16	3.68	0.34	0.08
Desktop 2	7	654.43	5.06	17.34	7.22	0.32	0.06
VC Tea Room	19	652.74	9.72	21.31	4.17	0.30	0.06
Desktop 3	12	648.92	8.28	21.61	4.00	0.30	0.07
Mean		**653.60**	**8.69**	**19.85**	**4.77**	**0.32**	**0.07**
M's Mac Book Pro	29	660.62	13.37	15.54	4.52	9.05	1.22

The results below indicate the Telstra 3G internet service is not adequate for video conferencing. Previous work by the researchers found a stable minimum of 2 Mbps down and 2 Mbps up are required for successful videoconferencing.

Table 9 Ookla speed tests Jigalong Clinic, 30th September, 2021 – over Telstra 3G mobile service.

Device	Time	Ping	Mbps Down	Mbps up
Mac Book Pro	10:21	130	0.1	1.29
Mac Book Pro	10:31	161	0.5	1.03
Mac Book Pro	10:50	107	0.18	0.66
Mac Book Pro	10:54	127	0.1	1.91

Outcomes and findings from the September trip to PAMS' Clinics.

PAMS staff indicated they are keen to access additional health services through telehealth, particularly for children. The TH4B Trial provided an opportunity for PAMS staff to access a range of specialists and allied health services to supplement the services available through WA Health. The researchers had regular meetings with WA Health to keep them informed of the projects activities. PAMS Staff have identified a number of children who require formal diagnosis by relevant specialists before treatment can commence. After training, the Child Health Nurse and NDIS Coordinator had the relevant skills to establish Zoom videoconferences and use the VisionFlex equipment for videoconferencing. Additionally, the nurse was trained in using the VisionFlex smart diagnostic tools. It is anticipated, if the PAMS managed devices are unable to do videoconferencing, PAMS staff could use the VisionFlex tablet to initiate or link to a videoconference.

Access to adequate internet is still a major barrier to telehealth for the 4 PAMS remote clinics (eg Tables 5, 8 & 9). The TVS deployed by PAMS is more complex than the system recommended by this research project and feedback from staff indicates the TVSs are not used to their capacity, if used at all. The technical issues have been identified by the researchers and referred to the ICT Service Provider, Biz365. Workstation and network configuration may be an impediment to establishing telehealth consultations. The researchers met with NBN Co staff on the 8th October, 2021 and it was agreed NBN Co would contact Biz365 and assist them in rectifying the situation. Once the technical issues have been resolved, PAMS staff may be able to enhance their use of videoconferencing including for telehealth.

It was found some of the draft training materials needed modification and two additional resources were needed (How to do an Ookla Speed Test and How to set up a video conference with the VisionFlex Tablet.



Figure 51 Staff accommodation at Jigalong. Note the NBN Sky Muster satellite dishes on the buildings.

Coodardie Station.

Background

Coodardie Station is a family-owned cattle station and is approximately 450 kms south of Darwin. The TVS and the VisionFlex equipment were taken to Coodardie Station to do a trial telehealth consultation with a remote Nurse Practitioner based in Cairns. The internet available was Telstra 3G through and an indoor repeater service.

Telehealth demonstration Coodardie Station Wednesday 23rd June, 2021.

TVS Performance & VisionFlex System performance.

The consultation was initiated. However, the clinician and the test site both reported the video was of poor quality (frequently freezing, fuzzy/unclear image, dropouts) and sound only worked one way (that is, with the Jabra speaker at the test site. The clinician could hear the people at the Coodardie site, but the clinician could not be heard at the test site). The clinician was using the laptop microphone and video equipment and the voice service failed. The testing was continued using videoconference and the phone for voice communication. Some diagnostics were done using the VisionFlex equipment, but again, due to poor internet quality, the performance of the VisionFlex hub was limited. Data was obtained from the pulse oximeter, but no other diagnostic data were able to be entered electronically. Data were entered into the hub manually as the connectivity was not of adequate quality for automatic downloads from devices such as the ECG or temperature device.

Coodardie Station update 30th September, 2021.

Coodardie station had experienced issues with their telecommunications. The researchers provided some assistance with resolving these issues and the family report their internet is much better and more reliable. Two family members have accessed telehealth with the researcher's assistance. One family member had their issue resolved through telehealth and another is receiving on-going treatment through the TH4B Trial. This treatment is reported to be providing better continuity of care than the treatment provided by NT Health and Sunrise Health Service.

References.

St Clair, M. and D. Murtagh (2019). Barriers to telehealth uptake in rural, regional, remote Australia: What can be done to expand telehealth access in remote areas? Studies in health technology and informatics 266: 174-182.

Chapter 8. Impacts of Medicare changes as of 1st July, 2022

Impacts on Patients from the changes to Telehealth Medicare items.

The changes came into effect on 1st July, 2022. Margaret Faux, CEO, Synapse has completed her PhD on the Medicare Benefits Schedule. She believes the changes will have a negative impact on Rural, Regional and Remote (RRR) Australians as well as other patients. The majority of the telephone Medicare rebate-able services were removed. A few remain, but are predominantly for very short consultations.

Below is a summary of key points from discussions with key stakeholders.

Changes to Medicare Telehealth Item numbers.
Doctors will have to use videoconferencing instead of telephone for most consultations. Whilst that sounds straightforward and simple in theory, there are reasons which will make it unworkable in some contexts:

1. Many RRR people (clinicians and patients) have unreliable internet. The requirements for the telehealth video conferencing Medicare items require the clinician to maintain audio and visual connection with the patient for the entire consult. This will mean, if the clinician or patient lose connectivity for even a few seconds, the doctor cannot claim that consultation on Medicare.

2. Some patients do not want to use videoconferencing. Aboriginal people or people with mental health or other sensitive issues often do not feel comfortable with videoconferencing.

3. Many people are digitally excluded due to a lack of digital skills or access to the necessary digital tools (internet and smart devices). Many Aboriginal and elderly people fall into this category.

4. Many people are isolated, not necessarily by geography. They may have health or other logistical issues that render them isolated. These people may not have the ability or the desire to do telehealth via videoconference.

The legal requirements clearly state the clinician has to maintain an audio and visual link throughout the consultation. It is possible the Professional Services Review (PSR) would check on connectivity outages if doing an audit.

Feedback from the Telehealth for the Bush (TH4B) Trial, survey and case studies has clearly indicated healthcare providers had issues with connectivity when consulting patients.

Another consequence of these changes is that specialists or GPs may opt not to bill to Medicare for consultations and charge the patient for the full cost of the consultation. The RACGP encouraged its members to increase their charges to patients. This will mean the loss of valuable public health data as the Medicare rebates are not being claimed, therefore, resulting in a loss of a primary source of data. This may have a long-term negative affect on the health system into the future. Some clinics have stopped bulk billing patients in 2022 (see NT Newspaper Article: https://www.ntnews.com.au/news/northern-territory/top-end-medical-centre-to-no-longer-bulk-bill/news-story/a0e5329b1bc823627dfa42d09e442641).

The benefits of videoconferencing for telehealth over audio only.

Many clinicians (GPs in particular) were not offering patients the option of telehealth consultation via videoconference and, in some cases, refused to provide a video consultation when asked to do so by the patient. It is clear there are significant benefits to doing a telehealth consultation via videoconference as it improves the two-way communication between the patient and the clinician and provides the clinician with useful visual and audio information. It allows the clinician to visually assess the patient and do a number of diagnostic processes, improves patient safety and also protects the clinician by ensuring the patient is the correct patient (sometimes an issue in Aboriginal communities).

It is believed the changes to the Telehealth Medicare items were intended to encourage clinicians to use videoconferencing rather than just audio. Have these changes effectively discriminated against rural, regional and remote patients and clinicians? Many rural, regional and remote people rely on accessing a large proportion of their health services via telehealth, particularly in an emergency – it may be many hours travel to a major health centre. Ideally, videoconferencing should be one of the major tools a clinician has to meet the needs of their patients, but have these changes to Medicare effectively reduced access to health services for the people most in need?

Discrimination against some cohorts of patients and clinicians

The changes to the Medicare Item numbers requiring continuity of video and audio streaming throughout the consultation discriminates against patients and clinicians who do not have adequate (capacity and stable) internet. There are also many patients (eg Indigenous and elderly) who may not have the digital skills or tools to use videoconferencing. There are times when the patient may prefer to have a phone call (eg some Aboriginal people prefer not to be seen on video or some people accessing mental health services or other services may feel more comfortable accessing services via audio or chat service.

Many patients and some clinicians in regional and remote areas may have inadequate internet to ensure fully entire videoconferences. People living in the northern parts of Australia are frequently subject to severe storms and cyclones and power outages. These weather events render the satellite internet and many other telecommunications services inoperable until the storm passes. With storm events, there are frequent incidences of damage to hardware which results in telecommunications service being unusable until it is repaired. This may take many weeks to rectify and repair the service, and, in very remote areas, fault rectification may take many months.

The new Medicare items essentially are discriminatory against some cohorts of patients and clinicians in the sense they are excluding these people from doing telehealth. Rural, regional, remote, digitally excluded patients and those patients who prefer to access services via phone or chat will no longer be able to access many Medicare funded health services via telehealth. For some patients, it reduces their choice of service - essentially forcing them to use videoconferencing against their will.

Minimising transmission of COVID-19 and other airborne diseases.

With the increase in COVID-19 cases and the stress on the health system, increasing efficiency by using telehealth is essential. In the current pandemic, clinicians and patients can reduce the risk of being contaminated with the virus by doing telehealth (when appropriate) instead of in-person consultations. This will reduce the number of patients in waiting rooms and the risk of transmission from patient to patient, and, clinic staff to/from patients. With exponential growth in airborne diseases (such as Covid-19, influenza and gastroenteritis), any reduction in transmission will reduce risk to patients and clinicians and reduce impact on the already stressed health care system.

Professional Services Review (PSR).

Clinicians must meet all the requirements of the Medicare item number before they can claim that payment. The policing infrastructure of Medicare, the PSR, is so punitive and brutal that clinicians are fearful of being subjected to PSR processes. (There is near 100% conviction rate). Medicare are clawing back so much money via the PSR that doctors are very fearful of being reviewed by the PSR. Doctors can be required to pay back very large sums of money from previous years (Faux, 2021). If the doctors are not confident of meeting all the requirements of the Medicare item they will stop providing those services as it represents too much risk to them. A number of specialists have already departed from the TH4B Trial due to the changes in Medicare. This may also result in clinicians charging the patient and not bulk billing items – increasing costs to patients (many who cannot afford the additional costs and therefore many not access services they need).

Basis for the change in Medicare Telehealth Item numbers.

It seems changes to the Medicare system have not been based on well researched criteria. Margaret Faux is concerned these changes are not based on clear evidence: “They say the changes are evidence based, but I have yet to see the evidence. Because from what I know, the evidence was that everybody wanted telephone services. That was the evidence and yet we seem to be doing the opposite of what the evidence says. And forcing consumers and doctors both to do the opposite of what they want.” (Margaret Faux).

Requirement for GPs to see the patient in person prior to being able to claim Medicare Telehealth items.

Currently, the patient needs to have seen the GP or another GP from that practice before any GP from that practice can claim Medicare Telehealth Items. The definition of practice is unclear. Many GPs do locum services and may only be part of that practice for a limited time. Doctors and hospitals have provider numbers. When a patient is seen by a specialist at a hospital there will be three provider numbers on that claim: The referring doctor, the specialist and the hospital. This provides the government with information about that episode. Primary care clinics do not have provider numbers. What constitutes the practice is currently ill defined. This exposes doctors to risk as the definition of practice is unclear. This may not be identified as a problem until the clinician is reviewed by the PSR.

The impacts of the 30:20 Rule.

The rule states if the clinician does 30 or more relevant phone services on 20 or more days in a 12-month period they are providing inappropriate services and will be audited by the PSR. This affects GPs and specialists. In some Aboriginal Medical Services, a remote GP can do 6 consults a day – most not meeting the strict Medicare videoconferencing requirements due to video and/or audio streaming drop-outs. The other complication is that a GP or specialist may provide more than one billable service in the one consultation. There is no way to track how many phone consultations the clinician does other than manually. If the clinician forgets to record all services provided, and, track the number of telehealth services they have done, they risk being audited and prosecuted by the PSR.

Impacts Summary.

It is important clinicians and patients maximise the effectiveness and efficiency of health services provided by telehealth. Clearly videoconferencing provides an improved quality of service due to improved communication between the clinician and the patient. However, the implementation of the new Medicare telehealth Items may result in:

- Reduced access to health services for regional and remote patients, Aboriginal people, the elderly, isolated people, the digitally excluded and people living in areas subject to severe weather events.
- Increased transmission of airborne diseases.
- Increase costs to patients for services.
- Potentially reduce health data collection for policy and decision makers.
- Further increase mental pressure and stress on clinicians.

Recommendations:

1. Regional and remote clinicians and patients be immediately exempted by the requirement to have continuous video and audio streaming throughout the consultation.

2. The Medicare changes be urgently reviewed by a panel that includes:

- Rural, regional, remote and very remote clinicians.
- Rural, regional, remote and very remote patients.
- Aboriginal people.
- Aboriginal Medical Services.
- Geographically isolated and other isolated people (or their representatives).
- Aged people and their representative groups.
- Digitally excluded people.
- Technical experts such as Satellite technologists, NBN Co.
- Margaret Faux – Australia's expert on Medicare Billing.

For information about total number of MBS consultations report in Quarter 2 2021 please see:

https://coh.centre.uq.edu.au/telehealth-and-coronavirus-medicare-benefits-schedule-mbs-activity-australia

Chapter 9. Key findings from research and activities.

Key Project Findings and outcomes.

Key findings outcomes from this project are presented below. These findings are based on research and other project activities such as:

- Site visits.
- Digital Health for the Bush Forums (2020, 2021, 2022)
- Broadband for the Bush Network Meetings
- Project Survey
- Project Case Studies
- Discussions with project partners and network members.

Background.

Only 500,000 people live in Australia's most remote locations, but, they have disproportionate access to health services and consequently, poorer health outcomes (National Rural Health Alliance, 2016). There are often long waits to access services, and in some cases, people are unable to access the services they need. Participants in this research in the rural, regional and remote areas (RRR) have reported long waits (eg 6-12 weeks) to see a GP.

This research indicates lack of access to adequate telecommunications is still a major barrier to accessing telehealth for many regional and remote people. There have been significant advances in satellite internet technologies and the Sky Muster Plus service has been shown to be adequate for telehealth via videoconferencing with a typical minimum download of 25 Mbps down and 9 Mbps up with a ping (delay) of approximately 560 ms (St Clair and Murtagh, 2020). The research has demonstrated telehealth can be part of the solution to this long-term problem and supplement the services currently available in rural, regional and remote (RRR) areas (e.g. St Clair & Murtagh, 2021).

A number of organisations are actively highlighting issues raised by consumers (individuals, families, businesses and communities (e.g. National Farmers Federation: https://www.farmers.org.au/getinvolved/campaigns/rrrcc-data-drought.html, Better Internet for Rural, Regional and Remote Australia: https://birrraus.com/, and B4BA: http://broadbandforthebush.com.au/)).

Bandias and Ram Vemuri (2005) identified telecommunications in rural and remote Australia impact more disproportionately on regional communities particularly in the delivery of education and health services. Services such as telehealth have been difficult to implement in the Northern Territory due to a lack of adequate infrastructure and connectivity (Murtagh, et al., 2017).

The project's survey and case studies supported these findings and highlighted individual's experience of internet connectivity and telehealth in the regional and remote areas.

> *"I noted the press release when the news was released regarding "unmetered" additions with SkyMuster Plus. Well done to all those working behind the scenes to make this happen. Strangely, although we are by nature grateful people, the fact that so much lobbying has to go into acquiring these changes makes you feel that rural people are second class citizens. If only governments could realise the economic and environmental potential of excellent internet access to the whole of Australia. Trade is no longer generated by factories next to highways, it is now generated through intellectual property being marketed worldwide. Rural people have plenty of ability which is being restrained by access to good communication and online education."*
>
> *Case Study Participant*

A range of digital tools such as internet connectivity, videoconferencing software and diagnostic tools are being developed at a rapid rate, however, identifying which tools are appropriate, reliable and usable by very remote people and communities is a key component of the research. Research results from the previous Laynhapuy Telehealth Project have indicated the standard Telehealth Videoconferencing System using the National Telehealth Connection Service

(NTCS) and associated hardware was highly resource intensive and may not be the most suitable solution for the needs of very small remote communities (St Clair and Murtagh, 2018). Staff within the clinics, local community members and visiting clinicians were encouraged to use and innovate with the available equipment. This 'spirit of innovation' allowed less formal technologies such as Face Time and Google Duo) to be included in the diagnostic and treatment processes (St Clair et al, 2019).

A more holistic approach to health service delivery, digital inclusion, education and community development is required. The long-term aim of this research is to enhance and improve the lives of regional and remote people including Aboriginal people living in small, very remote communities, provide opportunities for the development of sustainable jobs on communities using savings derived from the implementation of telehealth whilst generating research outputs in the fields of health informatics and collaboration.

Issues impacting on the use and effectiveness of telehealth.

The research has identified the following issues:

1. The lack of adequate, reliable and affordable internet connectivity is still a barrier to accessing health care services via telehealth.
2. Although the concept of "telehealth" has become more widely known, many people still do not understand how they can extend access to health services via telehealth.
3. Many GPs either do not offer telehealth, or only offer telehealth via audio (phone). Many clinicians do not maximise the use of videoconferencing or smart diagnostic tools to enhance their data collection of patient diagnostic parameters.
4. Primary health providers and diagnostic services do not always share diagnostic results or communicate well to maximise their effectiveness in treating health care consumers.
5. Referring specialists sometimes fail to provide discharge/consultation summaries to the health care consumer's referring practitioner.
6. Some healthcare providers are refusing to upload consumer's health data to My Health Record when the health care consumer requests this action.
7. Some healthcare providers are refusing to provide the patient with their health data when the patient requests those diagnostic results. (This poses the question: Who owns the data? Medicare. who paid for the diagnostic test? The provider who provided the test? The referring clinician? Or, should the patient own their own health data? Note the healthcare consumer pays the Medicare rebate as a contribution to the cost of the Medicare insurance scheme).
8. Many remote people are not getting the care they need in a timely manner and are often experiencing lengthy delays for diagnosis and treatment resulting in much poorer health outcomes.
9. There is a lack of access to a range of services in regional and remote areas possibly due to a lack of healthcare providers.
10. The current funding models do not support the expansion of health services to RRR.
11. Multiple changes to Medicare rebates for telehealth may reduce access for remote healthcare consumers.
12. The lack of funded patient end support is a major barrier to uptake of telehealth in regional and remote Aboriginal and GP clinics.
13. If specialists do not bulk bill a specialist appointment, the Aboriginal Medical Service (AMS) staff member (eg GP or NP) is not able to claim a MBS payment for that consultation. This is an issue raised by PAMS, LHS and Aboriginal Health Council of WA.

The pandemic has resulted in a significant number of changes to health service delivery and the implementation of telehealth throughout Australia. To increase efficiency, effectiveness and access to telehealth it will be important to understand the barriers and enablers to telehealth implementation as well as the benefits to patients and clinicians to improve how health services are delivered in rural, regional and remote (RRR) areas.

Expansion of telehealth from a national perspective.

There has been a steady increase in Telehealth consultations since 2011 (see Table 1). In the 2018-19 financial year there were 236,910 telehealth services paid by Medicare. In the March 2020 to March 2021 period (following MBS changes due to the pandemic) there was 52.9 million telehealth services paid by Medicare. During the same period there was 212 million 'in person" consultations. This represents a significant increase in telehealth consultations and a major change to healthcare delivery in Australia. A key point of concern exists when comparing phone and video consultations as there is evidence video-based telehealth consultations provide higher quality clinical outcomes (Greenhalgh et al. 2016, Wade et al., 2014, Smith et al., 2020).

Table 1 MBS Telehealth Services Pre-Covid 2011 – 2019 video telehealth services. Note, changes to MBS due to the pandemic saw telehealth via phone approved for MBS claims (source https://www1.health.gov.au/internet/main/publishing.nsf/Content/Medicare+Statistics-1).

Financial Year	Services
2011-12	26,058
2012-13	71,324
2013-14	101,733
2014-15	125,770
2015-16	150,629
2016-17	162,468
2017-18	188,363
2018-19	236,910

A comparison of phone and video-based telehealth GP consults since December 2019 indicates a high uptake in telehealth with most consultations done by phone (see Figure 1). There were no GP Medicare Benefits Schedule (MBS) telehealth consultations reimbursed by Medicare prior to the pandemic. *(Source https://coh.centre.uq.edu.au/telehealth-and-coronavirus-medicare-benefits-schedule-mbs-activity-australia).*

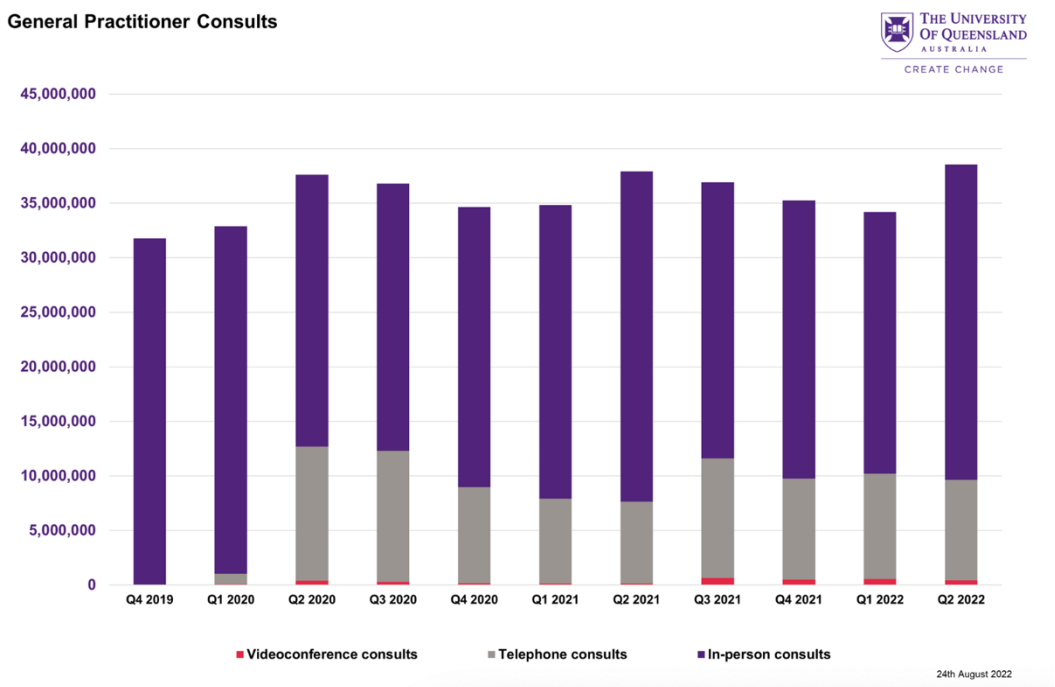


Figure 52 The Centre for Online Health has published Medicare consultation reimbursement data showing significant phone-based telehealth using Covid MBS item numbers.

A similar increase in phone-based specialist telehealth consults occurred (see Figure 2). Considering Figures 2 and 3, a comparison of the use of videoconference-based telehealth by specialists to GP videoconference-based telehealth use may indicate a greater acceptance over time. Since 2011, medical specialists have been able to bill Medicare for videoconference-based Telehealth consultations in remote areas (Modified Monash Model (MMM) 6 and 7). This has resulted in a greater number of medical specialists using (and being accustomed to using) videoconference-based telehealth than GPs since the beginning of the pandemic. This comparison raises questions regarding the mechanisms and time it takes to implement these changes to healthcare practice.

Psychiatrists and general mental health consultations have increased telehealth Medicare billing during this period (see Figure 5 and 6). Video-based telehealth is nearly equal to phone consultations when both pre-Covid and post-Covid telehealth MBS items are added together. There may be additional factors that influence the number of videoconference-based telehealth consultations done for mental health interventions due to its face-to-face consultation style and a reduced need to do physical examinations of the patients. This may point to a need for a greater focus on remote diagnostic tools and their introduction for more physical and body system-based healthcare. **As these tools improve and develop, they could begin to replace some physical examinations, therefore increasing remote access to a broader range of healthcare services. However, operator capacity to use these tools may still be a barrier to uptake.**

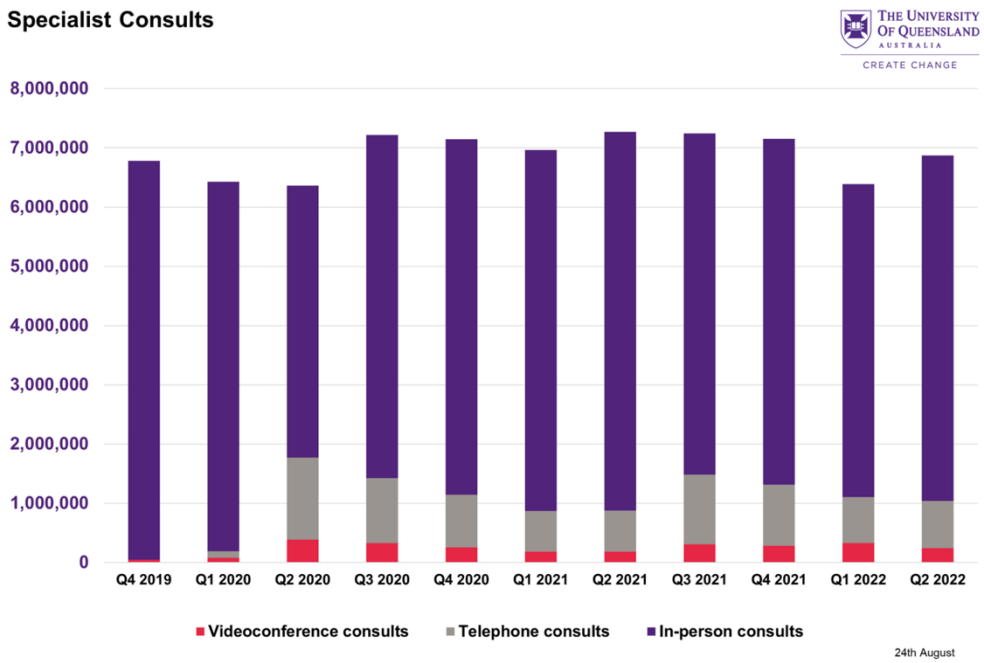


Figure 53 Specialists had been using more Medicare videoconferencing pre-Covid and since March 2020 have increased uptake of videoconferencing by a greater proportion than GPs

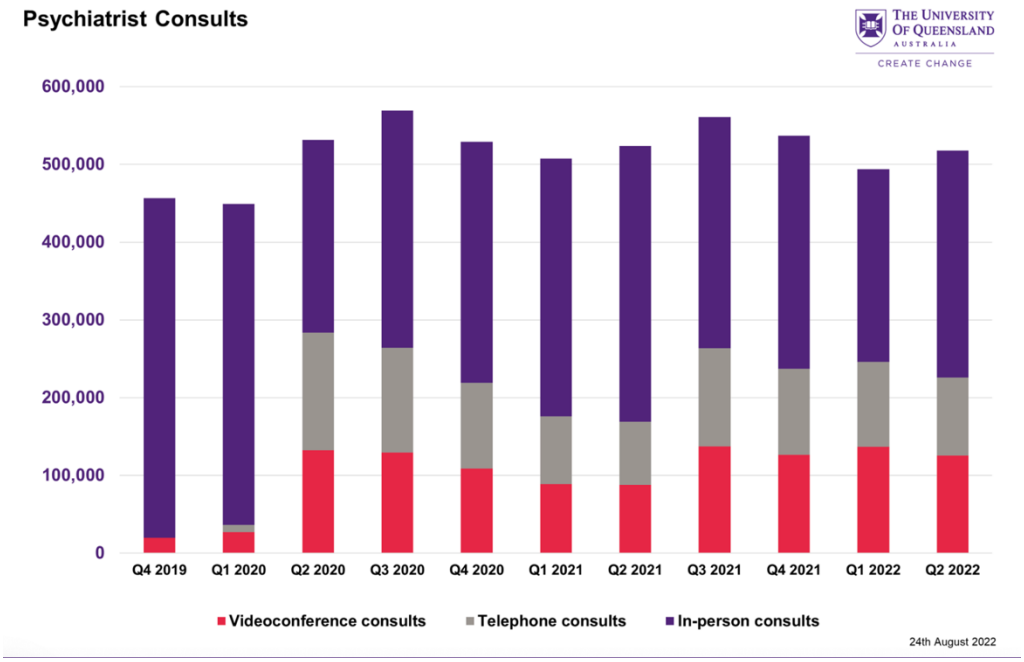


Figure 54 Psychiatrists have been using more Medicare videoconferencing pre-Covid and since March 2020 have increased uptake of videoconferencing by a greater proportion than GPs

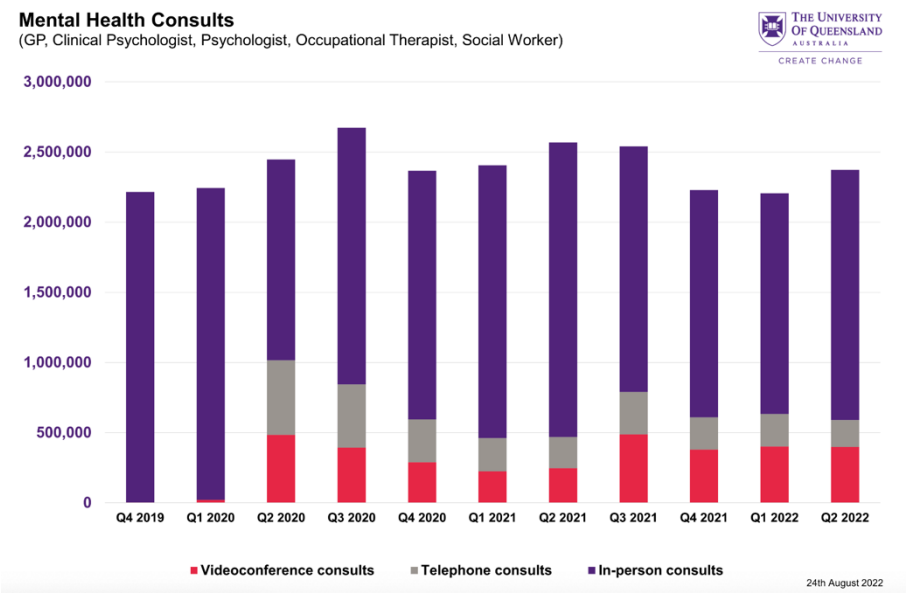


Figure 55 There has been more mental health Medicare videoconferencing pre-Covid and since March 2020 have increased uptake of videoconferencing by a greater proportion than GPs

The introduction of COVID Medicare rebates for Allied Health Professionals and Nurse Practitioners and a greater use of phone consultations is evident (see Figures 6 and 7). This may indicate a preference for well understood technologies (ie phone) by both practitioners and patients. These data describe telehealth usage in the general population and make no reference to geographic isolation. With access beginning to be more available (ie fewer COVID lockdowns), there may be a preference for patients to see healthcare providers in person and clinicians may prefer to see patients in person. The use of telehealth, in the period (June 2021 to October 2021) may have increased due to the lockdowns in Victoria, New South Wales, Queensland and the Australian Capital Territory. A reduction in access to MBS rebated services due to pandemic lockdowns may be similar to remote Australians' usual healthcare experience. People living in urban areas experiencing difficulties in accessing clinicians in person due to the pandemic may result in urban populations (including

policy makers and politicians) gaining a better understanding of the difficulties in accessing health services in geographically isolated areas.

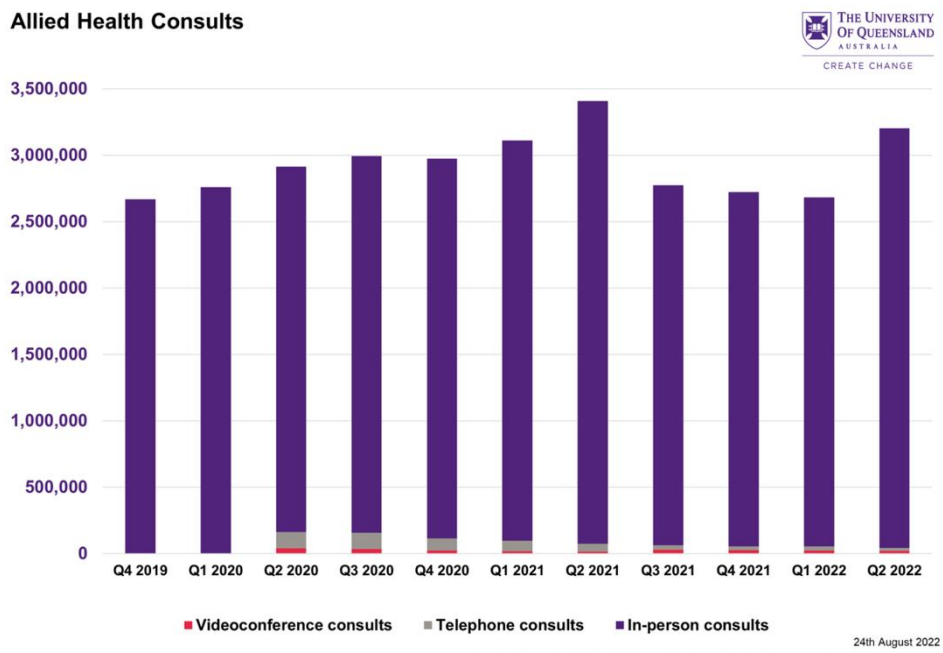


Figure 56 There has been more Allied Health Medicare videoconferencing since March 2020. There has been increased uptake of videoconferencing by a greater proportion than GPs. There were no Medicare items for Allied Health pre-Covid

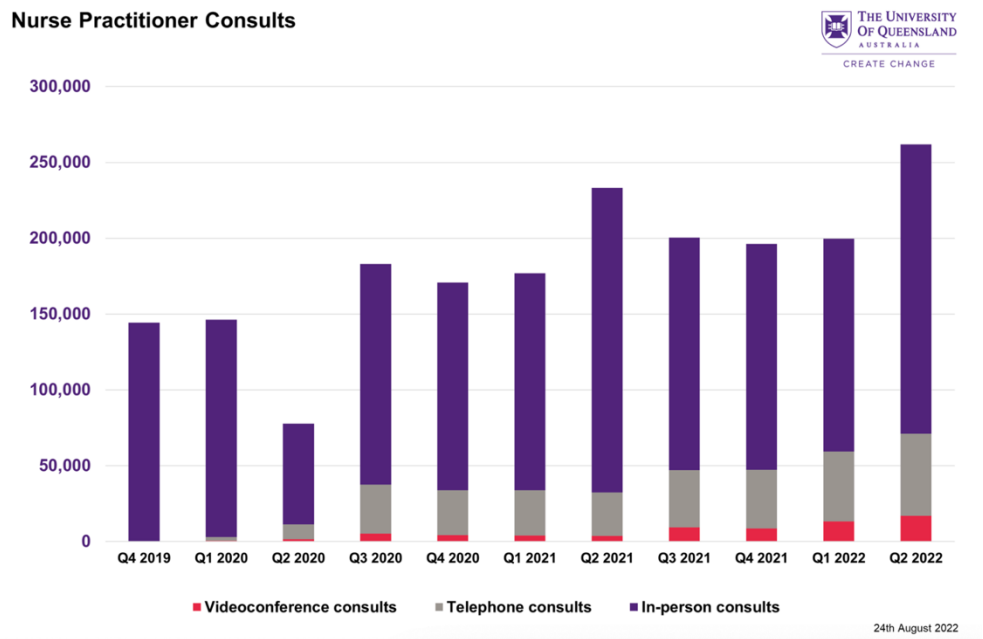


Figure 57 There has been more Nurse Practitioner Medicare videoconferencing since March 2020. There has been increased uptake of videoconferencing by a greater proportion than GPs. There were no Medicare items for Nurse Practitioners pre-Covid

The Covid-19 Telehealth Medicare item claims for clinical consultations represents a change in practice as a response to the pandemic. The approach to expanding telehealth use in primary healthcare provided protection for clinicians as well as the general population from the spread of infection. This has demonstrated an effective method of augmenting healthcare delivery to all consumers, including regional and remote people and should continue through supported developments, collaborations and skills improvement both for clinicians, clinic staff and patients. In December 2021,

new telehealth Medicare rules were introduced. These rules where designed to limit phone-based telehealth and encourage videoconference-based telehealth (Hunt, 2021). The application of new rules may be a factor that impacts the productive use of telehealth in RRR Australia.

This CRCNA telehealth project developed a robust simple-to-use telehealth system that has been deployed in a number of remote Aboriginal Communities and Laynhapuy Homelands used telehealth via videoconferencing as 'Business as Usual' from mid-2020.

Barriers and enablers impacting effectiveness of telehealth.

There has been a significant increase in the use of telehealth initiated by the pandemic and the research identified a number of barriers to telehealth uptake and effectiveness. These issues are listed below.

Research sites.

Laynhapuy Homelands.

In 2016 the researchers secured a grant of $407,540.10 from the NT Government – Regional Economic and Infrastructure Fund and an additional $50,000 from Telstra (see below) to determine if telehealth could be done via satellite internet connectivity. This research determined telehealth via videoconferencing could be done over satellite internet and this project was nominated for the Chief Minister's Award in 2017.

The project was done as a collaboration between:

- Laynhapuy Homelands Health Service.
- Northern Institute, Charles Darwin University.
- Aboriginal Medical Services Alliance Northern Territory.
- Broadband for the Bush.
- eMerge.
- Telstra Health.

A number of clinics in the Laynhapuy Homelands previously lacked adequate internet to access eHealth systems, telehealth or diagnostic services such as internet connected Electrocardiography (ECG). The NT previously led the country in the use of standards-based secure messaging for clinical information (eg specialist referrals, hospital discharge and pathology reports), shared health patient records and other internet connected diagnostic devices such as the iStat machine (blood analysis).

Funding was obtained to install 3 mining-grade (Gilat) satellite services and connectivity costs for 12 months was included. The three communities chosen for telehealth implementation by the Laynhapuy Health Service were Gan Gan, Yilpara and Wandawuy These were the largest and most distant communities.

Additional support for the project was obtained from Telstra Health's Telstra Reconciliation Action Plan (RAP). As part of the Telstra RAP, additional equipment was provided including a video end point, uninterrupted power supply (UPS), network switch, installation and 12 months connectivity to Telstra Health's National Telehealth Connection Service (NTCS) for each of the three clinics as well as the Laynhapuy Health Office in Yirrkala. The value of the equipment was approximately $50,000 for each site, totally approximately $200,000.

A fundamental component of the underlying technology that supports telehealth is high bandwidth network connections. Twelve months connectivity for three remote clinics in the Laynhapuy Homelands provided an opportunity to demonstrate the value of telehealth and videoconferencing prior to the service incurring costs. Towards the end of the project, staff regularly used videoconferencing for telehealth. Diagnoses were being aided by Facetime (i.e. iPhone 5 and later model camera optics) and digital capabilities provided adequate video quality to do triage and significant

diagnostic assessment. The project demonstrated telehealth could be successfully done via high-grade satellite internet (stable 2 Mbps down, 2 Mbps up, 600 ms ping).

After that project's completion, LHS decided to continue paying the connectivity costs (approximately $90,000 pa) for the high-grade satellite connectivity as the value of telehealth via videoconference was recognised from a patient care and financial context. There were other benefits of telehealth including being able to implement treatments more responsively due to the ability to facilitate group decision making through videoconferencing (St Clair and Murtagh, 2019). It was decided to discontinue the use of the Telstra Health videoconferencing system as it was expensive (approximately $430 per month per site for four sites), unreliable and difficult to use. The researchers identified the need for a much simpler, more robust and reliable videoconferencing system which led to the implementation of this CRCNA Telehealth Project.

John Kelly, GP/Physician, Laynhapuy Homelands Health Service was based in Sydney or regional NSW. Typically, between 3 and 8 consultations were done daily using telehealth. Additionally, videoconferencing was used to share images and videos with patients, family and staff in the homeland clinics to address diagnostic and treatment issues. Video clips from the internet were used to demonstrate examination and treatment techniques (St Clair and Murtagh, 2019). Access to video conferencing changed the way Laynhapuy Homelands deliver services to their remote clinics (Jeff Cook, pers. comm.).

The use of video conferencing as part of service delivery in the remote Laynhapuy Homelands was a "game changer" in remote Indigenous health service delivery (St Clair and Murtagh, 2019). Face-to-face consultation and direct supervision and observation of patient examinations delivered better health outcomes for patients. By showing patients and families pictures from the internet the supervising GP can demonstrate clearly what the problem was and the treatment required (St Clair and Murtagh, 2019).

> ***"A picture says a thousand words…especially when it's the patient's third language"***
>
> John Kelly, Physician and GP, Laynhapuy Health Service.

Telehealth implementation has been shown to reduce costs associated with patient travel, minimise time spent away from community and provide improved patient satisfaction eg the use of remote diagnostic systems for identification of cardiac issues can improve patient care and save lives.

Outcomes from CRCNA Telehealth project for Laynhapuy Homelands.

The Laynhapuy Homelands Health Service (LHS) have a number of communities with health clinics. From the work in 2016/17 the LHS used videoconferencing telehealth as a "Business as Usual" strategy while the high-grade satellite was functional. The phones were often non-functional in those communities for up to twelve weeks, and the audio quality was often very poor. It was clear good quality internet was required for telehealth service delivery.

At the commencement of this project, the NBN Sky Muster Services in many of the communities were not functional. The three mining-grade services had failed by March, 2020 and, at the start of the pandemic, LHS did not have reliable access to internet to do telehealth on a number of their communities.

The researchers had distributed the summarised data from testing the Sky Muster Plus service over the 2019-20 wet season in February, 2020. In March 2020, Jeff Cook (Laynhapuy Homelands Health Services Manager) contacted Marianne St Clair to clarify if the Sky Muster Services would provide adequate internet for telehealth and requested assistance to obtain NBN Sky Muster Plus internet services for seven of their remote clinics. Jeff Cook expressed his concern regarding the pandemic and indicated access to telehealth via videoconferencing was critical, particularly with the Covid-19 situation.

Simbani Research, in collaboration with NBN Co, SkyMesh, Emerge IT, SkyBridge and JMAC Comms fast tracked the processes to install seven new Sky Muster Plus services for Laynhapuy Health Service so they could have access videoconferencing for telehealth. There was also assistance provided by the NT Chief Minister's and Senator McMahon's Office.

The installer, Johnathon McCartney (JMAC Comms contracted by SkyBridge) submitted an application to the Northern Land Council and the NT Government for a permit to travel to the Laynhapuy Homelands on Monday 11th May, 2020. At that time, it could take many weeks to obtain a permit to travel to Aboriginal communities in the NT. Johnathon McCartney drove to the homelands and collected additional equipment from eMerge IT Solutions in Katherine (Routers, UPS, cables, etc) to install the Wi-Fi equipment as well. Jeff Cook, met Jonathon on the Homelands and travelled with him for the installations. Johnathon did the Wi-Fi equipment installations essentially on a volunteer basis, but also provided some ICT education to the Clinic Manager, Jeff Cook.

Travel was approved for the following communities at their Health Clinics and Johnathon installed the 7 NBN services, Wi-Fi routers and tested the equipment to ensure it worked correctly:

- Gan Gan
- Dhalinybuy
- Wandawuy
- Yilpara
- Garrthalala
- Gurrumurru
- Dhuruputjpi.

Johnathon posed no risk to the communities from a Covid-19 perspective as he had only been in the Darwin Region since the Covid-19 lock down. (Note, the Darwin region had no Covid-19 cases at this time).

The performance of the Sky Muster Plus services was so reliable, affordable and effective, Jeff Cook ordered another four NBN Sky Muster Plus services for their community stores – which further confirmed the researchers' findings the Sky Muster Plus service was adequate for videoconferencing and videoconferencing for telehealth.

Laynhapuy Homelands Health Service continue to use telehealth as a business as usual (BAU) mode to provide health services to their very remote homeland communities using NBN Sky Muster Plus. These communities are approximately 200 kms from the head office in Yirrkala. There have been some minor issues at times with the NBN Services, but these have been resolved as required. Jeff Cook has often resolved the issues on-site with remote support from David Murtagh, SkyMesh and NBN Co.

Towards the end of the project, LHS identified an issue: Telstra removed the ability for EFTPOS transactions to be done over HCRC and if the satellite connection at the store failed due to weather conditions or lack of power, no transactions could be done until the satellite internet services recovered. This issue was referred to Telstra for rectification. Some LHS staff were successfully using the VisionFlex digital stethoscope. However, with staff turnover, use of that device did not continue .

Puntukurnu Aboriginal Medical Service.

Puntukurnu Aboriginal Medical Service (PAMS) is an Aboriginal Community Controlled Health Service located in the East Pilbara region and delivers services in communities located in the Great Sandy, Little Sandy and Gibson Deserts. PAMS provides comprehensive health services supported by visiting clinicians and allied health practitioners to the Martu people in the four communities of Jigalong, Parnngurr, Punmu and Kunawarritji. PAMS has its administrative hub based in Newman. The administrative hub provides the overall management of the organisation, undertakes the operational activities associated with logistics and travel and supports the clinical services in the communities.

Punmu Clinic.

The Punmu community is in the northern part of the Karlamilyi National Park on the edge of Lake Dora 377 km from Newman. The population is approximately 140 and is a one nurse station with accommodation and clinic space for visiting clinicians.

Kunawarritji Clinic.

The Kunawarritji community is approximately 1,531 kms from Newman and is the most remote of the PAMS clinics. The population is approximately 76 and is a one nurse station. The community is 5 kms north-west of Well 33 on the Canning Stock Route. This site has not yet been visited by the researchers, but a number of training sessions have been delivered to staff when working at this site.

Parnngurr Clinic.

This clinic was initially established in the 1980's when groups of Martu people decided to move back to their country. The community is located 370 kms from Newman and access is via a reasonably well maintained, unsealed road. The community has had up to approximately 130 people, but at the time of this research the population was approximately 20-40. The new clinic is large and spacious and is a one nurse station. It has large consulting rooms including facilities for visiting clinicians. There is staff accommodation on the community.

The researchers visited Parnngurr Clinic on the 13th May, 2021 at the request of the CEO. His main objective was for the researchers to test the VisionFlex equipment to see if it worked adequately at one of their remote clinics. This gave the researchers the opportunity to work with the Acting Clinic Manager, who was a Nurse Practitioner. Video conferencing on a number of devices was moderately successful using the researchers' equipment including the VisionFlex tablet with some freezing, delays and failures. The VisionFlex smart diagnostic tools and videoconferencing were tested and demonstrated with very positive feedback from the Acting Clinic Manager. The clinic manager could see uses for the mobile tablet and smart diagnostic tools and requested a quotation for the mobile VisionFlex system.

The researchers did some videoconferencing and internet speed tests. A number of Ookla speed tests were done at the single nurse station. The weather was clear, sunny, not windy, dusty or smoky. Most of this testing was done when the nurse was not using the internet. This was a business grade NBN service and consistently did not perform as well as the Sky Muster Plus service in the Darwin Rural Area. Staff reported the internet was very unreliable and the "coloured spinning wheel of death" often appeared on their screens.

The Clinic Manager and other staff complained the internet in the clinic was intermittent and videoconferencing could not be done reliably. After examination of the ICT infrastructure, the researchers concluded the workstation system implementation was suboptimal. Communicare (i.e., PAMS Patient Records System) backups were being done manually by the nurse (one nurse station). These Communicare synchronisations are bandwidth intensive and can reduce the quality of videoconferencing due to contention.

It was concluded the NBN Business Grade Satellite service did not perform to expectations with very patchy connectivity, possibly due to network configuration issues. It is suggested the NBN Business Grade Satellite service should provide better quality of service than was evidenced by the testing. This issue was referred to NBN Co and BIZ365 (PAMS' ICT provider) for resolution.

VisionFlex equipment: The VisionFlex Mobile system was tested at Parnngurr Clinic as requested by CEO. The VisionFlex system diagnostics worked well and videoconferencing worked, despite intermittently inadequate internet with some lag and freezing.

Jigalong Community

Jigalong is located approximately 165km east of Newman and is perched on the edge of the Little Sandy Desert. Approximately 450 people live in Jigalong and the community has a school that provides education from kindergarten to year 12, a shop and a swimming pool.

Jigalong is the clinical hub for Puntukurnu Aboriginal Medical Service and has the largest number of clinical staff, apart from the new Newman clinic. The clinic is serviced by three nurses (two Remote Area Nurses and a Nurse Practitioner), one GP, a receptionist (full time), Aboriginal Health Professionals and a Driver. The GP travels from Jigalong to Parnngurr, Punmu and Kunawarritji each fortnight to provide an outreach service to the more remote and less populated communities. Visiting services such as Ear Science Institute Australia, Hearing Australia, Lions Outback Vision, Obstetrics and allied health services provide outreach services to all four communities.

PAMS staff wanted to use the VisionFlex System for staff meetings via videoconference. They also indicated access to digital professional development both within PAMS and by external providers would be beneficial. They did have some older workforce members who were challenged by ICT technologies. PAMS staff were keen to link in with the RFDS trial and work closely with RFDS.

VisionFlex tools to diagnose developmental issues for children.

Subsequent to a number of virtual and in person demonstrations of the VisionFlex tools, PAMS purchased a set of equipment for the Child Health Nurse. PAMS had difficulty in establishing formal diagnoses for a number of developmental issues in children at various communities. The project team, with the assistance of Synapse Medical provided access to a suite of specialists with the aim to obtain formal diagnoses and then implement support mechanisms through NDIS. Despite extensive work with the Child Health Nurse and PAMS's NDIS Coordinator, no additional children were able to access NDIS services through this project. The main barrier to this eventuating was the non attendance of children and their guardians to the appointments with the nurse and relevant specialists (via telehealth). The project team were able to assist another person to obtain NDIS support through the Telehealth for the Bush (TH4B) trial, so the processes established were demonstrated to be effective.

PAMS Summary and conclusions.

TVS Systems & internet: Each of the four remote clinics have Telehealth Video Conferencing Systems installed and NBN Business Grade satellite services. However, the TVSs were not the devices recommended by the researchers, but more complex and expensive systems. The TVS had a camera with integrated directional microphone speaker. This solution has a high-quality camera but an inbuilt microphone and speakers. Testing had shown integrated microphone and speakers tend to provide a poorer quality audio experience. They do not automatically manage feedback and echo and are highly directional. During patient consultations healthcare workers tend not to be facing the microphone at all times. With a high-quality microphone and speaker system, healthcare workers' voices are captured very efficiently even when facing away from the microphone. The TVSs were either mounted to a wall or on a trolley. Feedback from staff indicated the TVS was too hard to use, not accessible and the internet was not adequate for videoconferencing. The single screen was also too large making moving the whole TVS very difficult.

Staff reported the internet in the clinics was intermittent and was not reliable. After examination of the ICT infrastructure, the researchers concluded the workstation system was inefficient. Following discussions with NBN Co technical staff and direct observation of the clinics' network environment (ie guest and secure Wi-Fi), it was concluded the virtual private network (VPN) technology was not fit for purpose. The researchers and NBN Co technical staff both recommended a more appropriate VPN technology.

Key points:

- The ICT setups at Parnngurr and Jigalong are an inhibitor to the implementation of telehealth.
- The lack of reliable internet is also a barrier to reliable video conferencing and therefore telehealth.
- The staff expressed frustration with the lack of ability to do telehealth reliably although keen to take up telehealth to supplement their limited access to health services, particularly specialists and allied health professionals.
- Staff capacity to use digital tools varied and a number of resources were developed and provided to PAMS staff. Some staff members such as the Child Health Nurse increased their personal capacity to the extent they could use videoconferencing and VisionFlex equipment independently and confidently.

Gawa Community.

Gawa community is a small remote Aboriginal community on Elcho Island 600 kms from Darwin by air. There are approximately 20 Adults and 46 children living in the community with a nurse visiting for a few hours each week for basic services and dispensing medications. Through this CRCNA Telehealth Project and the Digital Health for the Bush Forum (St Clair et al, 2021) the Gawa Community requested access to community Wi-Fi to facilitate assistance to move to a more pro-active community-based primary health care model.

Simbani, VisionFlex and Synapse Medical supported the Gawa community and NBN Co as the Wi-Fi service was installed at the Old School building (May 2021) and the first telehealth consultations were done. Seventeen health checks supervised by an Aboriginal Nurse Practitioner located in far north Queensland were delivered over that

connection. NBN Sky Muster Plus satellite service with managed Wi-Fi was installed and provided the community with a level of control over content filtering and time-of-day access. Initially, the community requested Wi-Fi be available from 3-6 pm. However, a few weeks later, the community requested availability be extended (2-7 pm) to expand access to services, without making the Wi-Fi available for children during school time. The project team also established a 24 hr account which could be used in the event of an emergency.

The Gawa community identified the provision of community Wi-Fi and establishing regular access to health services via telehealth using appropriately skilled and supported community members on site may, in part, close the gap in service and improve health outcomes for Gawa and other similar, small and remote Aboriginal communities. Many small remote homelands do not have on-site healthcare workers. This work led to the development of the concept of Telehealth Technician's (new CRCNA Project H.5.2223001 Development of innovative primary health service managed by Telehealth Technicians for very remote Aboriginal communities: 2023 -2026). It is proposed to train a number of community members (at least one female and one male) in using Information and Communications Technology (ICT) and smart diagnostic/monitoring tools to assist community members to access a range of health services via telehealth. By the development of the role "Telehealth Technician" these communities can move from a very basic outreach health service to a pro-active comprehensive primary care service.

Using the theory of collaboration (Grey, 1989; Huxham and Vangen, 2004), this new model of service delivery may address gaps in health care for rural, regional and remote people, including very remote Aboriginal Communities and cattle stations.

Using the theory of collaboration as the basis for this research.

Collaboration is the process where people and/or organisations work together to achieve a shared goal. The researchers use the theory of collaboration as the basic philosophy underlining the research and associated work. Collaborations are dynamic and complex in nature and some components of collaboration may include, but not be limited to; the role of collaborative leadership, distributed power, shared decision making, coordination, cooperation, communication and the requirement for nurturing and trust building. Below is a brief summary of the theory of collaboration.

Theory of collaboration

Collaboration is a process in which stakeholders work together in a constructive manner to attain an agreed goal whilst working through their different understandings, perceptions, interests and limitations (Gray, 1989). Collaboration generates an outcome that stakeholders are unable to generate on their own (Bryson, Crosby and Stone, 2015). Collaboration is a process that evolves, is useful for achieving shared visions and involves joint ownership of decisions as stakeholders share the responsibility for the outcomes (Gray, 1989). Collaborations can be of two types; 1) Negotiating complex and difficult situations and 2) Trying to achieve a shared vision (Gray, 2000). A significant proportion of the literature on collaboration is focused on negotiation of difficult problems eg resolving environmental issues, mining rights, progress and development issues such as new building developments (Gray, 1989). The researchers primarily used the theory of collaboration for the achievement of a shared vision (objectives of the stakeholders and the project).

Collaborative advantage (Vangen and Huxham, 2010) is defined as stakeholders working together to generate a positive outcome, recognising that all stakeholders may not have the same shared goals (Huxham and Vangen, 2005). An opposite concept is collaborative inertia (Huxham et al, 2004) which can refer to a range of situations including discord amongst stakeholders or large resource allocation without generating achievement in a timely manner. Facilitation of collaborative advantage often requires intervention and/or leadership from an external and impartial facilitator (Vangen et al, 2003b). Clearly, by increasing situations of collaborative advantage and minimising collaborative inertia more successful outcomes may be generated.

***Factors that can influence the outcomes of collaboration*:** Engaging partners from a variety of disciplines and backgrounds (including government, research and not-for-profit organisations) in collaborations is resource intensive, requires compromise, commitment, good communication (often over large distances), building of trust, management of aims and power distribution (Huxham and Vangen, 2005; Gray 1989; Bryson, Crosby and Stone, 2015).

Stokols, Misra, Moser, Hall and Taylor (2008) report that a number of factors increase the effectiveness of a collaboration: Consensus in agreed ground rules, objectives, responsibilities, shared decision making, continuity of collaboration throughout the project, prior positive history between members, effective leadership, readiness and mindset of members, good communication infrastructure, good incentives and sustained long term support for the project (including funding) are factors affecting the outcomes of collaboration. Training (Hall, Feng, Moser, Stokols and Taylor (2008) and shared learning (Fink, 2007) also support effective collaboration. Collaboration has an increased likelihood of success if there are powerful sponsors, champions, facilitators and established networks (Bryson, Crosby and Stone,

2006; Crosby and Bryson, 2010; Bryson, Crosby and Stone, 2015). The shared objective needs to be developed collaboratively and should not be defined by a single person before the collaboration commences (Vnasuna, McCormick, Stefanco, Herter and McDonald, 2011).

Establishing the shared objective: Gray (1989) reports that it is important that the team as a whole, and all the members of the team, work towards an agreed objective. However, Vangen and Huxham (2011) propose that getting participants to agree on a minor objective at the commencement of the collaboration and work towards establishing the shared objective is effective. It may take time for members to be prepared to collaborate and commit to the shared objective (Huxham et al, 2005, Vangen and Huxham, 2013). A number of factors may influence the collaboration including building of relationships, building of trust, members getting to know each other particularly when they are from different perspectives/disciplines/cultures (Vangen et al, 2003a; Vangen et al, 2013). It may be necessary for members to understand issues from others' perspectives or frames of reference (Gray, 2004). Also the way different cultures think and behave may have an impact on the collaboration. In a cross-cultural context it is important that bridges be built between the cultures (Murphy and Arenas, 2010) so that members can work collaboratively.

The project team leaders have built relationships with some of the project partners over the last 20 years and have built on these relationships using the principals of collaboration particularly in sharing information and building trust between partners. It is suggested the success of this project is, in part, due to having a collaborative approach to the work.

Identified barriers identified through the survey tool.

There were a number of barriers to telehealth identified by survey respondents.

Barriers identified by clinicians included the lack of:

- Adequate technical resources (hardware and software tools).
- Easy to use equipment.
- Easy to use software.
- Adequate knowledge of telehealth systems.
- Time/human resources to set up telehealth sessions.
- Confidence.
- Adequate technical support.
- Inadequate internet.
- Medico-legal concerns.
- Financial patient-end support.
- Not adequately resourced through Medicare billing (lack of patient-end support.

Barriers for patients accessing telehealth included:

- Clinician did not do telehealth (33%)
- Inadequate internet (25%)
- Clinician prefers face to face consultations (17%).
- The service was not billable to Medicare (8%).
- Unsure how to use video conferencing tools (8%)

A number of survey respondents comments included:

"No Medicare rebate for some services."

"Had to have seen clinician first."

"Confusion regarding which phone number to ring."

"Lack of adequate internet and user's skills."

"Equipment and software needs to be easy to use from both the clinicians' and patients' perspectives."

Patient respondents indicated a range of concerns regarding telehealth:

"Doctors not taking it seriously as a way to offer healthcare to remote patients."

"The only concerns are that there might be something overlooked, that would be picked up during an in-person visit. This can be overcome with the right diagnostic tools, cameras and measurement devices working with the telehealth service."

"Misdiagnosis and that its not available."

"None whatsoever, the experts will say if they think you need to seek additional medical advice."

"Privacy"

"Clinicians doing phone consults when they should be using videoconferencing and possibly smart diagnostic tools."

Clearly, the lack of adequate technical and human resources and capability are barriers to the uptake of telehealth from both the clinical and patient perspective.

The need for Telehealth Education.

It is clear there is a need for better information and education about telehealth, how it can be used and accessed and its benefits to rural, regional and remote communities.

Some respondents' comments are listed below:

"Doctors need to understand the distances remote patients need to travel, and offer it as a service. Patients need to be informed they can ask for it, and it needs to be seen as a legitimate way of accessing healthcare, not a one off or a fake consult."

"There is definitely a need for better public education around the benefits of telehealth. We need to let people know that telehealth is more than a phone call, more than a text message, and can include real time, high quality, diagnosis by the doctor, if there is adequate support from the telehealth service. But the service itself must be supported by Government in the form of Medicare billing."

"Everything is about education, Covid has proved that if the population is informed then people will make better decisions. Telehealth, in association with existing medical services, can only be a good thing. I just hope it does not go the other extreme, like townies discovering "bush orders" (Click and Collect) and all of a sudden its hard to collect an order (ie demand exceeding supply)."

"Yes, need a multi-pronged approach for the public and clinicians. Our GP just does not want to do telehealth. Most providers I have dealt with either do not put patient data up to MHR or refuse to do so. This is a major problem for the expansion of telehealth."

Benefits and uptake of telehealth.

The benefits of telehealth have been demonstrated in the Laynhapuy Homelands (St Clair and Murtagh (2019) and are seen as a way to improve service delivery in remote Indigenous communities as well as reducing costs of health care. Uptake of telehealth in the NT has been limited, for a variety of reasons e.g. inadequate access to broadband internet. Through collaboration, the initial project at Laynhapuy (St Clair and Murtagh, 2018) demonstrated the value of uncontended and unlimited internet access in implementing telehealth.

Through this CRCNA Telehealth Project, telehealth via videoconferencing over Sky Muster Plus has become BAU for the Laynhapuy Homelands. LHS have received additional income through the telehealth Medicare items which is not tied to delivering specific programs, therefore, that income can be used for other purposes. LHS have used the additional Medicare income to provide a more holistic health care service by building laundry and bathing facilities for women and children. This facility also provides a safe yarning place for the women. Laynhapuy has developed a nuanced approach to maximising specialists' time by doing case conferencing (St Clair et al, in prep.).

Production of a Best Practice Model of ICT infrastructure standards and guidelines.

As a component of this research project, a Telehealth Videoconferencing System template was produced and promoted widely through various media including project partner websites, social media, conference presentations, project meetings, DH4B and B4BA forums. Emerge stocked the hardware components in their store in Katherine and VisionFlex deployed the camera and speaker as standard components of their equipment packages.

Technology has changed significantly over the last 15 years with a strong movement to cloud based networked systems. Many Aboriginal Community Controlled Health Services (ACCHS) in the Northern Territory and other remote locations in Australia have moved to cloud-based systems which have the advantage of centralising and standardising computer system administration, data backups and security. This allows remote access from multiple locations. It supports secure 'work from home' solutions. It also supports work from remote internet connected environments including satellite internet in the most remote parts of Australia. These systems allow a person's medical record to be accessed from multiple locations through teams of clinicians working in multiple organisations which facilitates comprehensive primary healthcare across vast regions of Australia.

The NBN Sky Muster Plus satellite internet service has become more effective, reliable and affordable (approximately $200 per month per site). NBN expanded the Sky Muster Plus service to provide reduced metered download (ie increased download amounts) with unlimited downloads between 12am and 4pm. Prior to this project, Laynhapuy were paying approximately $90,000 pa for mining grade satellite internet for three of their most remote communities (Gan Gan, Wandawuy and Yilpara). Through this project, Laynhapuy have 11 Sky Muster Plus services in their communities, have deployed a simple, robust network solution for those sites and use telehealth via videoconferencing as BAU at a cost of approximately $26,400 for all 11 sites per annum.

In contrast to this, Puntukurnu Aboriginal Medical Service (PAMS), on the advice of their ICT provider, deployed Business Grade Satellite Service to their four remote clinics. These clinics are well equipped and the higher-grade quality of satellite service should facilitate an increased ease of use, improved performance and use of videoconferencing for telehealth. However, the NBN Business Grade Satellite services deployed at these remote clinics did not perform to expectations with poor connectivity. Hence, PAMS staff do not maximise the use of telehealth via videoconferencing in their remote clinics. This has been referred to NBN and PAMS ICT provider to investigate.

A "Best Practice Model of ICT infrastructure" based on agreed standards and guidelines would be useful to provide guidance to clinics and their ICT providers. This would need to be supported with training and funding to implement. A suggested approach to reducing this barrier is outlined in the Strategic Recommendations (Chapter 1).

Modification of current funding models.

Medicare Benefits Schedule (MBS) changes came into effect on 1st July, 2022 with further changes already legislated but not implemented (someone just needs to press the "go button!"). The new Medicare items essentially are discriminatory against some cohorts of health care consumers and clinicians in the sense they are excluding these people from doing telehealth. Rural, regional, remote (RRR), digitally excluded health care consumers and those health care consumers who prefer to access services via phone will no longer be able to access many health services via telehealth. For some health care consumers, it reduces their choice of service - essentially forcing them to use videoconferencing against their will.

Dr Margaret Faux, CEO, Synapse Medical has completed her PhD on the MBS. She believes these changes have a negative impact on RRR Australians as well as other health care consumers. The majority of the telephone Medicare rebate-able services have been removed. A few remain, but are either for very short consultations, or are underfunded for longer consultations. There is only one GP telephone service remaining for people living in Modified Monash Model classifications 6-7 (remote and very remote locations), which must be 20 minutes or longer. This means a 6 minute phone consult for a script will not be Medicare billable.

Dr Margaret Faux is concerned these changes are not based on clear evidence:

"They say the changes are evidence based, but I have yet to see the evidence. Because from what I know, the evidence was that everybody wanted telephone services. That was the evidence and yet we seem to be doing the opposite of what the evidence says. And forcing consumers and doctors both to do the opposite of what they want."

Margaret Faux, 2022.

Changes to Medicare Telehealth Item numbers will exclude many RRR people.

Doctors will have to use videoconferencing instead of telephone for most consultations. Whilst that sounds straightforward and simple in theory, there are reasons which will make it unworkable:

1. Many RRR people (clinicians and health care consumers) have unreliable internet (St Clair and Murtagh, 2019). Our current CRCNA research project (Developing a simple, robust telehealth system for remote communities) has confirmed access to affordable, reliable and adequate internet for videoconferencing is still a major barrier to Telehealth in 2022. The legal specifications for the telehealth videoconferencing Medicare items ***require the clinician to maintain audio and visual connection with the health care consumer for the entire consult.*** This will mean, if the clinician or health care consumer drop out for even a few seconds, the doctor may be in breach of Medicare requirements and therefore be unable to claim that consultation on Medicare. This will increase out-of-pocket costs for health care consumers.

2. Some health care consumers do not want to use videoconferencing. Aboriginal people or people with mental health or other sensitive issues often do not feel comfortable with videoconferencing.

3. Many people are digitally excluded due to a lack of digital skills or access to the necessary digital tools (smart devices and internet). Many Aboriginal and elderly people fall into this category.

4. Many people are isolated, not necessarily by geography. They may have health or other logistical issues that render them isolated. These people may not have the ability or desire to do telehealth via videoconference.

Further to dot point 1: The legal requirements clearly state the clinician has to maintain continuous audio and visual contact throughout the consultation. It is likely the Professional Services Review (PSR) Agency (the Medicare watchdog) would check on connectivity outages if doing an audit.

Feedback from the Telehealth for the Bush (TH4B) Trial and findings from this CRCNA funded project "Development of a simple, robust telehealth system for remote communities" has clearly indicated health care providers had issues with connectivity when consulting health care consumers.

Another consequence of these changes is that specialists or GPs may opt not to bill to Medicare for consultations and charge the health care consumer for the full cost of the consultation. The Royal Australian College of General Practitioners is currently encouraging its members to increase their charges to health care consumers. This will mean the loss of valuable public health data as the Medicare rebates are not being claimed, therefore, resulting in a loss of a primary source of data. This may have a long-term negative affect on the health system. Some clinics have already stopped bulk billing health care consumers (see NT Newspaper Article: https://www.ntnews.com.au/news/northern-territory/top-end-medical-centre-to-no-longer-bulk-bill/news-story/a0e5329b1bc823627dfa42d09e442641). Many Darwin GP practices are now charging a gap fee of approximately $40 - $60. This will result in more health care consumers presenting to emergency departments.

The benefits of videoconferencing for telehealth over audio only.

Many clinicians (GPs in particular) were not offering health care consumers the option of telehealth consultation via videoconference and, in some cases, refused to provide a video consultation when asked to do so by the health care consumer (Digital Health for the Bush 2021 Forum). It is clear there are significant benefits doing a telehealth consultation via videoconference as it improves the two-way communication between the health care consumer and the clinician as well as providing the clinician with useful information. It allows the clinician to visually assess the health care consumer and do a number of diagnostic processes. It also improves health care consumer safety and protects the clinician by ensuring the health care consumer is correctly identified (sometimes an issue in Aboriginal communities).

It is believed the changes to the Telehealth Medicare items were intended to encourage clinicians to use videoconferencing rather than just audio. However, these changes effectively discriminate against RRR health care consumers and clinicians. Many RRR people rely on accessing a large proportion of their health services via telehealth, particularly in an emergency – it may be many hours travel to a major health centre. Ideally, videoconferencing should be one of the main tools a clinician has to meet the needs of their health care consumers, but these changes to Medicare effectively have reduced access to health services for the people most in need!

Discrimination against some cohorts of health care consumers and clinicians.

Many health care consumers and some clinicians in RRR areas may have inadequate internet to ensure fully continuous videoconferences. People living in the northern parts of Australia are frequently subject to severe storms and cyclones. These weather events render the satellite internet and many other telecommunications services inoperable until the storm passes (St Clair & Murtagh, 2020). With storm events, there are frequent incidences of damage to hardware which results in the telecommunications service being unusable until it is fixed (this may take many weeks or months to rectify and repair the service).

The changes to the Medicare Item numbers requiring continuity of video and audio streaming throughout the consultation discriminates against health care consumers and clinicians who do not have adequate internet (i.e. capacity and stability). There are also many health care consumers (eg Indigenous and elderly) who may not have the digital knowledge, smart phones or internet connectivity to use videoconferencing. There are times when health care consumers may prefer to have a phone call for accessing mental health or other culturally sensitive services and may feel more comfortable accessing services via audio or message chat service.

Minimising transmission of air-borne diseases.

With the increase in COVID-19 and the stress on the health system, increasing efficiency by using telehealth is essential. In a pandemic, clinicians and health care consumers can reduce the risk of being contaminated with the virus by doing telehealth (when appropriate) instead of in-person consultations. (Note this applies to other communicable diseases that present exposure risks during consultations for healthcare providers and consumers). The use of telehealth will reduce the number of health care consumers in waiting rooms and the risk of transmission from health care consumer to health care consumer, and clinic staff to/from health care consumers. Any reduction in transmission of airborne disease will assist health care systems to cope with health system crises.

Professional Services Review (PSR).

Clinicians must meet all the requirements of the Medicare item number before they can claim payment. The policing infrastructure of Medicare, the PSR, is so punitive and brutal clinicians are fearful of being subjected to PSR processes. (There is near 100% conviction rate.) Medicare is clawing back so much money via the PSR that doctors are very fearful of being reviewed by the PSR. Doctors can be required to pay back very large sums of money from previous years (Faux, 2021). If the doctors are not confident of meeting all the requirements of the Medicare item, they will stop providing those services as it represents too much risk to them. This may result in clinicians charging the health care consumer and not bulk billing items – increasing costs to health care consumers (many who cannot afford the additional costs and therefore may not access services they need).

Requirement for GPs to see the health care consumer in person prior to being able to claim Medicare Telehealth items.

Currently, the health care consumer needs to have seen the GP or another GP from the same practice within the previous 12 months before any GP from that practice can claim Medicare Telehealth Items. Under the new legislation, when implemented, ***health care consumers will have to see the same practitioner in person three times before they can access telehealth from that practitioner!*** Essentially limiting the health care consumer's ability to access services from another provider and locking them into only being able to access services from the one GP! We recommend this requirement be immediately lifted for RRR populations, many of whom have limited or no access to a GP. This rule, known as the '12 month rule' has been one of the greatest barriers for GPs to provide services for RRR people through telehealth. If a person cannot travel to access a GP, they are effectively excluded from accessing services through telehealth.

Voluntary Patient Registration.

The recently announced *Primary Health Care 10 Year Plan* includes 'voluntary patient registration' (VPR). The practical effect of VPR for RRR people is GPs will retain their constitutional right to charge whatever fees they choose, while consumers will lose their reciprocal right to choose their GPs if they want to access telehealth.

There is nothing voluntary about being forced into having a potentially expensive telehealth consultation with your 'usual GP' for a short consultation (e.g. for a repeat prescription). The health care consumer will not be permitted to call another clinic which may do bulk billing for such services). There is no control over the fees the GP can charge and the option to change to another provider is removed.

It is recognised GPs are underfunded for the services they provide and assistance for them to remain viable in the current system is required. However, increasing consumer out-of-pocket expenses is not a sustainable solution. Many health care consumers will attend the nearest public hospital emergency departments instead of using a GP service. This movement away from GPs will further exacerbate GPs' financial situation. Additionally, many hospitals are under great pressure due to the pandemic, so this situation would place further pressure on a system that is already struggling to cope with current workloads.

The introduction of VPR may result in increased medical expenses for health care consumers and is already legislated – someone just needs to push that 'Go Button!'

Videoconferencing can improve the telehealth experience from both the health care consumer and clinician perspective: It is important that clinicians and health care consumers maximise the effectiveness and efficiency of health services provided by telehealth. Clearly videoconferencing provides an improved quality of service due to improved communication between the clinician and the health care consumer. However, the implementation of the new Medicare Telehealth Items will result in:

- Reduced access to health services for RRR health care consumers, Aboriginal people, the elderly, isolated people, the digitally excluded and people living in areas subject to severe weather events.
- Increased transmission of COVID-19 and other transmittable diseases.
- Increase costs to health care consumers for services.
- Reduce health data collection for policy and decision makers.
- Further increase mental pressure and stress on clinicians.

Can Nurse Practitioners reduce the gap in services to RRR people?

Only 500,000 people live in Australia's most remote locations, but, they have disproportionate access to health services and consequently, poorer health outcomes (National Rural Health Alliance, 2016). There are often long waits to access services, and in many instances, people are unable to access the services they need in a timely manner. The research has demonstrated telehealth can be part of the solution to this long-term problem and supplement the services currently not available in RRR areas e.g. (St Clair & Murtagh, 2021).

Through the Telehealth for the Bush (TH4B) Trial, Project Partners, Simbani Research and Synapse Medical developed a pathway that connects doctors, specialists and nurse practitioners to health care consumers in the same way ride sharing companies connect drivers. Nurse Practitioners (NPs) are highly qualified Registered Nurses with extensive experience before doing a masters level degree. They are taught pathophysiology and how to diagnose. They also specialise in areas such as: Emergency, Aged Care, Medical, Surgical, Rural and Remote, Community, Drug and Alcohol, Women's Health, Mental Health, Paediatrics, Chronic and Complex Care, Private Practice - they are highly skilled professionals. NPs are educated and authorised to work independently, diagnosing, and treating health care consumers in collaboration with medical practitioners. NPs can provide in person (face-to-face) and telehealth consultations without a previous in person consultation through Medicare rebates, provide prescriptions and access to PBS medicines, order diagnostic tests and refer health care consumers to specialists. National standards ensure NPs provide high quality, consumer-centred health care working in similar roles as GPs.

However, NPs are not encouraged or supported to "close the divide between urban and RRR health service delivery". MBS funds are limited for NPs. GPs and Medical Colleges need to recognise the value of NPs. A GP can claim $39.75 for a 6 minute consultation (MBS Item 23). A NP will typically spend an hour with a new health care consumer. For a consultation with a GP of more than 40 minutes, the GP will receive $141.15, but a NP will only receive $52.70. Again, the MBS system needs extensive changes.

> *"We don't need to increase funding to Medicare, we just need to be more efficient and effective in the way we spend Medicare funds! The system is broken, but it can be fixed if a new, more innovative approach was taken."*
>
> *Dr Margaret Faux.*

It is recommended more nurses are encouraged to pursue this advance qualification. There are approximately 2500 registered nurse practitioners in Australia. According to the Commonwealth Department of Health (2021) there are over 73000 medical specialists and 31000 general practitioners in Australia. Nurse Practitioners have a scope of practice that allows them to undertake some tasks usually done by general practitioners. These include diagnosing patients, some prescribing, referrals to diagnostic service (e.g., xrays, pathology etc) and referrals to medical specialists. It is concerning that Medical colleges and the Australian Medical Association are reluctant to allow Nurse Practitioners to be fully utilised within the healthcare system. Nurse practitioners, pharmacists and GPs should be supported to work at higher levels of scope of practice, thereby "spreading the load' for primary health care. This is particularly important in regional and remote locations where there is a shortage of GPs. Supporting nurse practitioners and GPs to work at high levels of scope of practice, there will increase access to services for RRR.

Telehealth for the Bush Trial.

The Telehealth for the Bush Trial is a new and innovative model of health service delivery aimed at rural, regional and remote health consumers. The TH4B Trial (the technology combined with the NP pathway developed as a component of this CRCNA Telehealth project) evolved to provide access to a wide range of health services to forty-two health care consumers over two years. They have had appointments through the TH4B Trial and accessed telehealth-based healthcare which supplemented available services or provided services that were not available. Some of these health care consumers have had more than one subsequent appointment with a specialist, others have had pathology and diagnostic imaging services provided and two have required surgery. One health care consumer was linked into the public wait-list and had their surgery within a few weeks in the public health system. One patient who had attempted to access services through NDIS for a number of years was successfully connected to NDIS. For some, TH4B replaced services where there was no continuity of care or provided access to services that were unavailable to the health care consumer.

In response to feedback from project networks, a number of child-orientated specialists, including allied health professionals, were made available for the TH4B trial. In particular, participants in the case study research and the Digital Health for the Bush Forums have specifically identified long wait periods (in some cases years) to have children

assessed for developmental issues. This lack of access or delayed access can result in children not receiving treatment early and therefore reducing development potential (Digital Health for the Bush 2020, Digital Health for the Bush 2021). This is a serious issue repeatedly raised by the Isolated Children's and Parents' Association.

The MBS changes pose a serious threat to the continuation of the TH4B Trial with a number of specialists already withdrawing from the program including Oncologists and Psychiatrists.

Broadband for the Bush is seeking to have these MBS changes reversed at least for RRR health care consumers and clinicians. B4BA and network advocated for:

1. Regional and remote clinicians and health care consumers be immediately exempted by the requirement to have continuous video and audio contact throughout the consultation.

2. The Medicare changes be urgently reviewed by a panel that includes:
    - RRR health care consumers and clinicians (including Nurse Practitioners and Aboriginal Health Professionals).
    - Aboriginal people.
    - Aboriginal Medical Services.
    - Geographically isolated and other isolated people (and/or their representatives).
    - Aged people and their representative groups.
    - Digitally excluded people.
    - Technical experts such as Satellite technologists, e.g. NBN Co.
    - Dr Margaret Faux – Australia's expert on Medicare Billing.

3. A round table discussion with key stakeholders be held to investigate how MBS funds could be used more effectively and efficiently to increase access to a wider range of health services for all health care consumers including RRR people and investigate how NPs can ease the deficit of GP availability.

For information about total number of MBS consultations report in Quarter 1 2022 please see:https://coh.centre.uq.edu.au/telehealth-and-coronavirus-medicare-benefits-schedule-mbs-activity-australia

Issues with My Health Record (MHR)

There are a range of issues identified by consultations and case studies in relation to My Health Record:

- My Health Record is not fully supported by health practitioners.
- There are still concerns about security and privacy.
- Information is not comprehensive enough to be useable by the practitioners.
- The patients do not know how to ensure the outcome of their consult is recorded on their MHR record.
- Patient's do not understand or have adequate access to managing their own data on My Health Record.
- Patients are looking up their MHR and finding results they expected to be on file missing from the record.
- Currently allied health providers do not have access to the MHR from within their clinical records systems.
- Data does not get uploaded automatically to MHR.

Evolution of My Health Record.

The Health Connect program introduced by the federal government in the early 2000s allowed the Northern Territory to develop one of the first Australian and international shared health records.

Some of the barriers identified during this development seem similar to those now experienced by the My Health Record system. Key to making the NT system work well were two elements:

1. Unified authentication (ie user did not have to enter passwords and usernames multiple times).

2. Automatic sending of patient event summaries. The current MHR system requires doctors to confirm information and send the data manually to MHR.

Extensive feedback from consumers confirms event summaries are not being sent without a specific request from the patient. In some cases, clinicians and diagnostic services have refused to upload health data to MHR. The lack of easy access and consistent patient clinical histories devalues the MHR as a tool for other clinicians to use.

The NT Shared Health Record System (SHRS) used prior to the MHR was based on openEHR (open Electronic Health Record) which is an open standard specification for the modelling and storage of electronic health records (EHRs) and related healthcare information. It provides a standardised way of representing clinical and administrative data within electronic health systems, making it easier to share and exchange healthcare information across different systems and organisations. Ocean Informatics works on promoting and implementing the openEHR approach to electronic health records and health information management.

The company contributed to the design and development of openEHR's foundational concepts, including archetypes and templates. These concepts are crucial to the standardised representation of clinical data and the interoperability of health information systems. Archetypes define clinical concepts in a structured and standardised manner, while templates combine archetypes to create specific clinical documents or data structures.

Ocean Informatics created tools and software which assisted in the practical implementation of openEHR principles in the NT SHRS. One of the key events for the NT shared record was hospital-based doctors were encouraged to complete more timely discharge summaries and upload to the NT shared record system. This gave doctors a reason to check the shared record. Access to patient shared records increased dramatically from clinicians based in NT hospitals. The MHR system is currently not seeing this secondary clinical use.

Case Study.

Case Study summary of Dr John Kelly's interview with David Murtagh.

Dr Kelly works for the Laynhapuy Aboriginal Health Service in East Arnhem Land in the Northern Territory. He has used shared records systems since 2005 when the NT shared record system was implemented. This system served Aboriginal Community Controlled Health Services, NT Health Department primary health services based in remote centres throughout the whole of the NT and NT Hospitals. A major point of difference between the NT eHealth Record and MHR was the NT system automatically uploaded event summaries without intervention from doctors. In 2012 the then PCEHR (Personally Controlled Electronic Health Record) was launched and work was started to transition from the NT based shared record to the My Health Record (MHR). Program logic was developed to initially send records to both the NT and national systems for patients who were registered to both systems. This logic changed during the transition project to only send records to the MHR for patients who were registered to the MHR.

Initially if a patient was registered for both MHR and NT shared record clinical documents were sent to both systems. In early 2019 as a result of the MHR opt out strategy, 93% of all Territorials were registered to the MHR. A significant reduction in clinical documents automatically sent to the NT based shared record has been observed. Thus, reducing the amount of current patient information available in the NT Shared Record. The MHR system seems to have less available information even though there are now significantly more patients registered for the MHR.

One of the key features of the NT based shared records system was its ability to present a summary of patient information sourced from multiple clinical documents from multiple providers. For example, before the transition project, a patient (registered for the NT Shared record) who usually attended primary health clinic A and presented at Hospital B, then attended a funeral at another community and forgot or misplaced their current medications, could ask clinicians at the primary health clinic B to view their key health information and medications on the NT shared record in one quick search.

Dr Kelly is now experiencing significant delays using the MHR because:

1. There is not a summary of patients' information available in one location on the MHR.
2. Shared health summaries and event summaries are not being sent to the MHR by NT based clinicians.
3. Individual clinical documents have been difficult and time consuming to search through using the MHR.

Possible solutions, training and support could be made available and could include training on the new components of the MHR especially the new medicines view which for the first-time summarises information contained within multiple clinical documents.

Improving the My Health Record (MHR) system in Australia can have a substantial impact on healthcare, particularly in facilitating coordinated care, improving patient safety, and aiding in access to healthcare data and informatics. The following improvements are recommended:

1. Ensure that MHR is interoperable with other electronic health record (EHR) systems to facilitate smoother transition and sharing of data.
2. Include more types of data such as radiological images, laboritory reports and data from wearable health technology to provide a patient's health status.
3. Employ data validation techniques to ensure the information entered is accurate and up-to-date.
4. The user interface should be intuitive for both healthcare providers and patients.
5. Providing multilingual support to facilitate ease of use including Aboriginal languages.
6. Use MHR data to help healthcare providers create personalized health plans for patients.
7. MHR should integrate telehealth features that facilitate remote healthcare.
8. Offer patients educational resources based on their medical history and risk factors.
9. Ensure the system is robust enough to be accessed in remote areas, possibly through offline features or low-bandwidth functionality.

The MHR system should become a cornerstone in Australia's RRR healthcare infrastructure.

New models of healthcare provider staffing.

It is recommended to develop new models of healthcare provider staffing to allow workforce to co-locate between urban settings and RRR locations. When based in urban locations, healthcare providers could operate virtual-care clinics with a mix of RRR located non-clinical (e.g. Telehealth Technicians), support staff and RRR located clinically qualified staff. A trial Live in Live Out (LILO) workforce model of care to allow clinical staff to use virtual care strategies to maintain relationships with healthcare consumers at the same time as having access to urban amenities would be valuable.

It is suggested the following organisations could work collaboratively to progress this initiative: Simbani, NRHA, NACHO, other ACCHOs, PHNs who have RRR responsibilities, ADHA, ACNP, RACGP and ACRRM.

This initiative could decrease staff turnover in RRR locations and increase continuity of care for RRR healthcare consumers by making access to services more available, consistent and convenient.

Development of a research data repository.

It is recommended to develop a research data repository of all RRR medical financing information to support the development of new models of care (and associated funding) for regional and remote areas. This would establish a publicly available research and information hub to share key data on health expenditure in RRR Australia. It would allow for comparisons and improvement processes to evaluate and monitor healthcare expenditure in RRR areas.

It is suggested the following organisations could work collaboratively to progress this initiative: AIHW, PHNs who have RRR responsibilities, NRHA, CHF, ADHA, Health Departments.

This initiative could increase healthcare provider and consumer access to data which could lead to improved models of RRR healthcare and better access to health funding research data to inform policy. This initiative could also allow the RRR data dimension to be considered in healthcare advocacy, acknowledge and support the financial contributions RRR Australian businesses make to Australia's productivity and expand the use of diagnostic enabling tools for telehealth such as AI, smart diagnostic tools, and personal monitoring tools.

Expand the use of smart tools and Artificial Intelligence Tools.

Expand use of diagnostic enabling tools for telehealth such as AI, smart diagnostic tools and personal monitoring tools. There is currently little use of diagnostic tools during telehealth consultations. There should be a focus on improving and expanding the use of diagnostic tools that are able to capture measurement data and transfer it to the clinical record. Note the following suggested steps for improvements:

1. Identify diagnostic tools most needed in the specific remote area. For example, areas with higher rates of cardiac issues might benefit from remote ECG monitors.
2. Consult with healthcare providers, patients and administrative staff to understand which diagnostic tools would be most useful.
3. Start with pilot programs to test the utility and effectiveness of various diagnostic tools.
4. Healthcare staff should be well trained in using these diagnostic tools, interpreting the data they provide and integrating them into their existing workflow.
5. Choose diagnostic tools that are user-friendly, require minimal setup and are easy for patients to use on independently or with minimal support.
6. The diagnostic tools should be interoperable with existing EHR systems to facilitate the seamless transfer of data.
7. Implement features to validate the data being transferred to ensure its accuracy.
8. Ensure all data transfers meet healthcare compliance standards such as FHIR and HL7 and patient data is encrypted and secure.
9. Establish mechanisms for healthcare providers and patients to provide feedback on the diagnostic tools, with a view to ongoing improvement.
10. Use analytics to measure the impact of these tools on patient outcomes, healthcare delivery, and cost.
11. Explore options for funding the adoption of these tools through grants, public-private partnerships, or other healthcare incentives.
12. Choose tools that can be easily scaled to meet increasing demand.
13. Educate healthcare consumers on how to use these tools and why they are important for their healthcare, including empowering patients to manage their health issues better.
14. Customize diagnostic tools or their usage protocols based on local needs or cultural practices.

Overall conclusions.

Project sites.

Access to adequate internet is still a major barrier to telehealth for the many consumers including the four PAMS remote clinics as well as a number of remote Aboriginal communities and cattle stations (eg Case study data, DH4B Reports). The TVS deployed by PAMS is much more complex than the system recommended by this research project and feedback from staff indicate the TVSs are not used to their capacity. The technical issues have been identified by the researchers and referred to NBN Co and the ICT Service Provider. Inadequate workstation images are clearly an additional barrier to telehealth uptake.

Laynhapuy Homelands Health Service has embraced the use of telehealth via videoconferencing and have continued to improve the effectiveness of health service delivery including providing services via telehealth to a community member who did not reside in the homelands for over 12 months (St Clair et al, in prep). LHS have further deployed innovative approaches to increasing efficiencies and effectiveness of specialist consultations using telehealth (St Clair et al, in prep).

Expanding and improving the effectiveness of telehealth.

Many clinicians (particularly GPs) continue to do voice only telehealth consultations and do not take advantage of the benefits of videoconferencing. It is clear from the research, in many instances, videoconferencing provides a better telehealth experience from both the patient and clinical perspectives. An additional barrier to the use of videoconferencing and telehealth in general is the lack of funded support for the patient end.

Summary of barriers:

1. The lack of adequate, reliable and affordable internet connectivity is still a barrier to accessing health care services via telehealth.
2. Although the concept of “telehealth” has become more widely known, many people still do not understand how they can extend access to health services via telehealth.
3. Many GPs either do not offer telehealth, or only offer telehealth via audio (phone). Many clinicians do not maximise the use of videoconferencing or smart diagnostic tools to enhance their data collection of patient diagnostic parameters.
4. Primary health providers and diagnostic services do not always share diagnostic results or communicate well to maximise their effectiveness in treating health care consumers.
5. Referring specialists sometimes fail to provide discharge/consultation summaries to the health care consumer’s referring practitioner.
6. Some healthcare providers are refusing to upload consumer’s health data to My Health Record when the health care consumer requests this action.
7. Some healthcare providers are refusing to provide the patient with their health data when the patient requests those diagnostic results. (This poses the question: Who owns the data? Medicare. who paid for the diagnostic test? The provider who provided the test? The referring clinician? Or, should the patient own their own health data? Note the healthcare consumer pays the Medicare rebate as a contribution to the cost of the Medicare insurance scheme).
8. Many remote people are not getting the care they need in a timely manner and are often experiencing lengthy delays for diagnosis and treatment resulting in poorer health outcomes.
9. There is a lack of access to a range of services in regional and remote areas possibly due to a lack of healthcare providers.
10. The current funding models do not support the expansion of health services to RRR including via telehealth.
11. Multiple changes to Medicare rebates for telehealth have reduced access for remote healthcare consumers.
12. The lack of funded patient end support is a major barrier to uptake of telehealth in remote Aboriginal and GP clinics.
13. If specialists do not bulk bill a specialist appointment, the Aboriginal Medical Service (AMS) staff member (eg GP or NP) is not able to claim a MBS payment for that consultation. This is an issue raised by PAMS, LHS and AHCWA

The following are suggestions to increase access to health services via telehealth for regional and remote people.

Future Research.

As additional project outcome, Project Partners, Simbani Research and Synapse Medical have developed a pathway that connects doctors, specialists and nurse practitioners to patients in the same way ride sharing companies connect drivers – the Telehealth for the Bush (TH4B) Trial.

Synapse Medical’s mobile phone application is a medical billing system which facilitates clinicians’ billing Medicare and other medical insurance providers from their mobile devices and can also be used to connect health care providers and patients through telehealth appointments. Nurse Practitioners (NP) are highly qualified Registered Nurses. NPs are educated and authorised to work independently, diagnosing, and treating patients in collaboration with medical practitioners. NPs can provide in person and telehealth consultations, access Medicare rebates, provide prescriptions and access to PBS medicines, order diagnostic tests and refer patients to specialists. National standards ensure NPs provide high quality, patient-centred care working in similar roles as GPs.

The TH4B Trial (the technology combined with the NP pathway) evolved to provide access to a wide range of health services to forty-two patients.

Additional functionality has been added to the mobile phone app for this project. Referrals can be made at the press of a button. Administration is reduced, Medicare billing is correct and healthcare is provided using a fast, compliant framework through this project trial. Patient data (subject to patient’s approval) is uploaded to MHR thereby improving data integrity and continuity of care for patients.

Using the theory of collaboration (Grey, 1989; Huxham and Vangen, 2004), this new model of service delivery may address gaps in health care for rural, regional and remote people, including remote Aboriginal Communities and cattle stations.

Collaboration is a process in which stakeholders work together in consultation to attain an agreed goal or goals and work through different lenses (eg understandings, perceptions, interests and limitations) (Gray, 1989). Collaboration generates outputs that players are unable to generate individually (Bryson, Crosby and Stone, 2015). Collaborations including a variety of disciplines and backgrounds (eg government, Industry, research and not-for-profit players), is resource intensive, requires compromise, commitment, good communication (often over large distances), building of trust, management of aims and power distribution (Huxham and Vangen, 2005; Gray 1989; Bryson, Crosby and Stone, 2015). A collaborative approach to implementation of telehealth is the basis of methods used by the project team and generate the above outcomes.

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