Expansion of Telehealth in remote Northern Australia and the potential for international collaborations.

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Abstract.
The NT leads 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) and internet connected Electrocardiography (ECG). Benefits of telehealth have been demonstrated both internationally and through local assessments. Reduced costs associated with patient travel, minimized time spent away from community and providing improved patient satisfaction eg use of remote diagnostic systems for identification of cardiac issues can improve patient care and save lives. For example, the Chinese government is looking to telehealth as a solution to service delivery issues.

Uptake of telehealth in the NT has been limited, for a variety of reasons eg inadequate broadband access. Through collaboration between stakeholders, staged implementation has been developed in NA requiring engagement with hospitals and Aboriginal Community Controlled Health Organisations (ACCHOs). Additionally, initial discussions with colleagues from CDU working in remote China and Indonesia indicate there may be opportunities for collaborative work on extending telehealth services to remote areas in China and Indonesia.

NA Context: Currently DoH is working to expand the number of acute, allied health and specialist services that provide telehealth solutions to remote patients. NT ACCHOs are developing change management strategies for telehealth usage that recognize existing work practices. They are also expanding the use of video conferencing within their organisations to support management, training, internal and external clinical support. Multiple organisations who currently interact to provide remote communities with primary health services and individuals who require access to specialist and acute/emergency clinical interventions will also be included in the digital solutions expansion.

The program will assist remote ACCHOs to establish telehealth and aid them in evaluating the cost/benefits of reliable internet and telehealth services as well as expanding digital inclusion. It will also promote telehealth enabled health outcomes into the future and has a significant research component:

- Assess the costs and benefits of telehealth implementation including financial and non-financial.
- Identify barriers and enablers for implementing telehealth.

- Identify other potential and perceived outcomes and successes.
- Assess if additional roles (eg telehealth Coordinators) can be developed and sustainably funded through patient travel savings and additional Medicare income.
- Develop strategies to deal with technical issues such as delay in communications with satellite solutions.

This research will inform policy development to improve service delivery to remote communities and provide support to ACCHOs to expand telehealth and digital inclusion.

Introduction.
The use of telehealth has been fundamental to the delivery of health services in remote Australia for many years using technologies such as telegraph, radio, fixed line and satellite phones. The next generation of telehealth is using video conferencing and digital devices to provide more effective diagnostic processes. A significant effort is being made to work collaboratively to develop and share these approaches across the community controlled health sector.

The Northern Territory (NT) population is approximately 32% Indigenous, of which approximately 79% live in remote Indigenous communities (ABS, 2011) with over 100 remote clinics. For the purposes of this program, Indigenous refers to Aboriginal and Torres Strait Islander peoples.

Remote Indigenous communities (as defined by ABS (ABS, 2006)) in Australia tend to have inadequate Internet bandwidth to reliably use video conferencing services, access remote "dial a doctor" type video services or new innovative telehealth solutions. These communities often have limited access to teleconferencing and bandwidth (ACAAN, 2016; Park, 2016; Bandias and Vemuri, 2005; Bryant et al, 2015). There has been limited uptake of telehealth by community health clinics, the NT health system and by individuals in remote locations. According to the NT Government there are at least 30 communities in the NT with over 100 people and no internet available through ADSL and/or NextG mobile (NT Government, 2015).

The NT Department of Health (DoH) is currently focused on the introduction of more opportunities for telehealth consultations in their major hospitals as a result of the recent release of the Evaluation of the PATS-Telehealth Project paper (Department of Health, 2015) which identified $1.2 million savings over 1100 consults. The preferred model for specialist consulting is to establish regular clinics so booking staff from both primary health and hospital based services can plan groups of consultations for efficiency reasons. As new specialist clinics attempt to allocate these regular telehealth clinics, primary health services must meet the demand for the consultations.

Currently there are no health clinics connected to the internet by satellite using telehealth in the NT. The technology is available with current satellite services, has been found adequate,

but is very expensive (AMSANT eHealth Forum, 2015). **It expected the NBN satellites will provide adequate bandwidth if they perform as advertised**.

A number of sites have the satellite quality to be used for telehealth but not the bandwidth as it is currently being used to access datacenter base clinical information systems. To adequately serve both videoconferencing and datacenter traffic connection bandwidth will need to increase.   The costs and benefits of additional bandwidth need to be determined and the financial viability to implement telehealth demonstrated.

Significant funding has been made available to the government sector to implement telehealth, but there has been limited support for expansion of telehealth in the community controlled sector. This program has been established to expand telehealth in Northern Australia and will provide access to high quality Internet for a number of implementation sites, training and support to implement telehealth and assist in the costs and benefits (financial and non-financial) analysis for a number of community controlled health services.

Program evolution.
The program has evolved from a cross-sector collaboration (Bryson, Crosby and Stone, 2015) between a number of stakeholders:
- Aboriginal Medical Services Alliance NT (AMSANT).
- Broadband for the Bush Alliance Limited (B4BA).
- Telstra Health.
- Northern Institute (NI), Charles Darwin University (CDU).
- NT Department of Health (DoH)

In 2015, B4BA, AMSANT, Telstra Health, DoH, Centre for School Leadership (CDU) and the NI established a collaboration by providing support for a number of projects including the B4BA Forum, telehealth pilot projects in remote clinics and jointly hosted conferences. Telstra Health, through its Reconciliation Action Plan (RAP) has provided $1.5 million to expand telehealth in the NT. The program has received approximately $50,000 seed funding from CDU. The collaboration has further expanded to include eMerge IT Solutions and was recently successful in obtaining a grant of approximately $400,000 to implement telehealth in the Laynhapuy Homelands, East Arnhem.

Program activities to March, 2017.
The program has provided a number of communities with access to broadband through the Telstra RAP and has produced grant applications to provide satellite services to additional communities. Funding has been secured through the Regional Economic and Infrastructure Fund (NT Government) to deploy 3 high quality satellite services and implement telehealth for 3 communities in the remote Laynhapuy Homelands.

The program provides project support to communities to implement telehealth and is expanding by:

1. Building on existing relationships to develop stronger alliances with program partners (AMSANT, NI, B4BA, eMerge, ACCHO peak bodies, ACCHOs, Telstra, TelstraHealth, CSIRO) and community organisations and members.
2. Building and extending current networks and relationships to increase collaboration for future implementation and research opportunities.

A fundamental component of the underlying technology that supports telehealth is high bandwidth network connections. The connectivity for implementation sites will be provided for an agreed period to allow evaluation prior to the clinic incurring costs. Research will be undertaken to establish use case scenarios, understand and describe change management processes, develop cost-benefit analysis (financial and non-financial) and measure traffic quality. Communities will be able to demonstrate other uses for video conferencing in context such as correctional services, education, and training.

There is a paucity of quantitative and qualitative analysis of telecommunication use in the remote community controlled health sector in NA. This program will build on current knowledge by:
1. Using a combination of focus groups and semi-structured interviews to develop case studies and subsequent analysis.
2. Develop a model of innovative service delivery to increase expansion of telehealth and access to internet resources (including videoconferencing) for local health, education and other community based organisations.

Key activities for implementation sites will include:
1. Commissioning of high quality Internet connections for the site. Higher latency services such as satellite will need specific training to acclimatize to delays as a result of the longer time the signal takes to get to and from the satellite.
2. Commissioning high-end video conferencing interface solution that could be used to access other NT department video networks (eg Corrections, Children and Families and Education).
3. Identify potential users, use case scenarios and develop a site specific implementation strategy.
4. Clinical workflow development and mapping.
5. Establish Quality of Service managed network through the deployment of network routers with multiple Internet connection capability.
6. Measure and monitor Internet use through router report generation.
7. Establish evidence collection for case study/use case/benefits analysis.
8. A series of publications (such as plain language reports – verbal and written) including evaluation of impacts, case studies, clinical workflow development and refinement of the innovative model of service delivery.

Uses (current and potential) for telehealth and videoconferencing.
NT Department of Health current use of telehealth.

There are about 26 specialties that operate within NT with telehealth as a component of their model of care: Paediatrics, General Medical diseases, Endocrinology, Gastroenterology, Occupational Therapy, Renal, Burns, General Surgical, Pre-admissions, Gynaecology, Orthopaedics, Oncology, Psychiatric, Dermatology, Cardiology, Cardiac rehabilitation, Rheumatology, Thoracic medicine, Sleep disorders, Memory clinics, Hepatobiliary, Pain management, Spinal, Haematology, Addiction Medicine, (Michelle McGuirk, pers comm).

Potential use of telehealth in the community controlled primary health sector.
Through discussion with stakeholders, the following list describes possible uses for telehealth and videoconferencing for remote health centres.

1. Primary Health.
Increased access to GP services.
There is significant opportunity for face-to-face services to be augmented by additional telehealth consultations. These consultations are currently not being used to the best advantage, as there is limited opportunities for Medicare billing for GP consultations. **It is strongly recommended that the recent MBS review result in increased GP Medicare items for telehealth consultations.**

2. Acute Care.
Cardiology emergency management.
Cardiology wait-lists mean that patients could receive treatment earlier if video conferencing was used to compliment face-to-face diagnostic consultations. Local staff could receive instructions from the off-site cardiologist more effectively when performing check-ups and in emergency situations. A number of Internet connected ECG machines have been deployed across the NT as part of the NT Cardiac Network Project. This project is establishing a method to provide on-call cardiologists immediate secure access to ECG reports. The reports from these devices can be downloaded directly to a central cardiology system in Darwin and assessments done immediately by the cardiologist, thereby identifying patients who may require urgent medical attention and need to be evacuated immediately.

Emergency cameras
Emergency cameras have been deployed in 18 towns throughout the NT. These devices provide remote controlled access to cameras in emergency treatment rooms in larger communities. The system is being used successfully by on-call medical staff for more effective diagnostic evaluations when evacuations are considered.

Other Internet connected diagnostic equipment used for emergencies.
There are a number of Internet connected diagnostic tools including iStat blood analysis machines, simple blood pressure devices, blood sugar monitoring, weight scales, ultrasound, and various other tools to provide digital information to aid diagnostic processes.

3. Tertiary Services.
Outpatient appointments and patient travel.

Current practice (from remote sites) for outpatient attendance and specialist review involves sending the patient to large regional hospitals (eg Darwin, Katherine and Alice Springs) usually involving significant travel. Absences from family and community are significant and may impact considerably on the patient's decision to attend as well as having social implications.

These transfers are usually through the Patient Assisted Travel Scheme (PATS) and are primarily funded through the NT Government DoH. Outpatient visits to major centres often requires provision of accommodation that further adds to the costs of service delivery. Historically, there has been an uncontrolled increase in patient travel costs.

Using telehealth to reduce travel to appointments can significantly reduce the costs to the PATS. For example, a person with a hernia in a remote community may travel to:

- Their first consult in the community for the initial diagnosis.
- A local major centre for diagnostic tests.
- Receive the results.
- Specialist consult to arrange the surgery.
- Darwin for the operation.
- Receive their post-op assessment.

This represents several patient travel events costing thousands of dollars and days of inconvenience. At least three transfers from community with possible savings of over $5,000 and reduced time away from family could be achieved through telehealth consultations (David Murtagh, 2016).

Reduced patient travel associated with the increased use of telehealth may improve compliance in appointment attendance rates. High rates of failure to attend (ie Did Not Attend (DNA)) have been reported. Patients are disqualified from further travel, if they DNA often.

Cardiology recovery.
There are a number of tools available for patients to monitor and support recovery post operative procedures, however, these require access to stable and good quality Internet. These devices can be used by less experienced staff to provide ongoing monitoring and grow individual skills and confidence while providing a valuable chronic disease-monitoring program.

Wound management.
Wound management is difficult without visual assessment. By providing good quality and responsive video footage in real time, the remote clinician can more accurately direct the required treatment.

Palliative Care.

Hospitals have provided palliative patients with i-pads so they can maintain contact with family and friends on community (Simon Quilty, pers. comm.).

Outreach Services
Clinics receive visits from outreach specialists such as dieticians, exercise physiotherapists, podiatrists and occupational therapists. These consults are often very infrequent and inconsistent. Patient contact could be increased through telehealth sessions in between onsite visits enhancing the effectiveness of the outreach service.

Mental Health
Psychiatry, psychology and social work services could be more effectively delivered, with higher satisfaction via videoconferences rather than phone. There is anecdotal evidence that mental health onsite service delivery can improve outcomes for the patient and their family (WINSC, 2015).

Social and emotional well being.
A number of patients need to relocate to major centres due to medical requirements (eg the need for dialysis). These people essentially 'disappear' from their home community (Jeff Cook, pers. comm.). By providing regular video conferencing with family and friends isolation may be reduced.

A number of community members are located in detention facilities in major centres and have limited access to their community network. By providing videoconferencing, communication can be maintained more effectively with family and friends on community.

4. Support Services.
Staff connectivity.
Connecting on a frequent basis through videoconferencing to other remote workers, visiting outreach specialists, hospital clinicians and associated networks could foster relationship development and collaboration.

Education and Training.
Many higher education and training organisations provide access through Internet based technologies. For example, CDU has many external students but it is a requirement to access the Student Learning Management System, library resources, tutorials and seminars via Internet. However, many students in remote areas have limited access to Internet. Provision of good quality Internet could provide increased access to training and education services.

Access to Government Services.
Many government services (eg CentreLink) are managed through a web-based interface. In the past, CentreLink staff visiting remote communities were able to assist remote clients in accessing resources. However, many of these services have ceased remote community visits and therefore people in these areas are eligible to access Centrelink support but are unable to do so because they cannot register on-line.

Expected outcomes.

The expansion of telehealth through this program is anticipated to produce:

- Productivity gains.
- Increases in the number of telehealth consults.
- Health and social benefits.
- Decreases in patient travel costs.
- Decreases in Did Not Attend (DNA) rates.
- Development of training/engagement/change strategies to introduce video conferencing as standard practice in day-to-day business.
- Increased Medicare income for primary health clinics.
- Increase availability of Internet based clinical systems.
- Improve remotely based business efficiency through better recruitment.
- Increased availability of services provided through videoconferences.
- Improved specialist efficiency and patient waiting times.
- Better supported remote staff through increased personal interactions from service providers and management.
- Identification of barriers and enablers to implementing telehealth models of care in remote Australia.

Opportunities for international collaboration.

It is recognized that the health care system in China needs to better service rural and remote people and 80% of China's medical resources are based in cities with a lack of experienced medical practitioners in remote areas (Alharthi, 2012). In China, patients in remote areas travel to major cities to receive treatment and therefore add stress to those health services (Peters, 2015). This may not only be due to availability of services remote patients having very little trust in the smaller rural hospitals (Scott Shi, pers. comm.). Initial discussions have been held with other potential collaborators to share the results of this program's activities with Chinese and Indonesian health stakeholders.

Conclusion.

The benefits of telehealth have been demonstrated and are seen as a way to improve service as well as reducing costs of health care. Uptake of telehealth in the NT has been limited, for a variety of reasons eg inadequate access to broadband. Through collaboration, this program is developing staged implementation in over 18 health clinics throughout the NT and will provide quantitative and qualitative data on the costs and benefits (financial and non-financial) of implementing telehealth. It is anticipated that significant overall benefit will be demonstrated through implementing telehealth. The associated research will inform policy development to improve service delivery in remote areas.

Program partners are keen to establish an incentivised remuneration system to reduce the financial burden on remote primary health clinics. Increased telehealth consultations in primary health clinics transfer costs from acute and outpatient to primary health services.

This may gain overall health system efficiency but adversely affects primary health services. There have been a number of studies to indicate the cost and benefits of telehealth but the cost model does not take into account where the savings are made. Generally the savings exist in the patient travel budget controlled by the state and territory governments. Primary health services do not tend to benefit from these savings as they are funded through federal government funding and Medicare. Additionally, many remote clinics access GP services via telehealth (video conferencing where it is available) but these are currently not claimable under MBS. Savings from reduction in PATS and additional Medicare income could support the establishment of more "on community" jobs for local Indigenous people.

Recommendation: The MBS be expanded to include more item numbers for telehealth including telehealth services by GPs.

The Northern Territory has lead the way in eHealth with its adoption of shared medical record systems (Australian Government, 2015). Demonstration of innovative telehealth solutions could represent a national strategy to expand telehealth in remote areas. Innovative models of care developed in the NT may also be useful for countries such as China and Indonesia which are looking to telehealth to address remote service delivery issues

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