The ROAM Project Part 1: Exploring new frontiers in video conferencing to expand the delivery of remote O&M services in regional Western Australia

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Twenty-five trials were conducted over a three-month period to investigate the potential for delivering O&M services remotely via video conferencing. Participants varied in age, geographical location, level of functional vision, and O&M goals. The video conferencing connection was made using the Vidyo software platform. Eleven participants (located remotely) were required to wear a chest harness that had been adapted to connect with an iPhone 6+, and were accompanied by a support person. An office-based O&M specialist provided instruction, guidance, and training as required throughout the sessions. The trials appeared to demonstrate that a range of O&M services can be successfully delivered via video conferencing.

INTRODUCTION

Rehabilitation agencies across Australia face an ongoing challenge of meeting service delivery demands in an increasingly competitive market. Recent developments in the sector, including the introduction of the National Disability Insurance Scheme (NDIS), require an innovative service delivery model that is effective, sustainable, and cost-efficient. Within the profession of orientation and mobility (O&M), this challenge is
made especially unique because of the profession's specialised nature, average length of programs, availability of O&M specialists (including recruitment challenges), and the remote location of some clients. Geographically, the majority of Western Australia (WA) lacks the population critical mass to support widely dispersed O&M specialists.

In April 2015, VisAbility embarked on the Remote Orientation and Mobility (ROAM) project inspired by the VidKids™ pilot. The VidKids™ pilot was designed and conducted by members of the VidKids™ Alliance (First Voice national service network, Vision Australia, Deaf Children Australia, and VisAbility) and was funded by the Department of Social Services. The VidKids™ two-year pilot project (July 2013-June 2015) investigated the potential of video conferencing technologies in the provision of a range of diagnostic and therapy services (e.g., occupational therapy, physiotherapy, speech pathology, psychology, counselling), education support, and technology assistance to children with sensory impairment in regional and remote parts of Australia (Vision Australia, n.d.).

The purpose of the ROAM project was to investigate whether or not O&M services could be monitored and/or delivered remotely, similar to the VidKids™ project. The challenge was to take the existing static, indoor video conferencing format, and use it in a dynamic, outdoor environment. The intention of ROAM is not to replace face-to-face delivery of O&M services, but rather to complement traditional O&M services and expand the availability of these services to clients in regional areas.

The first ROAM pilot conducted by VidKids™ between August and September of 2014 explored both real-time and delayed monitoring using a range of smart devices with video conferencing capabilities. The second pilot conducted by VisAbility between April and July 2015 explored the viability of using the iPhone 6+ smartphone together with the Vidyo video conferencing software platform to deliver O&M services (Vidyo, 2016). This practice report will focus on the outcomes of the second ROAM project pilot.

**VIDEO CONFERENCE IN ALLIED HEALTH**

Video conferencing has been used as a tool in the delivery of multi-specialty health care services since the early 1990s (Harper, 2006). Since this time within the medical and health-related services terminology has evolved to include telepractice (Davis, Hopkins, & Abrahams, 2012), telehealth (Services for Australian Rural and Remote Allied Health, 2012), telemedicine (Harper, 2006), telerehabilitation (Schmeler, Schein, McCue, & Betz, 2008), teletherapy (Pramuka & Roosmalen, 2008), and tele-intervention (Blaiser, Behl, Callow-Heusser, & White, 2013).
There is a growing body of evidence about the efficacy of video conferencing within various allied health professions. Some of the reported advantages include:

- Increased family engagement during sessions (Behl & Kahn, 2015; Blaiser et al., 2013), less disruption to the family routine (Behl, Houston, Guthrie, & Guthrie, 2010), and increased confidence and empowerment for parents following the sessions (Davis, Hopkins, & Abrahams, 2012).

- Increased continuity of service provision, as well as increased flexibility regarding the timing, sequencing, and intensity of therapy (Australian Physiotherapy Association, n.d.).

- Reduction in the distances and frequency of travel for clients and specialist health services in rural and remote areas (Schmeler et al., 2008), including associated cost savings (Harper, 2006) and environmental benefits (Australian Physiotherapy Association, n.d.).

- Increased clinical support in rural areas, as well as indirect professional development benefits for remote clinicians participating in multi-disciplinary video conferencing sessions (Schmeler et al., 2008). For example, a physiotherapist supporting their client during remote occupational therapy will learn more about their clients’ occupational therapy goals and strategies by being present throughout the session.

- A means of compensating for the challenges in recruiting and retaining specialist rehabilitation professionals in regional areas (Australian Physiotherapy Association, n.d.).

- Increased affordability due to the advancement of mobile technologies and broadband internet access (Behl & Kahn, 2015). For example, video conferencing capabilities are already built within smartphones which are now standard issue for many employees of community-based health service agencies.

- Decreased rate of appointment cancellations because of inclement weather and ill health (Behl & Kahn, 2015), and reduced rates of absenteeism from work and school to attend specialist appointments (Kattlove & Shaw, 2008).

Some disadvantages of video conferencing include:

- Therapy sessions feeling less personal (Blaiser et al., 2013).

- Challenges in establishing trust and rapport (Pramuka & Roosmalen, 2008).

- Greater risk of breaches in client confidentiality and privacy because of an increasingly mobile allied health workforce. Therapists are recording data and sessions which might be vulnerable to accidental transmission and distribution (Boisvert, Hall, Andrianopoulos, & Chaclas, 2012).
The lack of standards and guidelines in the practice of video conferencing, and considerations for rehabilitation professional’s code of ethics (Schmeler et al., 2008).

Difficulties surrounding funding, rebates, and remuneration for remote allied health services (Services for Australian Rural and Remote Allied Health, 2012).

The recognition and acceptance of telehealth within Australia is reflected in the inclusion of specialist medical appointments via telehealth within the Australian Government Medicare Rebate schedule (Services for Australian Rural and Remote Allied Health, 2012).

The WA Country Health Service (WACHS) recognises that individuals living in regional and remote areas often carry a greater burden of disease and disability due to limited access to healthcare services, when compared to their metropolitan-based counterparts (WA Country Health Service, 2014). One of their primary strategies in combatting this issue is “the rapid expansion of telehealth into regional WA” to increase access to primary and allied health services (p. 30). Video conferencing is being incorporated into mainstream service delivery, and the goal is for telehealth services to become standard practice for regional healthcare provision in WA.

**VIDEO CONFERENCING AND O&M**

There is a growing body of literature about the use of video conferencing within the profession of O&M. Garaj, Jirawimut, Ptasinski, Cecelja, and Balachandran (2003) described trials in which a mobile GPS device was used to provide remote verbal assistance to a traveller with vision impairment. The system consisted of a digital video camera worn on the user’s chest, with a GPS receiver stored in a backpack. The O&M specialist was positioned at a ‘navigation centre’ with a personal computer that simultaneously displayed the user’s location on a digital map, as well as video footage of the traveller’s surroundings. The communication of instructions was conveyed by the specialist via a hands-free mobile phone. While the trial was limited, it did report some success in improving the orientation of the user within the trial area.

In Poland, similar trials were completed whereby the user wore a camera at chest height with a built-in GPS receiver, and a headset for communication with the ‘operator’ (Baranski, Polanczyk, & Strumillo, 2010). As with the previous trial, the operator received simultaneous video footage and GPS location information. The authors acknowledged that poor connection and video quality meant that the system did not present a safe or viable solution. However, another trial conducted with sighted volunteers used a similar system with more successful results (Baranski & Strumillo, 2015). Sighted volunteers were used to
provide feedback on the quality of the remote guidance being provided, i.e., recording the number of possible collisions and potential disorientation or wrong turns.

In Italy, trials involved the provision of remote guidance via haptic feedback to users who were blind in unfamiliar indoor settings (Scheggi, Talarico, & Prattichizzo, 2014). Users wore camera glasses (conveying video footage to the remote operator via Skype) and a haptic bracelet on each wrist. The operator viewed the footage and provided feedback to guide the user by activating one of the bracelets. The system appeared effective in providing remote guidance to the user who is blind.

In 2015, Hans Jørgen Wiberg developed the “Be My Eyes” smartphone application (Holton, 2015). This innovative application connects users who are blind via the smartphone with remote sighted volunteers for instances where the user needs to ‘borrow’ a pair of eyes for a specific task, for example, assistance with reading printed text, or assistance locating a particular landmark. The system connects registered users and volunteers via a one-way video and two-way audio connection. To date there are over 25,000 registered users who are blind and over 335,000 registered volunteers with sight (Be My Eyes, n.d.).

Dewald and Smyth (2013-2014) conducted a needs assessment survey to ascertain the feasibility of providing early intervention O&M services via teleintervention. Participants came from Canada, the United States, and Australia, and included O&M specialists, teachers of students with vision impairment, dual-qualified teacher/O&M, related professionals, administrators, professors, and others. Their results revealed that most respondents were unfamiliar with the use of video conferencing technologies as a means of service provision. However, 68% indicated that they would be interested in using this method if it was available in their geographical area, and if adequate training was provided.

Holmes and Prentice (2015) presented a case study describing their experiences using the FaceTime application as a tool for orientation. The traveller who is blind connected with a remote O&M specialist using FaceTime on the iPhone to receive information and guidance when travelling in environments that had been identified as frustrating, for example, locating the entrance to a specific shop. The authors concluded that FaceTime can be a useful tool in orientation and can increase independence.

No studies seem to have investigated the use of video conferencing specifically for O&M assessment, equipment prescription, or delivery of O&M training programs. However, Brennan et al. (2010) noted that video conferencing can be successfully incorporated into a wide range of rehabilitation services, including assessment, education, intervention, monitoring, prevention, supervision, consultation, and counselling. Their document provided practice guidelines for telerehabilitation practitioners, and was compiled via
collaboration with members of the American Telemedicine Association. To date, ROAM has delivered the following O&M services:

- Assessment: interview, and functional indoor and outdoor mobility assessments (for adults and school-aged children).
- Prescription of mobility aids: identification cane, long cane, and support cane.
- O&M intervention/training: orientation, route travel, indoor orientation, mobility aid techniques, road crossings, advocacy for footpath modifications, acquired brain injury (ABI) scanning, and wheelchair mobility.

**THE ROAM METHOD**

The ROAM method in this pilot program was incorporated into existing VisAbility client O&M programs. There was no focus on which type of O&M program might be best suited to ROAM.

Schmeler et al. (2008, p. 13) noted that the “appropriate selection of telerehabilitation technology may be conceptualised as a clinical reasoning task, since appropriate use of telerehabilitation requires assessment of individual needs and environmental factors; consideration of diagnostic issues; implementation of an intervention; and follow-up to determine efficacy.” This implies that the process of trialling, selecting, and using telerehabilitation equipment and practices employs the same clinical reasoning skills used by allied health professionals in their assessment of clients and subsequent delivery of interventions. The selection of technology, equipment, and processes within the ROAM project has involved a combination of clinical reasoning and trial and error, and is constantly evolving.

The ROAM method involves three participants: the O&M specialist, who is usually located at their workplace seated in a place that ensures the client’s privacy and confidentiality (although the O&M specialist could be located anywhere as long as there was cellular coverage and privacy) (Figure 1); the client with vision impairment who is located remotely; and the support person (e.g., a family member, friend, allied health professional) who is located with the client (Figure 2). The client is set up with video conferencing equipment (on loan), which enables the O&M specialist to view video footage of their environment. The equipment includes a smartphone clipped onto a chest harness, and a communication device with speaker and microphone capabilities (for example, headphones with a built-in microphone). The O&M specialist establishes the video connection, and the support person assists with the set-up of equipment for the client. The O&M session then proceeds
according to the needs and goals of the client, for example, learning to use the long cane; learning the route to access a shopping centre in a new suburb; and so on.

The configuration of the ROAM set-up is quite flexible and can be adapted to suit a variety of O&M assessment and training purposes. For example, if the session is focussing on route travel, then the angle of the smartphone is adjusted upwards and a fish-eye lens is added to provide the O&M specialist with a maximised view of the surrounding environment. If the session is focussing on long cane techniques, then the angle of the smartphone is adjusted downwards with no lens added to allow the specialist to view the client’s cane in relation to their feet. Alternatively, the chest harness and smartphone can be worn on the front or back of the support person, who would then walk behind or in front of the client, respectively. This allows the specialist to view the entire body of the client in relation to their mobility aid as well as their surrounding environment. If the client has adequate residual vision, then a tablet or laptop might be preferred over the iPhone for the interview phase of the O&M assessment.

ROAM sessions are performed in real-time. However, it is also possible to ‘store-and-forward’ video footage for review at a later date (Kattlove & Shaw, 2008). This application is also useful for encouraging practice and reinforcement of techniques between O&M
supervised sessions. For example, the O&M specialist can provide video footage of a particular route to a parent, who is then able to reinforce the child’s use of specific techniques and strategies relevant to that route.

**ROAM EQUIPMENT: TECHNOLOGY**

The ROAM project uses the video conferencing software program ‘Vidyo’ which has good quality picture and sound, and a user-friendly interface. Vidyo allows document sharing (e.g., program plans, resources, videos of previous training sessions) and conference recording. The software can be accessed on a desktop computer, laptop, tablet, and smartphone.

Following the results of the initial VidKids™ ROAM pilot in 2014, the iPhone 6+ was selected as the more suitable and accessible client option as it has superior video processing capabilities, as well as an extended battery life. Most audio-visual methods of
communication via mobile use the camera on the front of the phone in order to capture the user’s face. However, during ROAM sessions the camera located on the back of the iPhone was preferred as it offered picture clarity and video quality superior to the front camera (the phone is positioned with its screen facing the client’s chest).

The support person also required a separate mobile phone in order to communicate with the O&M specialist. The specialist dialled the support person’s mobile and merged this call with the video conference, thus avoiding call charges being attributed to the support person’s mobile usage.

ROAM sessions use the best available Telstra network 4G coverage (Australia’s largest telecommunications provider) to establish and maintain the video conferencing connection. To date, 39 ROAM sessions have been completed throughout WA, and on only two occasions did the quality of coverage adversely impact the session outcome. ROAM does not require GPS coverage, and is suitable for both indoor and outdoor O&M activities and services. ROAM sessions are, therefore, immune to the adverse effects of poor GPS coverage and the urban canyon effect in city environments. The availability of Google Maps in ‘street view’ allows the O&M specialist to monitor and track the position and progress of the client without needing their GPS location. It also allows the specialist to adequately plan and prepare for ROAM sessions involving route travel. The support person can provide additional information about the environment if required or assist the client use the technology if needed (Pramuka & Roosmalen, 2008).

**ROAM EQUIPMENT: ACCESSORIES**

ROAM accessories include:

- Adjustable GoPro chest mount harness worn by clients (13-60 years of age).
- Velocity clip: this adapts the GoPro harness to connect with the iPhone 6+ and allows the angle of the iPhone 6+ to be adjusted as needed.
- Variety of screw-on iPhone camera lenses used to adjust the specialist’s field of view.
- iPhone headphones with built-in microphone (for the client/support person) allows three-way communication between the client, the O&M specialist, and the support person. For safety reasons, only one ear bud is used (allowing the client/support person to continue attending to environmental sound). A Bluetooth headset can also be used as a wireless option.
Phoenix ‘Duet’ PCS dual speaker microphone: this is connected to the specialist’s device (usually a laptop) to ensure premium sound clarity and quality.

ROLE OF THE SUPPORT PERSON

The presence of a support person appears essential for successful ROAM sessions (Figure 3). Boisvert et al. (2012, p. 13) noted the importance of “on-site personnel” with clearly defined roles to ensure successful telepractice outcomes. In addition, Baranski, Polanczyk, and Strumillo's (2010, p. 388) trials included a human guide as a ‘back-up’ for the participant who is blind. They noted that the presence of the guide “promoted a feeling of safety” and ensured that the “whole travel experience was less stressful.” The presence of the support person during a ROAM session allows the client to focus on the task at hand and maximises their absorption and retention of new information and skills. While a competent and experienced traveller might not believe the presence of a support person is necessary, it is strongly recommended within a ROAM session as a means of maximising safety and learning. For example, in the event that a client does not correctly anticipate an oncoming vehicle when road crossing.

The role of the support person during a ROAM session is to:

(a) set up the client’s equipment and provide technology support as needed

Figure 3. Support person monitoring the client from a distance.
(b) provide additional environmental information to the O&M specialist as required (beyond what is available via the video footage), and
(c) ensure the safety of the client at all times.

Throughout the ROAM project, the role of the support person was filled by other VisAbility allied health professionals, for example, occupational therapists (OTs) located in a regional office. This resulted in unanticipated benefits whereby the OTs developed a greater understanding of and appreciation for O&M and were able to screen other clients on their caseload for O&M services. In one ROAM session, a parent was the support person to her teenage daughter. The mother’s engagement resulted in her increased understanding of O&M terminology and techniques that she was able to reinforce on the route in between O&M training sessions.

The ROAM project aims to include non-VisAbility health professionals filling the role of support person, such as carers, external OTs, allied health assistants, and community health workers. It is envisaged that a ‘ROAM kit’ could be loaned to a remote health service. The service could retain the kit for the duration of the client’s O&M program and also supply a suitable support person to facilitate the sessions. Once the client’s O&M goals have been achieved, the kit would be returned to VisAbility, ready to be redeployed to another location. This will further expand the reach of O&M services beyond the current scope of VisAbility’s regional offices.

THE SECOND ROAM PILOT (APRIL-JUNE 2015)

At the conclusion of the VisAbility ROAM pilot project in June 2015, a total of 25 ROAM trials had been completed over three months, resulting in over 38 hours of ROAM. The combined results of the trials follow.

Demographics

Eleven participants agreed to be involved in the trials. Five were female staff members, three were female clients, and three were male clients. The clients’ age range was 13 to 60 years. The clients’ vision impairment ranged from legally blind to no light perception. One client’s vision impairment was congenital, while the remaining clients acquired their vision impairment adventitiously.

Staff location

Staff members involved in the study, based at the head office in Victoria Park, WA, focussed on establishing basic procedures and protocols for use of the ROAM equipment.
Trials involving staff were conducted in regional areas (Fitzroy Crossing, Broome, Kununurra, and Bunbury) and focussed on testing the quality of the audio and video connections.

**Clients**

Client 1: long cane user, received cane refresher training via ROAM.

Client 2: long cane user, required a new O&M assessment because of moving to a new residential location. The client was assessed and received orientation training via ROAM.

Client 3: recent long cane user, received cane refresher training via ROAM.

Client 4: long cane user, recently moved to Western Australia and received orientation training via ROAM.

Client 5: long cane user, had commenced face-to-face orientation training prior to the ROAM trial. The program was completed within the ROAM trial. The client also received cane refresher training during the ROAM sessions.

Client 6: new client, the O&M assessment was completed via ROAM. However, the O&M program did not commence within the trial period because of health issues.

**Client location**

Client trials were conducted in their homes and local neighbourhoods (with the O&M specialist located in Perth at the VisAbility office). Five clients lived in various suburbs within the Perth metropolitan area, and the sixth client lived in a regional town (Broome). The greatest trial distance was 2,225 kilometres (1,382 miles) from Victoria Park, Perth to Broome.

**Trial duration**

Trials ranged between one to two hours, according to the specific goal of the ROAM session. For example, a long cane training session was conducted in one hour, whereas orientation to a new travel route was conducted in two.

**Specific findings**

The findings of the trials suggest that it was possible to provide effective O&M assessment and intervention remotely via video conferencing. Clients were able to use long cane skills satisfactorily, and travel to their chosen routes independently. Remote support
and guidance from the O&M specialist to the support person was necessary to reduce instances of intervention when it was not required. For example, several support people felt the need to warn clients when their cane was about to locate a kerb or obstacle. The O&M specialist advised the support person that this was detrimental to session outcomes, and encouraged them to refrain from intervening in circumstances where the clients’ safety was not at risk.

FEEDBACK

Anecdotal feedback was collected from both the client and the support person to document individual ROAM experiences. Comments from support persons included:

- “It was a very rewarding experience. I felt confident whilst with the client, knowing I could talk to the O&M specialist at any time.”
- “The set-up and use of the equipment provided was very simple.”
- “It gave me an understanding of mobility for people who are vision impaired … I gained a real appreciation of the role of an O&M specialist.”
- “I had never viewed an O&M session before, so [it] was great to see how O&M specialists work … I can definitely take away some of those ideas for when I am working with clients.”

Comments from clients included:

- “I felt confident because you [the O&M specialist] were talking right there in my ear and [the support person] was behind me just to watch over me for any danger.”
- “… [the chest harness] was no problem at all. It was light and unobtrusive.”
- “I’d feel confident continuing the lessons via video linkup.”
- “I felt very confident to walk the route myself [after one ROAM session] because the crossing points that you told me were very clear and easy to remember.”
- “I can’t believe how smoothly it went.”
- “… it didn’t feel that much different than a regular session.”

DISCUSSION

Schmeler et al. (2008) noted a distinct lack of standards and guidelines to assist allied health professionals conduct video conferencing. However, the Australian Physiotherapy Association recognises that telerehabilitation is simply an alternative method of service
delivery, and as such “does not remove or alter any existing responsibilities for the provider of the rehabilitation service and providers must adhere to existing ethical codes of conduct, scope of practice, state and federal laws and individual discipline policies guiding practice” (n.d., p. 1). The same might be said of ROAM in relation to O&M practice. Nevertheless, one of the primary goals of the ROAM project is to develop a set of guidelines and best practice standards around the use of video conferencing within O&M service delivery. These are currently being drafted.

The development of easy-to-follow equipment manuals and instructional videos are also essential to assist the support person to deal with technical issues (these are being written). Support persons need adequate training in the use of the equipment and video conferencing processes. Technological competence is essential for a successful video conferencing session, and “established standardised protocol maximises the reliability and effectiveness of remote service delivery” (Boisvert et al., 2012, p. 13). Training also needs to ensure that the support person feels confident knowing when to intervene during client training.

ROAM is not designed to replace face-to-face delivery of O&M services. Rather, it is a complementary tool to reach more clients in regional areas. Clients have the choice to participate or not in video conferencing. Of the six clients invited to participate in the ROAM trials, all were willing to try this new method of O&M service delivery. Wherever possible, ROAM programs are supplemented with a face-to-face visit when an O&M specialist is available to travel to the regional area. This might be the first session with the client to conduct the O&M assessment and develop the subsequent ROAM program, or it might be a follow-up session to conclude a ROAM program that has already been completed remotely. Through their experience using video conferencing with children with hearing loss, Davis, Hopkins, and Abrahams (2012) found that supplementary face-to-face contact notably maximises the outcomes of telepractice programs.

**Limitations of ROAM**

As with any innovative method of service delivery ROAM has its limitations. A major limitation is that ROAM is dependent on multiple pieces of technology. Specifically,

- It is possible to experience technological malfunctions with the iPhone, headphones, laptop, Vidyo software, and network coverage.
- It is possible to experience issues with the GoPro chest harness, Velocity clip, and additional camera lenses.
- The iPhone is not waterproof and ROAM sessions cannot be conducted in wet weather.
• Outdoor ROAM sessions are difficult to conduct at night because of low lighting that reduces the field of view and detail available to the O&M specialist.
• Remote rapport building is challenging with some new clients.

FUTURE DIRECTIONS

Following the encouraging outcomes of the initial ROAM pilot project, VisAbility was successful in securing additional funding to extend the trial period until August 2017. This funding was made available through the Disability Services Commission of WA’s Targeted Disability Professional Services Project. The goal of this third ROAM pilot is to persevere with trialling ROAM equipment and methods, to continue developing best practice guidelines, and protocols that will enable ROAM to become ‘business as usual’ going forward.

The ROAM project will continue to remain flexible, dynamic, and integrate necessary change such as technology updates. ROAM seems a viable development to meet the future demand for O&M services by rural and remote Australians under a National Disability Insurance Scheme.

While the second pilot was able to encompass a relatively limited range of O&M service types, the third pilot will aim to test the efficacy of ROAM in an expanded range of areas, including:
• early intervention (assessment, intervention, parental education)
• public transport training
• assessment, prescription, and training in electronic travel aids (including smartphone applications)
• multi-disability O&M assessment and intervention
• re-orientation support (similar to the on-demand orientation support available through the Be My Eyes smartphone application).

CONCLUSION

The ROAM project appears successful in delivering a wide range of O&M services to clients living in regional and remote WA. The outcomes of trials have formed the foundation for drafting best practice guidelines. It has been identified that clearly defined roles and responsibilities within a ROAM session are critical to the success of that session, particularly when using non-specialist O&M support persons in the delivery of O&M services. To date, feedback from ROAM participants has been positive.
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