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VDOTS—a unique treatment pathway for protracted tuberculosis regimens

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Abstract

This project engaged 'at risk' client groups taking a 6-month course of tuberculosis (TB) treatment via directly observed treatment supervision (DOTS). Triggers included psycho-social impacts of treatment on individuals and their families. Overcoming treatment non-compliance and medication side effects underpins improved health outcomes. We proposed to achieve this by building trust, facilitating access, and creating innovative service delivery options to better connect with indigenous, refugee and migrant communities, a cohort witnessed to be familiar and competent at using internet-based video call services due to rurality and isolation.

The project team investigated accessible, low cost, and user-friendly video call facilities, selecting a secure web-based real-time video conferencing solution. Staff were trained to use the technology and manage equipment set-up, Google Chrome™ installation and video call activation. Staff were provided with access to the secure Telehealth platform. DOTS clients across Southern NSW and Murrumbidgee local health districts (LHD) were offered the video conferencing solution.

TB treatment supervision, DOTS, is costly for clients and providers. Clinicians conducting DOTS don't always appreciate the impact of non-compliance and treatment side effects nor the cost implications of these poor clinical outcomes. DOTS clients fear adverse consequences if absent from work or domestic responsibilities. Video DOTS (VDOTS) reduces anxiety and frees up time for clients. Service providers are no longer required to make home visits for clients that are unable to travel to access services.

Over a period of 12 months, 9 of 13 clients participated in the VDOTS trial. Four of 13 self-excluded citing inadequate equipment, poor technical literacy or personal preference.

Surveys indicated high levels of satisfaction with this patient-centred care model. All clients either 'agreed' or 'strongly agreed' that VDOTS was convenient, reduced travel costs, and support was available. Clients reported significant saving of personal time (mean 73 min x 182 days; range 30–210 min/day) and costs for fuel or public transport.

Savings to providers are demonstrated in reduced length of service encounter; the mean duration of calls was 6 min 49 sec (range 28 sec-31min; 23 sec call duration).

All (n=9) VDOTS clients 'strongly agreed' or 'agreed' they'd use this modality again. This model of care is potentially available to clients anywhere in the world with internet access. Use of this technology benefits clients choosing when and where treatment occurs whilst maintaining their privacy and work-life balance. Service providers benefit from reduced service costs, increased productivity, reduced travel-associated risk, and increased staff satisfaction. This modality works anywhere, most of the time, and is transferable across health services.

Background

Mandatory daily supervised treatment combined with the perceived stigma of TB disease, is frequently a 'step too far' for those diagnosed. Effects of stigmatisation include diminished social status, cultural or other forms of discrimination, and short to long-term social exclusion. Current models of care reduce neither the length of the treatment regimen nor the stigma. However, health practitioners can be innovative in meeting client needs by disrupting past service delivery models (i.e. DOTS) in order to reduce psycho-social and economic impacts of disease.¹

TB prevention, control and treatment compliance remains a significant health burden across the world.^{2,3} Australia is a low TB incidence country but we must continue working towards achieving Sustainable Development Goal (SDG) targets to end the TB epidemic by 2030.⁴ DOTS is recommended by the World Health Organization (WHO) End TB Strategy, and this approach is considered best practice across Australia to achieve: cure of the client; reduce spread of infection; avoid future disease reactivation; and prevent development of drug resistance.^{5,6} TB is curable when clients receive appropriate, uninterrupted treatment regimens.⁵

The NSW TB Program reports TB notification rates between 2011 and 2016 included 86% overseas-born, with 93% of this cohort being from high TB incidence countries.⁴ After at-home or in-hospitalised isolation, clients are often upset to learn that ongoing treatment will be supervised, including daily visits for a minimum of six months. This is often perceived as distrust by clients and can create resentment if not addressed appropriately by clinicians. Clients may experience shame due to cultural beliefs, threats to work and home life, and language barriers combined with fear and guilt about the potential of causing harm to others. Many also silently suffer from past trauma and torture. TB clients born in Australia may recall growing up in households where earlier generations have died from tuberculosis as drugs used for TB were not considered effective until the early 1970s when Rifampicin was introduced to TB drug regimens.

Clients in the study LHD were observed utilising technology to remain in contact with family and friends, interstate and overseas. They were also noted to be conducting business or study using video call platforms. Clients started suggesting video calls for treatment supervision. Telehealth in the clinical setting has been available for many years but mostly utilised in acute settings. Until recently, use of telehealth in the community setting wasn't routine practice but now could be explored.

A readiness amongst clinicians for technological disruption was also emerging. Research emphasised the need for clinician 'buy in' to ensure successful implementation of telehealth programs.⁷

Methods

The Murrumbidgee & Southern NSW LHD Director, Public Health and TB Clinical Nurse Consultation (CNC), Telehealth Manager and TB Care Coordinators (TBCC) met regularly to examine and trial accessible, low, cost, and user-friendly video call options. The final product needed to meet all NSW Health security parameters. The group concluded that self-recording episodes of care didn't meet the standard required for directly observed supervision. It was agreed that self or pre-recorded episodes of care created risk including delays to timely responses for treatment side effects and reduced the benefit of client and clinician relationships.

A collaborative approach was implemented, together with investigation to identify a user friendly, fit for purpose, secure telehealth platform that was economical. Mobile device platforms for the notification of side effects, ambient biosensors on medication containers to electronically record access to container, utilisation of personal health records information systems, and mobile device enabled video consultation were reviewed. A mobile device enabled video consultation platform was chosen. VDOTS became our vehicle to create technological disruption to local TB Services.

We hoped that VDOTS would be valuable for TB clients, embraced by clinicians, and transferable across the wider TB Program. Our VDOTS Trial started on April 1, 2017 in two rural and remote LHDs in response to the client demographic being mostly overseas or Australian born, but living in rural or remote locations.

A suitable platform was identified, and permission granted by Murrumbidgee and Southern NSW LHD Executives to commence the VDOTS Trial. Six TB Service clinics were selected to host a virtual clinic. The TB CNC maintained the role of platform administrator and delivered site-based education for each of the six TBCC. Forty-seven clinicians were issued email invitations to sign up to local virtual clinic as VDOTS was functional and ready to access.

TB notifications are received by Public Health Officers who refer results on to local TB Service Clinics for investigation and case management.⁶ TBCC initially interview clients and whilst discussing aspects of care also explain treatment pathways. This includes NSW TB Programs' treatment supervision requirements. DOTS and VDOTS are offered as alternate treatment models of care and TB clients elect their own pathway.

The NSW Health Agency for Clinical Innovation (ACI) provide a toolkit of telehealth guidelines for use by health professionals.⁸ This toolkit includes consent forms, assessment tools and satisfaction surveys. These documents were accessed and modified for local use in this trial.

Clients are assessed for capacity to participate in the VDOTS Program. Requirements include; ongoing daily access to devices, Wi Fi and data access and reasonable internet literacy for use and problem solving. Prior to commencing VDOTS each client completes paper-based IT literacy assessments. Need for others, such as an interpreter, to participate in consultations doesn't restrict access to VDOTS.

Clients must consent to participate in VDOTS program and training is provided to clients. Because TB notifications are sporadic and client locations vary, ongoing access to training is flexible and paperwork updates and virtual clinic locations able to be amended to reflect program needs.

Assessment and paperwork is completed by TBCC and clients use personal electronic devices. TBCC guides clients to upload Google Chrome™, platform applications and the virtual clinic access point is 'bookmarked' as a favourite within Google Chrome Bookmarks. Clients can now connect to VDOTS virtual clinics from wherever they want after the client and clinician negotiate daily consultation times.

Once diagnosis is confirmed discharge planning commences so clients are ready to commence accessing the virtual clinic immediately post discharge. If the client is diagnosed in the community, DOTS is commenced to allow clients and TBCC time to complete assessment, training, set-up and test runs.

Virtual clinic appointments are created in the same manner as all clinic appointments are booked and confirmed. The TBCC or CHN, responsible for service delivery that day receives an SMS alert signalling client arrival in the virtual waiting room. The call is then connected. If the TBCC or CHN are experiencing delays, they can SMS a response to the client.

The first TB client assessed as eligible was enrolled in the VDOTS Trial on April 1, 2017. The VDOTS call takes an average of 4 minutes and 10 seconds including observation of the client swallowing the medication, verbal review of side effects and completion of the medication and side effects charts.

Results

The VDOTS Trial commenced on April 1, 2017. Initially, five virtual clinics were created to correspond to the five clinic and care coordinator locations. A sixth virtual clinic was created in the health service to cover clients being managed in more remote locations by staff not attached to the TB Service. Of the six virtual clinics only one was not utilised due to a lack of suitable clients notified at that clinic location. The trial continued for seven months. During the VDOTS Trial 463 calls were registered by the video call provider from virtual clinic inception April 1, 2017 until the trial was concluded. VDOTS was implemented as an alternate treatment supervision service delivery pathway on November 1, 2017.

VDOTS post implementation study commenced on November 1, 2017 and concluded October 31, 2018. During the study period, 1037 calls were registered by the video call provider. The total number of calls for the study period (n=1037) included 10% (n=100) of calls initiated that did not progress to consultation with reasons unable to be determined.^{Table 1} Possible reasons for calls being <1 minute or aborted may include technical

difficulties, staff caught up elsewhere, clients needing to leave calls before they can be answered, an appointment being changed, or clinician and client training.

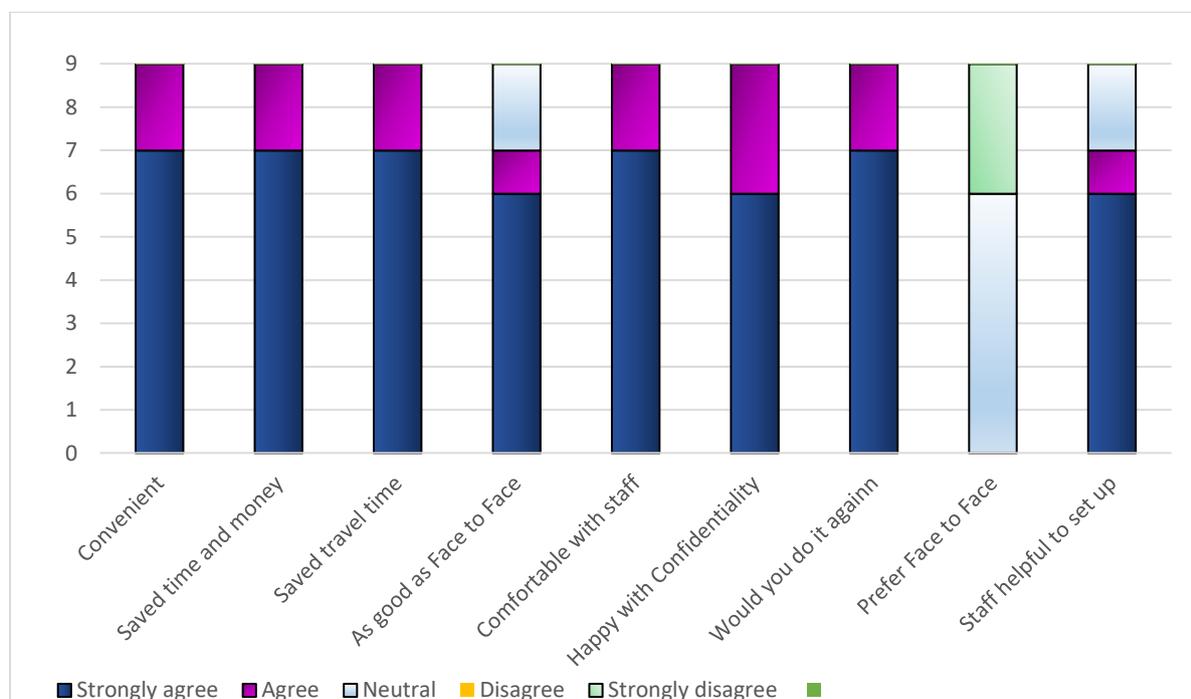
From commencement of the VDOTS Study, 100% (n=18) of TB notifications received by the TB Service covering two (2) LHD in rural NSW were reviewed prior to offering participation. Half of the overall cohort (n=9) were formally assessed, set-up and successfully underwent treatment supervision using the VDOTS pathway. Community Care teams managed treatment supervision using the DOTS pathway for 33% (n=6). Study exclusion occurred for 17% (n=3) of the TB notifications. Rationale included refusal to comply with TB treatment supervision, death and returning home.

Table 1 VDOTS Clinic consultations, November 1, 2017 to October 31, 2018

Clinic location	Total calls	Total call time (seconds)	Shortest call		Longest call		Average call length		
			Seconds	Minutes	Seconds	Minutes	Seconds	Minutes	
LHD 1 Virtual Clinic 1	141	46109	23	<1	1770	29.30	327	5.27	
Virtual Clinic 2	47	7155	50	<1	418	7.00	152	2.32	
Virtual Clinic 3	364	54632	9	<1	1080	18.00	150	2.30	
LHD 2 Virtual Clinic 4	22	5654	42	<1	502	8.23	257	4.17	
Virtual Clinic 5	463	114531	3	<1	1511	25.11	247	4.07	
Total calls	1037	228081	3801 min 21 sec 63 hrs, 21 min, 21 sec						

One client who initially chose not to participate in the VDOTS Study later joined. Four (4) TB notifications eligible to participate in the VDOTS study (n=14), elected not to be assessed as they had inadequate equipment, poor technical literacy or preferred to attend the clinic daily. Yet another client interchanged pathways, reflecting the flexibility created by the VDOTS option. Overall, we achieved a voluntary uptake of 71% (n=10:14) uptake for those eligible for the VDOTS study.

Table 2 VDOT Client Satisfaction Survey Outcomes, April 1 2017 to October 31 2018



All VDOTS clients were offered the opportunity to complete a Client Satisfaction Survey developed by ACI⁸. This survey asks nine (9) questions with set responses ranging from 'Strongly Agree' to 'N/A'. Outcomes show clients (n=9) either 'Agree' or 'Strongly Agree' VDOTS is convenient, reduces costs and staff are supportive.

Table 2 VDOTS clients surveyed (n=9) 'Strongly Agree' or 'Agree' they'd use this modality again.

Table 3 Client and Clinician VDOTS Satisfaction Survey—Reported Benefits

Client 1	More efficient, saved my time
Client 2	Saving time and travel
Client 3	Convenience, can do at work, anywhere
Client 4	Save my time, save my money and great and comfortable with staff
Client 5	Got to see nurse for weight and bloods to see how I am going
Clinician 1	Pt able to be contacted daily and able to continue ADL's & work without leaving workplace
Clinician 2	Convenience
Clinician 3	Convenient
Clinician 4	Convenience
Clinician 5	Flexibility for the client & for staff
Clinician 6	Less trouble for client increased compliance and less burden

Clinician Consultation Survey Questions also verified VDOTS implementation has been a positive innovation as a service delivery pathway for TB clients. The clinician responses in Table 3 show the respondents appreciate the impact VDOTS has had on both themselves and the clients. They also provided constructive suggestions on how to improve the service, such as more cameras around the CHC, and identified a local connectivity issue at the client's end during consultations.

Table 4 Clinician Consultation Survey Questions

Survey Questions	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Convenient for me	4	3	0	0	0
Helped me support patient	4	3	0	0	0
As good as F2F	2	3	1	1	0
I'm comfortable with technology	4	3	0	0	0
Happy to continue telehealth consults	5	2	0	0	0
I have information, skills and knowledge needed	3	3	1	0	0

Within twelve months, VDOTS, using a variety of locally preferred video call platforms, has been replicated across NSW and is now everyday practice in many TB services and Chest Clinics.

Discussion

TB has been described not just a clinical diagnosis but also a social experience.⁹ The median cost of treating drug-susceptible pulmonary TB in Australia is estimated at \$11,538AUD with a large portion (~50%) being attributed to inpatient bed days.¹⁰

In New South Wales (NSW) between January 2014 and December 2017, TB case notifications ranged from 443 to 539 per year.¹³ This equates to 80,626 -98,098 possible service events per year (not all cases receive daily treatment supervision).

VDOTS implementation is not designed to reduce the length of hospitalisation but creates savings post discharge in reduced length of time taken for daily service encounters. Pharmaceutical and case management doesn't change with VDOTS service delivery innovation. Table 1 shows the mean duration of calls was 4 min 10 sec (range 3 secs – 29 min 30 secs) whereas clinic or home visits take up to 30 minutes excluding travel time. This creates opportunities to redirect the staffing and resources to other priority areas.

When a diagnosis of TB is first discussed with clients, their initial reaction is often dismay, often they believe that TB has been eradicated.¹² Disbelief frequently precedes distrust.¹² Stigma includes the client's own preconceptions of TB, but discrimination is also regularly experienced by clients with HIV co-infections.¹⁴ TB clients are often marginalised by their diagnosis and the enforced treatment isolation initially. Culture, language, social status, or comorbidities such as HIV may also contribute to marginalisation and isolation.

The TB Service sought to simplify a service delivery model in a cost-effective way that supports program outcomes whilst empowering the client at the time when they are most likely to be overwhelmed and least able to manage the impact of their diagnosis.¹¹ VDOTS is an adaptation of a tool that is readily available and familiar to most TB clients and clinicians. It was necessary to redefine the existing telehealth model, so it fitted our service. VDOTS has been designed to increase trust, empower clients and demonstrate goodwill by providers, to create a flexible treatment space based around client capacity and need.

Despite TB diagnosis and treatment being free in Australia it still comes at a cost to clients. Clients attending clinics may have already suffered financial loss due to ill-health and isolation. Ongoing costs include access to public or private transport, travel, parking and time away from work or personal responsibilities. TB clients fear adverse consequences if absent from work or domestic responsibilities when fitting DOTS into their personal routine. This financial burden and threat to social and work place responsibilities is removed for daily treatment supervision when VDOTS is used as the treatment pathway

Our clients often struggle with privacy issues when clinicians visit a client's home or work place daily. Client and staff satisfaction surveys support VDOTS as a method of removing previous barriers to treatment compliance and client confidence regarding privacy and confidentiality concerns.^{Table 2} Many clients find it difficult to organise a regular daily clinic visit or create a set time for a home visit to have treatment supervised.

Limitations from within the health service included Wi-Fi accessibility and equipment access. DOTS is routinely performed by Community Health Nurses (CHN's) and this group had received Tablets and iPads to enhance contemporaneous documentation in eMR. CHN's now had equipment with Wi-Fi access, cameras and audio capability to take calls anywhere.

When DOTS is delivered in the community setting, return travel time, face to face encounter time, resources for staffing and vehicles etc. need to be available. There is also environmental risk in conducting 'home' visits in public places such as hotels, parks, workplaces, or rural properties where dirt roads, wildlife and grazing animals are encountered and wet, hot and dry weather can create further hazards. Implementation of VDOTS minimises cost and risk.

Clinicians deliver DOTS despite being regarded with suspicion and not necessarily welcomed. Poor clinician-client relationships quickly become treatment non-compliance. Miscommunications and simple misunderstandings do occur. Client and clinician expectations should be clear and frequently reviewed for the treatment duration. Open communication may also be inhibited by cultural and religious beliefs.

Using non-judgemental and everyday terminology when communicating with clients and family members, provides confidence that messages are heard and understood. Using VDOTS means that other health professionals or interpreters can be included in the video call as required and the client doesn't need to leave home unless absolutely necessary. Clinicians don't physically intrude in clients' space.

Side effects can occur rapidly requiring immediate hospitalisation, or insidious, such as slowly increasing nausea, visual disturbances, peripheral neuropathy or jaundice. These, and other symptoms, can be life threatening or result in significant injury to the individual, if not managed promptly. Missed dosing can result

in extended treatment time or the development of resistance to first line TB medications. Non-compliance can be more easily mitigated when clients and clinicians have choices such as DOTS or VDOTS).

Conclusion

We sought to understand treatment intricacies and manage them creatively as we progressed in order to improve the implementation of VDOTS. Once we managed the complexities of quality, usability and security we found that VDOTS was a simple, cheap and effective innovation. Implementation initially relied on client and clinician goodwill to adapt practice, especially at service delivery points where obstacles presented. Both anecdotal and statistical evidence demonstrates excellent client and clinician satisfaction and continued uptake of VDOTS across NSW TB Services and Chest Clinics. VDOTS was validated as a worthwhile project.

Competing interests

The author declares there is no conflict of interest.

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Presenter

Catherine McKenna is currently a tuberculosis (TB) clinical nurse consultant in rural and remote New South Wales. She has 30 years' nursing experience, 25 devoted to TB, staff health and well-being and public health. Innovative, client-centred service delivery has underpinned Catherine's practice including:

- design, implementation of VDOT in Murrumbidgee and Southern NSW LHD
- contributed to development TB database called Chest Clinic Surveillance System (CSS)
- design, implementation Staff Health & Wellbeing Unit in NSW

Catherine continues to serve on expert committees, consortiums and working groups. She is currently a member of the:

- NSW TB Advisory Committee advising on policy review, development, implications and protocols.
- NSW TB Coordinators Network sharing expertise on TB prevention and control and Catherine participates in several TB working groups.

Catherine's career highlights include:

- LHD and NSW recognition of VDOTS design and implementation
- Member on MWAHS Board of Directors
- Inaugural Westfund Scholar awarded to conduct research titled 'AHS procedure rates for Gastroscopy and Colonoscopies'.

Catherine has lived, studied and worked in rural/remote NSW, completed Registered Nurse Certificate (1984) and Bachelor of Health Science Nursing (2004), CSU. Shortly after completing training Catherine took up her first position caring for TB clients and embraced a life-long career in the field.