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Novel ENT live telehealth and live video-otoscopy clinics in remote Australia: outcomes and comparisons to traditional clinic models

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Main Article

Luke O'Neil takes responsibility for the integrity of the content of the paper

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Abstract

Background. Coronavirus disease 2019 challenged the delivery of healthcare in Australia, disproportionately impacting vulnerable patients, including Aboriginal and/or Torres Strait Islander peoples and those living in remote regions. The otolaryngology service provided to remote Western Australia adapted to these barriers by altering clinical consultations to a digital model.

Methods. A review was undertaken of patients in regional Western Australia. Demographics and clinical outcomes from 20 live telehealth clinics were retrospectively reviewed and compared to 16 face-to-face clinics.

Results. The demographics of patients reviewed in both live telehealth and face-to-face clinics were similar, except for a larger proportion of Aboriginal and/or Torres Strait Islander patients utilising telehealth. The outcomes of patients reviewed through each model of care were comparable. Live video-otoscopy provided diagnostic quality images in 92 per cent of cases.

Conclusion. The findings of our review suggest that, despite its limitations, a large proportion of ENT patients may be safely assessed through a live telehealth model.

Introduction

Patients in rural and regional areas of Australia face significant barriers to accessing culturally appropriate and timely subspecialty surgical care. Furthermore, populations in these areas are at higher risk of developing chronic medical conditions and have lower median income, poorer environmental conditions and greater difficulty accessing healthcare providers compared to populations living in metropolitan areas.[1] The impact of the coronavirus disease 2019 (Covid-19) pandemic on healthcare provision in Australia compounded these pre-existing inequalities, resulting in high-risk communities being disproportionately impacted because of prolonged restrictions in face-to-face healthcare delivery.

In Western Australia, the Kimberley region has a large population of people who identify as Aboriginal and/or Torres Strait Islanders, making up 41 per cent of the population, despite being just 3 per cent of the total population of Australia.[2] Aboriginal and/or Torres Strait Island populations are known to have a higher incidence of otolaryngology pathologies, especially otitis media, and continue to face challenges in accessing healthcare.[3] Otolaryngologists in Western Australia, similar to specialist service distributions across Australia, are mainly based in the metropolitan areas of the capital city.[4] To overcome inequitable access to care, the Kimberley region has had a long history of visiting specialists providing fly-in, fly-out services to the region in a collaborative arrangement with the Western Australian Country Health Service. As with other outreach programmes to the region, there are significant benefits for the residents as this service increases access to healthcare, improves outcomes and reduces the amount of travel required to see specialists, which limits disruption to family and cultural responsibilities.[5–7]

The Covid-19 pandemic in 2020 led to abrupt government health department-imposed restrictions on non-essential travel to the entire Kimberley region, resulting in a complete shutdown of the outreach programme. The sudden nature of this disruption initiated a rapid implementation of telehealth services to ensure patients in the community still had access to an otolaryngology service. Telehealth was considered an effective method of providing patient care while reducing the risk of spreading Covid-19 through the community, which was particularly important in the high-risk Kimberley region.

Telehealth can be conducted through two main modalities. The first is 'live', where the consultation occurs remotely in real time with the patient and/or delegate at the other end. There is two-way audio and/or video connectivity and, in our case, a live video of the patient's ears (video-otoscopy). Live telehealth allows the benefits of physician–patient

rapport to be developed, clinical information to be obtained directly from the patient and medical advice to be delivered in real time.[8] However, the limitations are the need for co-ordination, connectivity and time with the patient, as well as the requirement for a skilled otoscopist to be with the patient to provide adequate images.

The second modality is a 'store-and-forward' model, where the clinical information is obtained from an asynchronous patient interaction, with subsequent review undertaken by an otolaryngologist. A store-and-forward system allows patients to be assessed at the convenience of the otolaryngologist, but the diagnosis and subsequent management are highly dependent on the quality of the information available to the clinician.[10]

The current study had two aims. First, to evaluate patients of the newly established live telehealth clinics in comparison to patients attending routine face-to-face clinics provided by in-person visiting otolaryngologists prior to the Covid-19 pandemic to assess if the patients and their outcomes in these two settings were comparable. Second, to review the role of novel live video-otoscopy in telehealth clinics.

Methods

A Western Australian Country Health Service Human Research Ethics Committee and Western Australian Aboriginal Health Ethics Committee ethical board review was undertaken, and a waiver of consent was obtained (approval number: RGS4322). All 20 telehealth clinics performed in 2020 from various communities across the Kimberley region were included for review. For comparison, 16 face-to-face clinics in 2018 from various regional hubs within the Kimberley region were randomly selected. A retrospective review of the health records was undertaken. Demographic data were collected, including age, sex, accessibility of notes, 'did not attend' rates, Aboriginal and/or Torres Strait Islander status and whether the patient's appointment was new or follow up.

Consultation data included presenting complaint, diagnosis, mode of consultation (telephone or live video telehealth with nurse present or live video telehealth with a junior doctor present or face-to-face), whether or not an examination was performed, who performed the examination, whether or not otoscopy was performed, the method of otoscopy (live video-otoscopy or pre-recorded or performed by nurse/doctor) and the location of the patient during the consultation. The medical record available to the otolaryngologist was reviewed for additional clinical data, including the presence of a new audiogram, previous imaging, previous clinical notes and previous audiograms. The outcomes of the review were also collected, including whether or not the patient was waitlisted for surgery, discharged from the service, prescribed antibiotics, booked for imaging or audiogram, booked for face-to-face review or referred for vestibular testing.

All telehealth consultations were performed with the otolaryngologist based in metropolitan Perth, with patients required to attend their local hospital or medical centre to be able to participate. Patients who had telephone appointments were not required to attend the local hospital. Assessment of patients with ear-related complaints was performed using live video-otoscopy, which was set up by connecting a Welch Allyn™ video-otoscope to Western Australian Department of Health teleconferencing software ('Scopia'). This enabled simultaneous audio-visual communication between the otolaryngologist in Perth and the receiving site. Additionally, telehealth clinics were run with the assistance of existing in-person healthcare providers on the ground in the region. Otolaryngologists were sent a pdf with pertinent patient information to assist with assessment.

Descriptive statistics were produced to summarise the sample data. Fisher's exact tests and *t*-tests were used to compare the quantitative data of the two groups. A subgroup analysis of patients who had a live video-otoscopy during their consultation was also performed.

Results

A total of 36 clinics were reviewed, consisting of 20 telehealth clinics performed in 2020 assessing 116 patients and 16 face-to-face clinics performed in 2018 assessing 301 patients. Table 1 outlines the key findings. Overall, 134 patients (45 per cent) from 2018 were included in the analysis because of the inaccessibility of notes, whereas 108 patients (93 per cent) from 2020 were included. The mean age of patients in 2018 was 23 years (standard deviation (SD) 21.5; range, 1–77 years), which was similar to the mean age of patients in 2020 of 26 years (SD = 22.6, range of 1–81 years) (p = 0.292). The sex distribution was also similar, with 62 males (46 per cent) and 72 females (53 per cent) in 2018 and 56 males (52 per cent) and 52 females (48 per cent) in 2020 (p

Table 1. Key patient and appointment demographics

	Face-to-face (2018) (*n* (%))	Telehealth (2020) (*n* (%))	*p*-value
Age (mean (SD); years)	23 (21.5)	26 (22.6)	0.292
Age range (years)	1–77	1–81	
Sex (*n* (%))			0.388
– Male	62 (46)	56 (52)	
– Female	72 (53)	52 (48)	
Attendance (*n* (%))	301 (63)	116 (61)	0.789
DNA rate (*n* (%))	177 (37)	72 (38)	0.789
Accessible notes for data analysis (*n* (%))	134 (45)	108 (93)	<0.001
Aboriginal and/or Torres Strait Islander (*n* (%))	65 (49)	68 (63)	0.028
New or follow up (*n* (%))			0.121
– New	60 (45)	60 (56)	
– Follow up	74 (65)	48 (44)	
Mode of consultation (*n* (%))			
– Consultant	95 (71)		
– Registrar	39 (29)		
– Telephone	11 (10)		
– Telehealth (healthcare worker)	69 (64)		
– Telehealth (unknown)	28 (26)		

SD = standard deviation; DNA = did not attend.

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= 0.388). The 'did not attend' rate, where a booking was made for a patient but they did not attend, was also comparable between the two groups, with 37 per cent not attending face-to-face in 2018 and 38 per cent not attending telehealth in 2020 ($p = 0.789$). The number of patients who identified as Aboriginal and/or Torres Strait Islanders was significantly higher in the telehealth group than in the face-to-face group ($p = 0.028$).

Sixty-two patients (57 per cent) had their ears examined using telehealth, with 52 (84 per cent) of those patients having live otoscopy, 3 patients (5 per cent) having pre-recorded otoscopy and 7 patients (11 per cent) having otoscopy performed by a junior doctor or other healthcare worker. Seven patients (6 per cent) had their oral cavity examined and 3 patients (3 per cent) had their neck palpated. This is in comparison with face-to-face clinics, where 100 patients (75 per cent) had otoscopy, 76 patients (57 per cent) had their oral cavity examined, 52 patients (39 per cent) had their neck palpated and 25 patients (19 per cent) had a flexible nasendoscopy performed.

Clinicians had more access to patient notes when conducting face-to-face reviews compared to when using telehealth ($p = 0.004$). Small comparable numbers of imaging and 'other investigations' were accessed during both face-to-face and telehealth reviews. There were 58 patients (43 per cent) who had a new audiogram at face-to-face clinics and 31 patients (28 per cent) reviewed by telehealth who had a new audiogram available ($p = 0.108$). Small numbers of patients from both groups had an old audiogram for review (telehealth, $n = 28$; face-to-face, $n = 6$; $p = 0.573$). All patients who had audiometry also had tympanometry.

The presenting complaints of patients at face-to-face and telehealth clinics were similar for ears (58 *vs* 70 per cent, $p = 0.06$), head and neck (12 *vs* 10 per cent, $p = 0.688$), nose (7 *vs* 5 per cent, $p = 0.612$) and speech (0.7 *vs* 1 per cent, $p = 1$) (Table 2). Patients were more likely to present with laryngology and/or throat complaints at face-to-face clinics compared to telehealth clinics (20 *vs* 10 per cent, $p = 0.0496$). The most common diagnosis in face-to-face clinics was no identifiable pathology ($n = 22$), followed by tympanic membrane perforation ($n = 15$) and stable grommet check ($n = 12$). Patients reviewed by telehealth were most commonly diagnosed with tympanic membrane perforation ($n = 17$), followed by hearing loss of unknown aetiology ($n = 8$), stable grommet check ($n = 8$) and no identifiable pathology ($n = 8$).

Patients who were reviewed face-to-face were more likely to be waitlisted for surgery than those reviewed via telehealth ($n = 37$ *vs* $n = 14$, $p = 0.007$) (Table 3). Those reviewed via telehealth were more likely to have an audiogram requested ($n = 36$ *vs* $n = 21$, $p = 0.002$) and be re-appointed ($n = 75$ *vs* $n = 73$, $p = 0.024$) than those reviewed face-to-face. There were similar numbers of patients discharged in both groups (face-to-face, $n = 24$; telehealth, $n = 18$; $p = 0.865$). A small number of patients in both groups were prescribed antibiotics (face-to-face, $n = 15$; telehealth, $n = 12$; $p = 1$) and had imaging organised (face-to-face, $n = 16$; telehealth, $n = 14$; $p = 0.846$). No patients in either group had vestibular function tests ordered.

Table 2. Presenting complaints of patients reviewed in face-to-face and telehealth clinics

Presenting complaint	Face-to-face (2018) (*n* (%))	Telehealth (2020) (*n* (%))	*p*-value
Ear	78 (58)	76 (70)	0.06
Head and neck	16 (12)	11 (10)	0.688
Nose	10 (7)	6 (5)	0.612
Throat/laryngology	27 (20)	11 (10)	0.0496
Unknown	–	3 (3)	–
Speech	1 (0.7)	1 (1)	1
Headaches	1 (0.7)	–	–
Dental	1 (0.7)	–	–

Table 3. Outcomes from patients reviewed in face-to-face and telehealth clinics

Outcome	Face-to-face (2018) (*n* (%))	Telehealth (2020) (*n* (%))	*p*-value
Waitlisted	37 (28)	14 (13)	0.007
Discharged	24 (18)	18 (17)	0.865
Prescribed antibiotics	15 (11)	12 (11)	1
Imaging	16 (12)	14 (13)	0.846
Audiogram	21 (16)	36 (33)	0.002
Booked face-to-face	–	46 (43)	–
Re-appointed	73 (54)	75 (69)	0.024
Vestibular function tests	0 (0)	0 (0)	–

A subgroup analysis of 52 patients who had live video-otoscopy as part of their telehealth consultation was undertaken. Their mean age was 17.8 years (SD = 19.19) (range, 2–74 years), with more males than females (31 males *vs* 21 females). A large proportion of patients identified as Aboriginal and/or Torres Strait Islanders ($n = 39$, 75 per cent). There was a relatively even split between new and follow-up patients (52 per cent new *vs* 48 per cent follow up). There were 31 patients (60 per cent) with a new audiogram available for the clinician and 17 patients (32 per cent) with a previously performed audiogram for review. Forty-eight patients (92 per cent) had adequate otoscopic images for the otolaryngologist to make a diagnosis, whereas three patients were obstructed by wax and one paediatric patient was intolerant of the examination. The most common diagnosis was tympanic membrane perforation ($n = 17$, 33 per cent) followed by normal ears ($n = 5$), chronic suppurative otitis media ($n = 4$) and patent grommets ($n = 4$). There were five patients who were waitlisted for surgery (10 per cent). Of the five patients waitlisted for theatre, two were consented for tonsillectomy, two for grommets and one myringoplasty. There were 5 patients (10 per cent) discharged and 42 patients (80 per cent) re-appointed, with 23 patients (44 per cent) specifically booked for face-to-face review.

Discussion

Clinical care has been steadily pivoting towards using telehealth, particularly for patients living in rural and remote regions.[11] The known benefits of telehealth include accessible healthcare, reducing the burden of travel for the patients and family, increasing family involvement in care and overcoming workforce shortages to provide care in a cost-effective manner.[11] However, there are also aspects of telehealth that need to be addressed to increase the effectiveness of appointments, including a focus on cultural safety, ensuring adequate

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resources for the health service, as well as addressing privacy concerns and the confidence of patients using digital technology.[12,13] The rapid implementation of a broad telehealth programme in the Kimberley region as a result of the Covid-19 pandemic required the effective adaptation of services to the community whilst simultaneously addressing these factors.

We compared the characteristics and outcomes of face-to-face clinics with live telehealth clinics that were implemented during the Covid-19 pandemic. Overall, the live telehealth clinics were comparable to the face-to-face clinics in many aspects, and the study results are supportive of the continued complementation of telehealth with the face-to-face outreach programme. The main areas of difference between the telehealth and face-to-face clinics were larger proportions of patients who were re-appointed for further clinical review in the telehealth group and an increased number of patients who were waitlisted for surgery in the face-to-face group. It is likely that during the rapid early roll out of the telehealth programme and the unknown duration of lockdowns that the otolaryngologists who were involved with telehealth took a cautious approach to waitlisting patients for theatre, hence more patients were re-appointed. There was a trend during lockdowns to recommend reviewing patients at the next face-to-face clinic to confirm pathological suspicions that were challenging to assess through telehealth.[14]

The ability to perform a comparative physical examination using live telehealth communication has been raised as a limitation and a barrier for its widespread implementation.[15–17] It is likely this limitation contributed to the increased numbers of patients who were re-appointed in our review, with 43 per cent of patients from the telehealth cohort booked for future face-to-face assessment. Understandably, there were some patients booked for face-to-face follow up because of the need for a nasendoscopy, which is a limitation of telehealth. To overcome this limitation in the future, we plan to triage patients with a throat complaint to face-to-face clinics, with the hope of reducing the need for rebooking them.

However, there were cases who did not have a laryngeal complaint who were booked for face-to-face review with no indication for the requirement documented in the notes. It may have been that otolaryngologists lacked confidence with assessing some patients through telehealth, but there was no difference in the number of patients discharged between the groups. This finding suggests that otolaryngologists felt they could clinically clear a patient for discharge over telehealth with as much confidence as they could face-to-face.

Finally, the otolaryngologists who reviewed patients over telehealth were less likely to have access to patients' medical records when they were being reviewed, which could have impacted their ability to assess the progress of pathology over time and may have reduced their confidence in booking a patient for theatre, thus re-appointing them for future review.

Aboriginal and/or Torres Strait Islander peoples are known to have a higher incidence of ear pathology than the general population,[18] a finding that is further supported by our study as the most common complaint across both clinical modes in the Kimberley region was an ear concern. As a result of the higher incidence and challenges accessing healthcare, these patients typically face longer than recommended wait times to see an otolaryngologist and/or an audiologist.[5]

One of the biggest challenges in servicing a community with a large proportion of ear pathology is ensuring adequate visualisation of the tympanic membrane (otoscopy) to make a diagnosis. Video-otoscopes enable an otolaryngologist to examine a tympanic membrane through a digital service delivery model in real time, with evidence supporting its diagnostic use.[19] To supplement video-otoscopic images, improved diagnostic accuracy has been demonstrated in store-and-forward telehealth when an audiogram, tympanometry and nurse assessment is available.[20] In our review, the use of video-otoscopy was very effective, with the reviewing otolaryngologist able to make a diagnosis in 92 per cent of patients.

A limitation of video-otoscopy use was demonstrated in three cases, with one paediatric patient intolerant of the examination and two patients having wax obstruction. Anecdotally, the presence of a new or recent audiogram with tympanometry was vital to the assessment and diagnosis in our cohort, which is in keeping with previous research.[20] Furthermore, the otolaryngologists were comfortable in waitlisting ($n = 5$, 10 per cent) and discharging ($n = 5$, 10 per cent) patients. These findings correlate with literature reports suggesting that the use of a video-otoscope is an effective and important tool for the assessment of patients using live telehealth.[20]

There were no significant differences in the age and sex of patients reviewed, with a broad range of patients from 1 to 81 years old, suggesting that age is not a contraindication to access telehealth. There were no differences in the non-attendance rates between the service delivery models. This finding was contrary to initial predictions as it was thought there would be an increase in the number of patients utilising telehealth due to its accessibility, however given the patients had to attend their local hospital to access telehealth, the finding is not unexpected. Aboriginal and/or Torres Strait Islander patients have barriers to accessing face-to-face appointments, including transport, distance from home, inconsistent clinical staff, being unaware of appointments and their cultural obligations.[21] However, in our telehealth cohort there was an increased representation of patients who identified as Aboriginal and/or Torres Strait Islanders compared to the face-to-face cohort, which correlates with previous studies in other subspecialties suggesting high satisfaction for telehealth in this population.[22–24]

- Patients in rural and remote locations face significant barriers in accessing healthcare and are at high risk of developing otolaryngology pathologies
- The use of telehealth in these communities has widened access to care, thus improving clinical outcomes
- Video-otoscopy image quality was adequate for diagnosis in more than 90 per cent of patients
- Patients reviewed face-to-face were more likely to be booked for an operation, whereas patients reviewed by live telehealth were more likely to be rebooked for further clinical review
- A significantly larger number of Aboriginal and/or Torres Strait Islander patients accessed telehealth compared to face-to-face clinics

The limitations of this study include retrospective data collection, which has implicit biases. The data collected for this study were from the start of the pandemic and should be assessed in this context. Furthermore, Covid-19 impacted not only patients and the healthcare workers that assisted them, but all hospital staff. The limitations of workforce personnel impacted our ability to review charts from patients who attended face-to-face reviews, with access to only 45 per cent of records from these clinics. Telehealth clinic notes were more accessible, with 93 per cent included for review, likely due to the short time between the appointment and chart reviews.

Our study was also impacted by the variability in documentation of the clinician reviewing patients as well as the limited

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information in some of the dictated letters. At future clinics, a structured data collecting tool will be implemented in the region to assist with collecting clinical information. Finally, there were challenges with data collection due to patients having multiple names, making identifying their clinic reviews difficult.

There is a need for prospective studies to assess the benefits and limitations of the telehealth roll out. This will enable a greater understanding of the benefits and limitations of these services from the perspective of both otolaryngologists and patients, which could direct modifications to the programme. We need to ensure that the service we are providing is deemed culturally appropriate to the community, given the rapid implementation that had to take place. Furthermore, retrospective comparative studies can be undertaken once telehealth has been implemented in rural and regional areas for a period that enables healthcare workers and patients to become more familiar with the service delivery model. We expect that as telehealth becomes a more common technique and cases are appropriately selected, there will be comparative outcomes and it will continue to be an important adjunct to face-to-face clinics.

Conclusion

Telehealth clinics are an effective and accessible adjunct to face-to-face otolaryngology outreach clinics in the Kimberley region. The characteristics of patients using both face-to-face and telehealth clinics are similar, but Aboriginal and/or Torres Strait Islander peoples have increased representation in the telehealth group. Patients are more likely to be waitlisted when reviewed face-to-face and re-appointed when reviewed using telehealth. Prospective research should be undertaken to assess patient and surgeon perspectives of the telehealth programme to shape future changes.

Competing interests. None declared.

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