

# Diagnostic Accuracy of Telemedicine for Otolaryngology, Head and Neck Surgery in Regional Australia

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## Abstract

**Abstract Background** The use of telehealth during the COVID-19 pandemic has emerged as both a necessary and significant tool in the provision of safe and timely healthcare in the field of otolaryngology. Increased access to specialist care in a regional setting is an additional benefit. Variation in diagnostic accuracy of telehealth consultations may affect diagnosis and management. Therefore, our aim is to determine the diagnostic accuracy of telemedicine for otolaryngology in an Australian regional setting. **Methods** Retrospective review was conducted for all patients who received an initial telemedicine appointment over a 7 month period during the COVID-19 pandemic in regional Victoria, Australia. Data was collected regarding initial diagnosis and management from telemedicine consultations, subsequent physical appointment findings and management and intraoperative findings. Statistical analysis was performed using Prism (version 8.0, GraphPad). **Results** Two hundred and fifty-nine patients were included. The most common conditions referred were for consideration of tonsillectomy with or without adenoidectomy (44.0%). Overall diagnostic accuracy of the initial referrer was 63.3% and for telephone appointments it was 81.9%. Concordance of recommended treatment plans between telephone and physical appointments was 96.9%. **Conclusion** There are significant benefits of phone only telemedicine within the context of a global pandemic which were compounded by a regional setting. Paediatric patients were found to be of highest benefit for telemedicine with high diagnostic accuracy and concordance of treatment plans.

## Introduction

Since 1879, telemedicine has allowed consultations to occur remotely without face-to-face interactions between patients and clinicians.<sup>(1)</sup> It had been shown to be effective, efficient and cost-effective in various specialities.<sup>(2-7)</sup>

Due to the global COVID-19 pandemic, the use of telemedicine consultations had become an integral part of practice for various medical and surgical specialties, including otolaryngology, head and neck surgery (OHNS).<sup>(8)</sup> Otolaryngologists had been particularly at risk of contracting COVID-19 due to the higher viral load in the upper aerodigestive tract,<sup>(9)</sup> therefore the use of telemedicine had been especially important to enable ongoing safe patient care while minimising risk to clinicians.

Telemedicine consultations for OHNS patients provide additional challenges compared to other specialties due to the need for specialist examinations such as endoscopy which may not be performed by non-OHNS clinicians. Recent studies had shown good diagnostic concordance of telemedicine consultations in assessing OHNS patients when compared to face-to-face consultations,<sup>(8, 10-12)</sup> especially for OHNS conditions which are mainly diagnosed based on clinical history alone such as recurrent tonsillitis.

In most developed countries, the majority of otolaryngologists consult in metropolitan locations. Patients from regional or remote locations are therefore required to travel significant distances for specialist OHNS

review.<sup>(13)</sup> Although various Australian state governments provide subsidy for travel costs incurred, the impact to patient care can often be significant, even prior to the COVID-19 pandemic.

There is currently a lack of studies in the literature evaluating the use of telemedicine for OHNS in regional Australia. This study aims to assess the diagnostic accuracy of telemedicine consultations in assessing OHNS patients compared to face-to-face consultations during the COVID-19 pandemic.

## Methods

Retrospective analysis was conducted on all new adult and paediatric patients reviewed in the outpatient OHNS clinic since the State of Emergency announced by the Australian Victorian State Government on 15th March 2020 due to the COVID-19 Pandemic until 15th October 2020 (7 months). Ethics approval was obtained from the <blinded for review>.

All new patients of all ages referred for any OHNS condition was included in this study. Patients who did not have both a telephone and face-to-face appointment, with the telephone appointment being their first OHNS clinic appointment were excluded from the study. All patients were reviewed in a consultant OHNS clinic.

Data collected include patient demographics, language spoken, distance from hospital, referred OHNS condition, telephone appointment diagnosis and proposed treatment, number of investigations requested, as well as physical appointment findings, diagnosis and proposed treatment. Intra-operative findings were collected for patients who had undergone a surgical procedure. The number of clinical encounters as well as the date between a patient's referral until their definitive treatment decision were also determined.

Statistical analysis was performed using Prism (version 8.0, GraphPad). Descriptive data were reported as medians and interquartile ranges. Differences were analysed using the Mann-Whitney U test, with statistical significance defined as a p-value of less than 0.05 (Table 2).

## Results

Two hundred and fifty-nine patients were included in this study, with a median age of 19.4 years (0.9-91.3 years). The median distance patients resided from <blinded for review> was 15 km (9-179 km) and 2 patients required a telephone interpreter. Details of patient demographics, condition referred, and treatment outcome are presented in Table 1.

The median duration between the date of the first referral and the date of the first telephone appointment with the date of the definitive physical appointment were 317 days (9-1018 days) and 35 days (1-201 days), respectively.

The most common conditions referred to the OHNS clinic were for consideration of tonsillectomy with or without adenoidectomy (44.0%), with the majority of patients undergoing surgical treatment (69.5%). The median number of telephone and physical consultations per patient were 1 (1-3) and 1 (1-2), respectively.

Overall diagnostic accuracy of the initial referrer was 63.3%, with the accuracy of their examination findings being 33.6%. In 58.7% of referrals, examination findings were not stated. The diagnostic accuracy of telephone consultations was 81.9%, with the concordance of recommended treatment plans between telephone and physical consultations being 96.9%.

Residing less than 50km from the hospital, not having concurrent medical conditions and referrals for consideration of tonsillectomy with or without adenoidectomy were associated with significantly better referrer and telephone appointment diagnostic rates (Table 2). Paediatric patients had significantly higher telephone appointment diagnostic rates as well as concordance of recommended treatment plans. Referrals for consideration of grommets, laryngology and otology conditions were associated with significantly poorer referrer and telephone appointment diagnostic rates. More accurate referrer examination findings were observed in paediatric patients, referral for head and neck cancer, and less accurate for laryngology and rhinology conditions.

## Discussion

In the wake of the COVID-19 pandemic, delivery of healthcare had evolved to continue to allow for review and management of non-COVID-19 related medical conditions. Considerations and advantages include allowing for adherence to public health recommendations and reducing transmission risks to both patients and health care practitioners.<sup>(8)</sup> There had been particular concern within the OHNS community due to the increased COVID-19 exposure risk from the intimate nature of physical examinations of the upper aerodigestive tract and related aerosol generating procedures.<sup>(14)</sup>

Specific benefits to telemedicine during the COVID-19 pandemic observed within our unit included reducing patient numbers attending the hospital outpatient waiting rooms to allow for appropriate social distancing, further specialist triaging through specific OHNS history taking as well as initiating appropriate investigations prior to a patient's first physical appointment. Decreasing duration of subsequent physical appointments due to prior telehealth reviews was also a perceived benefit, however this was not formally measured in the scope of this study. In regional practice, telemedicine also facilitated timely specialist opinion and avoided the time and related costs required for patients to travel to a tertiary health centre, with a proportion of patients in our study residing greater than 50km from the hospital.<sup>(15)</sup> Despite reported hesitation in adopting telemedicine for OHNS clinics, previously reported patient satisfaction had been as high as 87%.<sup>(15)</sup>

In the 7-month study period, 259 patients were included, with telephone appointments. Initially during the reported study period, videoconferencing was routinely offered to all patients, due to poor interest and uptake by patients, subsequent appointments were conducted over the telephone. In our experience, further barriers to videoconferencing included technology literacy in elderly patients, lack of videoconferencing equipment in outpatient clinics and lack of training in clinicians. Ohlstein et al (2020) reported 72% of patients declined a telemedicine review, most commonly due to a lack of examination and the average age for patients declining telemedicine due to technical difficulty was 80 years old.<sup>(14)</sup> In one telemedicine OHNS patient satisfaction study, 64% of patients were bothered by a lack of physical examination.<sup>(15)</sup> Videoconferencing has the advantage of improved non-verbal communication; however, possibility of remote examination remains a challenge. Positioning of web camera, lighting and disposition in paediatric patients were significant factors.<sup>(12)</sup> Suggested adjuncts included asking parents or patients to take photos and display them to the camera or using video-otoscopes, which had a reported accuracy of 75.4% when taken by a telehealth facilitator with no formal healthcare training.<sup>(8, 10)</sup> In our study, poorer diagnostic rates in patients being considered for grommets or otological conditions could potentially be improved by remote video-otoscope images.

In our study we observed low accuracy of referrer examination for both laryngology and rhinology conditions. Direct examination of both sinonasal cavity and larynx requires specialist OHNS skills and equipment, which was particularly challenging during the COVID-19 pandemic due to the aerosol generating nature of examinations such as nasendoscopy. Alternatives in the setting of telehealth include increased use of radiological investigations such as computed tomographic scans for paranasal sinus disease and laryngeal pathologies, with limitations for small mucosal lesions and requirement for further investigation of reliability.<sup>(8)</sup> Non-image-based tools such as voice recordings and speech analysis systems, for vocal pathology had also been described.<sup>(8)</sup> Access to these investigations may be limited as a primary care referring physician.

From 13<sup>th</sup> of March 2020 the Australian government began subsidising all videoconferencing and audio-only telehealth appointments as a response to the COVID-19 pandemic. Medicare subsidy is equal for both video and telephone appointments, with Medicare paying \$89.55 for initial assessments and \$45 for subsequent consultations by surgical specialists.

The costs involved in the setup and provision of a telehealth service such as that used at <blinded for review> are minimal, as all outpatient clinic rooms are equipped with a telephone, with telephone interpreters available via three-way telephone calls. Most of the population will have access to a mobile or landline telephone and the patient incurs no cost given the telephone call originates from the hospital. An additional benefit for adopting telehealth consultations during the pandemic was reduced transport costs incurred to

patients, as we are the closest tertiary hospital in regional Victoria, which is relevant to a proportion of our patients residing greater than 50km from our hospital.

Evidence does exist supporting the diagnostic concordance between telehealth and physical appointments in OHNS, particularly in regards to digital photography and other remote investigation technologies such as otoscopy and even nasoendoscopy<sup>(10)</sup>, but not in regards to telephone appointments supplemented by referring general practitioner examination findings. Therefore, there is little available data for the purpose of comparison between the service we offered and previous experience with similar telehealth services. Our findings however do show that in resource limited settings and particularly in crisis situations such as the COVID-19 pandemic, that the initial telephone consult has high concordance with the final treatment plan (96.9%) despite some limitation in diagnostic accuracy (81.9%) as a consequence of the importance of physical examination for diagnosis in the discipline of OHNS.

Telephone appointment diagnoses were very strongly concordant with physical appointment findings for patients referred for consideration of tonsillectomy with or without adenoidectomy, with 90.4% diagnostic accuracy from the referring general practitioner and 99.1% concordance of diagnosis and treatment plan with the physical appointment. The relatively high rate of correct referrer diagnosis for paediatric patients (69.4%) and rate of correct telephone appointment treatment plan (100%) is likely a reflection of the prevalence of patients referred for consideration of tonsillectomy with or without adenoidectomy in the paediatric population. There is a general trend observed where the accuracy of telephone appointment diagnosis is higher compared to the referring practitioner, which reflected the ability to perform the necessary examination and the experience of the referring practitioner. Consequently, laryngology conditions had the lowest rate of telephone diagnostic accuracy (38.9%) due to the need for specialist skills and equipment for appropriate examination, with the accuracy of the referring practitioner's diagnosis being 5.56%. Of note, 58.7% of GP referrals did not include examination findings. If a greater proportion of referrals had included examination findings, telephone diagnosis accuracy may be higher and further assist in the triaging and timing of a patient's physical appointment. Despite this, proposed telephone treatment plans were still appropriate across all presentations at a rate of greater than 90%.

At our regional hospital in Victoria, Australia, the mean distance from the hospital for a patient was 15km, with a range of 9-179km. Our findings showed a significantly higher accuracy of referrer diagnoses and telephone consultation diagnoses in patients living within 50km of the hospital (69.3% and 88.9%, respectively) compared with those living greater than 50km from the hospital (54.7% and 71.7%, respectively). Despite a documented tendency towards increasing co-morbidities and health risk factors with increasing remoteness,<sup>(16)</sup> this is not born out in our demographic, with a mean number of comorbidities of 0.84 for patients residing less than 50km from our hospital versus 0.94 for those residing greater than 50km ( $p = 0.423$ ). Distance additionally appeared to have minimal impact on the ability to make presumptive treatment decisions based on initial telephone appointments. The aforementioned disparity may arise from patients on more remote areas often presenting to healthcare services, primarily general practice, less frequently and consequently with more complex presentation<sup>(17, 18)</sup>. It may also be a result of differing educational attainment and social determinants in remote areas impacting health literacy<sup>(16)</sup>.

The main limitation in this study is the lack of a control group to compare our findings and a lack of alternative telehealth modalities such as videoconferencing. Due to the unique and unprecedented nature of the COVID-19 pandemic, the patient demographic, referral pattern and triaging of patients in the outpatient clinic is substantially different from previously. Therefore, a retrospective comparison with patients prior to the pandemic would not provide accurate results. Although there were limited videoconferencing resources available in response to the COVID-19 pandemic at our hospital, our study had shown that a simple audio-only telehealth service can reduce patient-healthcare interactions in a pandemic response while allowing for appropriate triaging and the commencement of management following an initial telephone consultation and organising further investigations and physical consultations as necessary. Future studies may assess other telehealth modalities such as videoconferencing in OHNS as well as perform cost analyses of telehealth consultations.

## Conclusion

Adopting telemedicine in OHNS outpatient clinics is not without its challenges. There are significant benefits within the context of a global pandemic which were compounded by a regional setting. Paediatric patients were found to be of highest benefit for telemedicine with high diagnostic accuracy and concordance of treatment plans. Conditions requiring specialist examination such as laryngology or rhinology areas were less accurate. A control group and the addition or comparison with video conferencing may be of benefit in future studies. In the unique pandemic setting, rapid adoption of telephone only appointments had still proven worthwhile in our practice.

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