

## Smartphone Apps for Hearing Surveillance During the COVID Pandemic

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### Abstract

Telemedicine has become the preferred modality for providing healthcare during the COVID-19 pandemic. It has helped connect patients safely with their physicians to monitor their health. Telemedicine has its challenges. Technology, creativity and resourcefulness is assisting to overcome them. Amongst Otorhinolaryngological specialties, treating Otology issues via telemedicine has been traditionally difficult. Here we discuss our experience incorporating Smartphone apps and video otoscopes in Otology telemedicine during the COVID pandemic.

**Keywords:** COVID-19; Telemedicine; Otology; Quality Improvement; Smartphone Apps

### Introduction

Home-based healthcare using the telephone was first discussed in a Lancet article in 1879 [1]. Years later NASA developed the Mercury Space program to monitor human physiology remotely. They further developed this to monitor the Papago Indians. The Veterans Administration (VA) developed a program to offer education, monitoring and feedback from a remotely based disease management team. Remote monitoring programs did not become popular due to various challenges including patient acceptability, use of technology and meaningful transfer of data [1]. The COVID-19 pandemic has given telemedicine a new lease of life. With policy changes, the use of electronic health records and the patient's ability to access them via smartphone apps, telemedicine has provided a segue to patients who are anxious about visiting their physicians for medical care. Telemedicine has its challenges, especially for all Otolaryngology services. With the appropriate supporting equipment and technology, we attempted to provide Otology services via telemedicine to our semi-rural and rural population during this pandemic. A smartphone platform for simple hearing screen was described a few years ago for screening audiology services in

South Africa [3,4]. We attempted to study the role of Smartphone hearing evaluation apps in our Covid telemedicine practice and we discuss our experience and the challenges encountered.

### Materials and Methods

Louisiana State University Health Sciences Shreveport IRB approval was obtained for this study. The study was conducted between March to August 2020 at our tertiary care outpatient clinic. Patients requiring surveillance hearing tests were triaged from our outpatient health records. Patients consent to participate in the study was obtained verbally. Patients unable to consent, and prisoners were excluded from the study. Pediatric patients older than 10 years and with verbal consent of their guardian were included in the study.

At the telemedicine "visit", patients with complaints of new onset hearing loss or sudden hearing loss or fluctuating hearing loss were verbally consented for participation in the study. Patients were requested to download either the hearing application (app) MiMi (for iOS users) or Hearing Test app (for Android users). These

two apps were selected as they are available free of charge and are user friendly. Patients were also requested to download the Electronic Health record application "MyChart" from the iStore or Play Store. The patients were educated via phone about using the apps, recording their own hearing using ear phones and then uploading the results via the HIPPA (Health Insurance Portability and Accountability Act for patient privacy) compliant "MyChart" app from their Smartphones. The MyChart app is linked to the patient's electronic health record and we were able to review the uploaded hearing results in the patient's electronic health records. After reviewing the results, we were able to further triage and formulate a plan of care. Established patients whose hearing results showed worsening of their hearing loss compared to their previous audiograms were encouraged to travel to the clinic for further assessment. Patients with sudden onset hearing loss were also encouraged to have formal hearing evaluation at our clinic.

## Results

A total of 50 patients verbally consented to participate in the study. Of these, only 27 used the hearing apps and uploaded their results. Their ages ranged from 11 years to 82 years with four males and 23 females. Eight used the Android app "Hearing Test" while 19 used the iOS app "MiMi". Five of the 27 patients were new patients while the rest (22) were established patients at our clinic. Audiograms performed in the sound treated audiology booth from earlier outpatient visits were available for comparison in these 22 established patients. The study group included four patients with fluctuating hearing loss and complaints of Meniere's disease and two with sudden sensorineural hearing loss. A typical hearing test result obtained with the app is shown in figure 1.

**Figure 1:** Shows a hearing test obtained using the smartphone hearing app.

## Discussion

Although our academic practice is located in an urban area, our referral base is predominantly from the neighboring far flung rural communities. These communities do not have access to fast internet services for telemedicine. Some continue to use dial-up modems for their internet access. A majority of our patient population is covered by either State Medicaid insurance or Federal Medicare insurance. Pre-COVID 19 pandemic we conducted more than 500 otology outpatient visits per month. Transitioning to telemedicine brought about a radical change to our practice. Our in-office visits were restricted and patients were anxious about visiting the office due to the risk of contracting COVID. Setting up telehealth visits was challenging.

Otology emergencies are few and even fewer require emergent medical treatment. For our study we triaged patients based on their chief complaint with medical assistants and ancillary staff helping to sign up the patients for the telehealth visits. The first barrier was difficulty contacting patients, many of whom were not reachable; their voicemails were either not set up, or full. Many patients did not answer calls suspecting telemarketing nuisance calls. After the medical assistants successfully contacted the patients, an otology telehealth visit was scheduled.

Communicating during the telemedicine visit with hearing-impaired patients and seniors living alone without assistance was very challenging. Older patients, and technologically challenged patients had difficulty communicating during the telehealth visit and using the Smartphone apps for hearing evaluation.

There are several applications available for Android as well as iOS users to evaluate their hearing. Many of these require subscription. We used the free apps as our patient population are socio-economically challenged and to incentivize our patients to participate in the study. The drawbacks of using the Smartphone hearing apps were lack of validation of the apps, accuracy and cost. Very few of the Smartphone hearing apps are validated [2,3] and of the apps that have been validated, there is inadequate independent research to understand their accuracy.

On the other hand, the Smartphone apps helped us to triage patients, counsel them and alleviate their anxiety during the ongoing pandemic. They were particularly helpful in patients with episodic vertigo and fluctuating hearing loss. The apps were also useful as screening tools but cannot be recommended in lieu of in person audiological evaluation by a trained audiologist in a sound treated

booth. Technological advances, ease of use and validation of these apps may help to popularize them in future.

## Conclusion

Telemedicine otology visits supported by smartphone apps played a useful role in triaging new otology patients for expedited services and in the management of established patients with vertigo, tinnitus, chronic otitis media and fluctuating sensorineural hearing loss. Validated and user-friendly Smartphone hearing evaluation apps along with technological innovations in camera enabled otoscopes compatible with both iOS and Android smartphones could revolutionize otology telemedicine services in future.

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