Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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COVID-19 and the resurgence of telehealth in otolaryngology

Christina H. Fang, MD, Richard V. Smith, MD, FACS

From the Department of Otorhinolaryngology, Head and Neck Surgery, Montefiore Medical Center, The University Hospital of Albert Einstein College of Medicine, Bronx, New York

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The objective of this review is to examine the impact of the ongoing Coronavirus disease 2019 (COVID-19) pandemic on the use of telehealth in Otolaryngology. The use of telemedicine rose dramatically during the pandemic to meet the need for continued patient care while allowing for physical separation of providers and patients. Telemedicine has been used to evaluate patients with a variety of pathologies including dysphonia, vertigo, and anosmia. Innovative use of at-home exams, such as video-otoscopy has aided providers in overcoming challenges associated with a highly specialized physical exam. The use of telemedicine in Otolaryngology will likely remain essential in the post-pandemic era and has promising results for improving clinical efficiency.

Telehealth in the COVID-19 Pandemic

Telemedicine, which includes telehealth and other virtual services, refers to the exchange of medical information remotely using virtual technology to improve a patient's health.[1,2] Telehealth can be performed in a synchronous or asynchronous form. Synchronous visits involve real-time audiovisual interaction. Asynchronous visits involve exchange of information that occurs when the provider and patient are not connected at the same time, such as e-mail exchanges or pre-visit completion of surveys by patients.[3] Telemedicine has existed for many decades and was originally used to increase access to care in rural communities by allowing providers to expand their geographic reach.[4] Prior to the Coronavirus disease 2019 (COVID-19) pandemic, the use of telehealth was not widely implemented because of several limiting factors. First, there is an increased security risk with the exchange of protected health information across third party web-based platforms.[5] Additionally, the inability to perform in-person physical examination limits the information available to a provider, which can potentially have medicolegal consequences.[6] Furthermore, the reimbursements of telemedicine did not provide financial incentives for providers to offer this service.[7] Despite the implementation of the Interstate Medical Licensure Compact in 2017 to ease physician ability to practice across state lines, pre-pandemic licensure requirements limited the location of providers and patients during telehealth visits.[8,9] The low utilization of telemedicine was a national phenomenon, as less than 1% of physicians used telehealth prior to the pandemic.[10]

The World Health Organization declared COVID-19 a global pandemic on March 11, 2020.[11] This quickly led to drastic changes in the delivery of health care worldwide and an unprecedented rise in the use of telehealth due to public health concerns. Emphasis on 'social dis-

Address reprint requests and correspondence: Christina H. Fang, MD, Department of Otorhinolaryngology, Head and Neck Surgery, Montefiore Medical Center, The University Hospital of Albert Einstein College of Medicine, 3400 Bainbridge Avenue, Medical Arts Pavilion, 3rd Floor, Bronx, NY 10467.

E-mail address: cfang@montefiore.org

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tancing' and 'quarantining' to decrease person-to-person contact and risk of virus transmission made patients reluctant to visit clinics and hospitals.[12] In addition, closure of outpatient clinics and postponement of elective care early in the pandemic prevented patients from being evaluated in-person. In April 2020, there was an estimated 75% decline in outpatient Otolaryngology visits.[13] As a result, the use of telehealth to perform virtual medical assessments was rapidly adopted by clinicians. Telehealth visits allowed vulnerable patients to remain in their homes while maintaining access to the care they needed.[2]

Expansion of Telehealth Coverage

To meet the growing need for telehealth services during the COVID-19 pandemic, the Centers for Medicare and Medicaid Services (CMS) adopted major legislative and regulatory changes for reimbursements for such services.[2] Prior to the COVID-19 pandemic, Medicare coverage of telehealth services was limited primarily to the management of chronic conditions.[2] In addition, there were policy restrictions on where beneficiaries could receive these services and which providers would be reimbursed for such services.[2] In March 2020, after declaration of COVID-19 as a public health emergency, the CMS expanded the scope of Medicare telehealth by adding 144 telehealth services and allowing all beneficiaries to receive telehealth in any location.[1] The CMS further eliminated barriers by reimbursing evaluations performed over the telephone.[1] In addition, providers of certain services were covered by this expansion, including speech-language pathologists, occupational therapists, and behavioral health services.[14] Between March and October 2020, over 24.5 million of 63 million beneficiaries received a Medicare telehealth service.[15] Commercial insurance companies, including Cigna and United Healthcare similarly adapted to adjust reimbursements for telehealth visits.[16,17] Many states also loosened regulation on licensure requirements to provide telemedicine across state lines, further expanding access for patients.[18]

Telehealth in Otolaryngology

The use of telemedicine in Otolaryngology has been described in the literature since the 1990s.[19-22] These early reports focused on its use in providing remote expert consultation. Given that telemedicine in the form of a synchronous 2 way video-based virtual visit was not widely used, the rise of telehealth in Otolaryngology was particularly dramatic during the COVID-19 pandemic.[23,24] Otolaryngologists are at relatively high risk for COVID-19 exposure due to a high viral load in the upper aerodigestive tract and the risk of aerosolization during routine in-office procedures, such as indirect laryngoscopy.[25] Thus, the ability to perform virtual visits to reduce viral exposure for providers, staff members and patients and to preserve personal protective equipment (PPE) made telehealth a desirable alternative to in-office visits. To safely provide patient care and prevent transmission, providers don 1 time-use PPE when evaluating patients. Increased demand for PPE during the height of the pandemic led to intermittent supply shortages which placed providers at increased risk.[26,27] By offering virtual evaluations, offices were able to preserve scarce PPE resources and also divert patients away from emergency rooms and hospitals overwhelmed with COVID-19 patients.

During the pandemic, otolaryngologists have utilized telehealth to evaluate a variety of pathologies, spanning all subspecialties. In facial plastic surgery, telehealth has been used for preoperative consultations and postoperative evaluations of surgical site healing.[28] To overcome the challenges of obtaining high-quality photographs necessary for preoperative planning and documentation of outcomes, Tower et al. developed "screenshot photography," during which the patient is coached through optimizing camera angles, distances, lighting and background.[29] The authors describe the most ideal setting for patient positioning as a neutral background away from harsh direct light, with the camera at least 3 feet away from the patient's face. In rhinology, telemedicine has been used to evaluate patients with anosmia with the aid of at-home objective smell testing.[30] Other effective telemedicine interventions have included evaluation of dysphonia,[31,32] vertigo,[33,34] peritonsillar abscess,[35] nasal bone fracture,[36] and home management of positive pressure ventilation in children.[37] Video and photo documentation appear useful in these clinical scenarios. In cases of peritonsillar abscess, patients were evaluated using 2 tongue blades and video documentation taken of the oropharynx.[35] Patients with nasal bone fractures were evaluated using anteroposterior and overhead photographs.[36] Video recordings of eye movements during a Dix-Hallpike maneuver using a smartphone were utilized in evaluation of dizziness.[34]

The use of telehealth in Otolaryngology has its unique challenges. A comprehensive otolaryngological evaluation involves high dependence on the physical examination, which often requires specialized equipment, such as otoscopy and laryngoscopy.[38] In addition, palpation of relevant anatomy, such as the neck, cannot be performed remotely, potentially delaying diagnosis of a mass.[39] Thus, patients should be counseled on the limitations of diagnosis and management provided purely based on a telehealth encounter. This also highlights the need to perform video-based telehealth, as opposed to telephonic telehealth, in the initial evaluation of a patient. There are cases however, where clinical reasoning based on a thoroughly obtained patient history and external exam findings can be adequate. Several studies have reported use of a basic smartphone camera and microphone in a telehealth visit to diagnose otolaryngologic disorders[32,34-36,40] and highly sensitive questionnaires to monitor for postoperative complications or disease recurrence.[41,42]

To help overcome the challenges of a highly specialized otolaryngologic exam, innovative use of at-home ex-

Table 1 Examples of telemedicine platforms and devices used in Otolaryngology.

Subspecialty	Device or Platform
Otology	Smartphone or tablet attachable otoscope[66-69] Self-recorded videos for vertigo evaluation[70]
Audiology	Smartphone enabled audiometry application[44,45,67,71,72] Cochlear implant evaluation using Web application server and Bluetooth enabled audiometer[46]
Head and Neck/General	Flexible digital endoscope for oropharyngeal examination[47] Transmission of continuous positive airway pressure adherence data for evaluation of obstructive sleep apnea patients[73]
Laryngology	Smartphone based voice analyzer application[74,75]
Facial Plastics	Live video consultation for facial plastic surgery evaluation[28,76]
Rhinology	Smartphone based application for sinonasal symptom questionnaire[77] Smartphone enabled digital otoscope attachment used for anterior rhinoscopy/nasal endoscopy[13]

Figure 1 Example of at-home otoscope (Teslong technology)

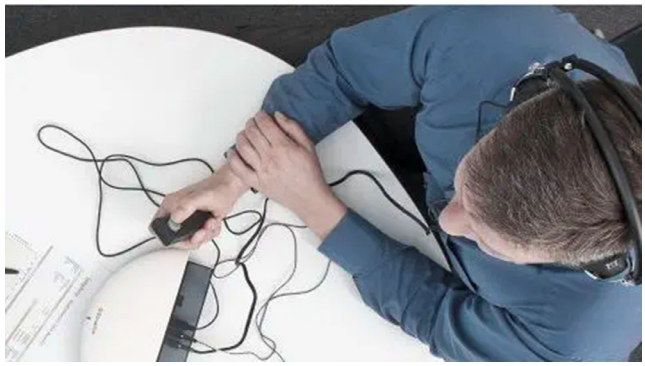


Figure 2 Portable diagnostic audiometer (OTOSphere, Otovation)

ams can assist in patient evaluation and management (Table 1). In adult patients, the use of video-otoscopy, either using a smartphone-enabled otoscope or specialized video otoscope has been shown to be equal to in-person otoscopy based on a recent systematic review.[38] Several smartphone otoscope devices have been developed, including the Cellscope, Anykit, Tytlocare, and Teslong (Fig. 1). These devices can be used to relay real-time images during a clinical encounter. In pediatric patients, evidence to support parental use of smartphone-enabled otoscopy did not appear to be as strong because of decreased accuracy.[38] Instead, the use of at-home otoscopy by parents is thought to be better used for postoperative monitoring of tympanostomy tube placement in children.[43] The use of smartphone applications can also provide helpful supplemental information. For patients with hearing loss, the use of a smartphone-based vibration test and application-based hearing test has been described with positive results.[44,45] Portable diagnostic audiometers have also been utilized in the evaluation of hearing loss (Fig. 2).[46] For oropharyngeal examination, use of USB adaptable flexible endoscopes has been described (Fig. 3).[47]

The diagnostic accuracy and efficacy of treatment provided during telehealth visits is important to quantify. A retrospective review of patients who presented with laryngeal complaints found high concordance rates between their initial telemedicine visit and subsequent outpatient office visit.[48] Specifically, they reported 86.0% and 93.6% concordance rates for diagnosis and management, respectively. This supports the use of telemedicine as a feasible initial option for patients with laryngology-related complaints.

Physician and patient perceptions of telehealth appear to be generally positive. The American Otolaryngology – Head and Neck Society Telemedicine & Telehealth Working Group surveyed otolaryngologists on their telemedicine experience in 2021.[49] Of 282 otolaryngologists, 99% re-

Figure 3 USB compatible flexible endoscope (Shenzhen Anykit Technology Co Ltd)

ported increased use of telemedicine during the pandemic and 85% intended to continue using telemedicine after the pandemic. 76% of providers felt that their patients responded favorably to the use of telemedicine as part of their care. The attitudes of Otolaryngology patients toward telemedicine are also favorable with a high satisfaction rate.[50-53] Perceived benefits of telehealth by patients include improved convenience and decreased costs associated with travel and parking.[52,54] Higher patient satisfaction has been associated with videoconference visits (vs telephone) and patients with English as a preferred language.[53]

There are barriers to telehealth to be aware of, however, which include patient access to technology, access to an interpreter, lack of trained staff, level of patient education, and patient comfort.[52,55,56] Based on an open-ended survey of Otolaryngology patients who had a video-based telehealth visit, the majority of reservations were centered around internet connection and accessing the user interface.[54] It is plausible that as telehealth becomes more prevalent in medicine, the patient experience with a video encounter will improve with increased use. Some patients in this survey also noted there was a greater benefit to a telemedicine visit if there was already an established relationship with the provider.[54] The use of a digital platform may potentially marginalize those with limited internet access or limited digital literacy, homeless patients, and undocumented immigrants.[57] Specific to Otolaryngology, we should be cognizant of patients who may not be able to communicate well in a virtual setting, such as those with hearing loss or with laryngectomies.[58] Physicians therefore should conscientiously decide which patients are most appropriate for a telehealth evaluation.

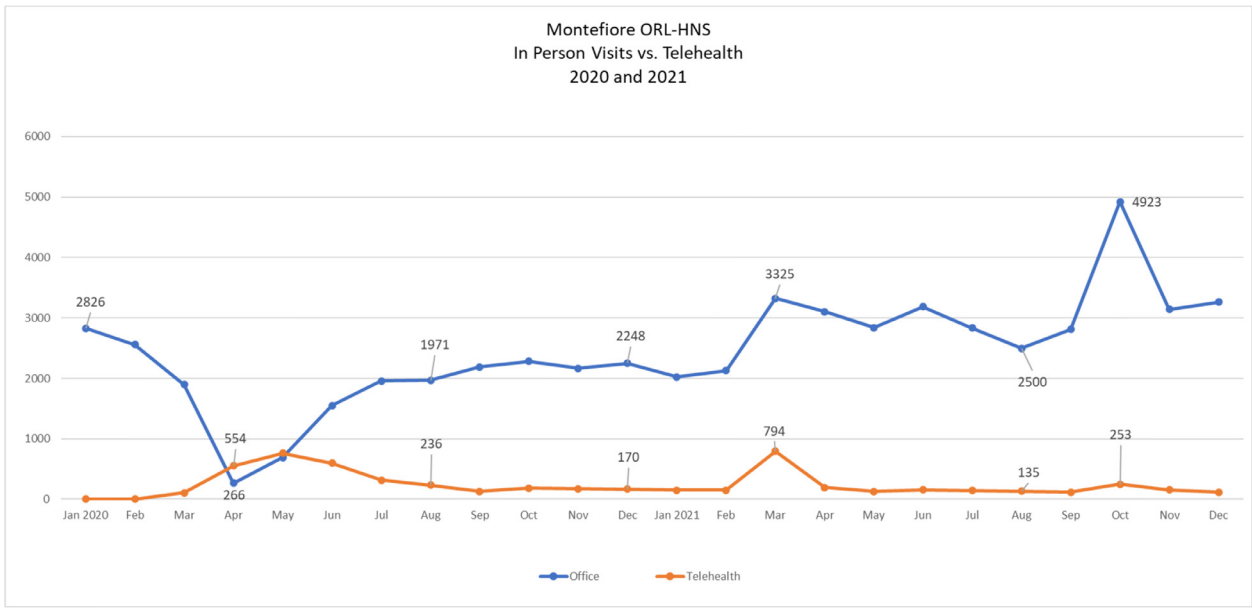
It is important to consider the patient's comfort level with telehealth as well. Although most providers agree with the implementation and continued use of telehealth, patients are not necessarily equally invested.[59] The use of telehealth has declined as the pandemic has continued, as can be seen in Fig. 4, depicting the actual number and percentage of visits for telehealth and in-person. The change is notable in the early part of the pandemic, when New York City was greatly affected and many of our providers were reassigned to inpatient intensive care units. We saw a rapid return to in-person visits, when we reopened to the general population in early May, 2020, although we were seeing in-person visits throughout March and April, 2020 for acute conditions. As can be seen, despite offering telehealth to many of our patients, our telehealth volume has been consistently limited in number, with 1 temporary spike during a subsequent COVID-19 wave. This is in large part due to patient demands (for in person visits) and the need for specialized physical examination in Otolaryngology. Despite the accessibility of telehealth throughout the pandemic, many patients have waited to have any contact with their otolaryngologist and have only recently been returning to the office. We have found some success in having an experienced comprehensive otolaryngologist use telehealth as an expedited evaluation for comprehensive otolaryngology patients to facilitate transfer of care to the appropriate subspecialist, with arranging all necessary testing, to improve the timeliness of care. Overcoming reluctance in certain patients, however, will be required to make telehealth a universal platform.

The Future of Telehealth

As the use of telemedicine increases in our specialty, future studies are important to determine which patients and conditions are most appropriate and conducive for telehealth evaluation. A systematic review found that in-person follow-up appointments were required in 13%-72% of initial Otolaryngology telehealth consultations.[60] This high conversion to in-person visits suggests that telehealth is best used for triaging patients with specific complaints.[60,61] Virtual visits are also effective for evaluation of patients where a detailed physical examination is not critical (ie, preoperative discussion about surgery, interval follow-up visit after initiating medical management).[13,60] Patients with conditions that require detailed physical examination for accurate diagnosis, such as a neck mass, would instead be better suited for an in-office visit. Creating consensus guidelines to standardize which patients are most amenable to telemedicine consultation will aid in streamlining and optimizing healthcare resources.

The marked increase in the use of telehealth during the pandemic has long term implications. With the ever growing pressure on hospital systems to reduce cost of care, telehealth may help improve clinical efficiency without compromising quality of care.[62] In Otolaryngology as well as other specialties, telehealth visits have been shown to decrease office visit cycle time, defined as the time that a patient spends at a visit, when compared to in-person visits.[52,63,64] Moving forward, incorporation of telemedicine

A.



B.

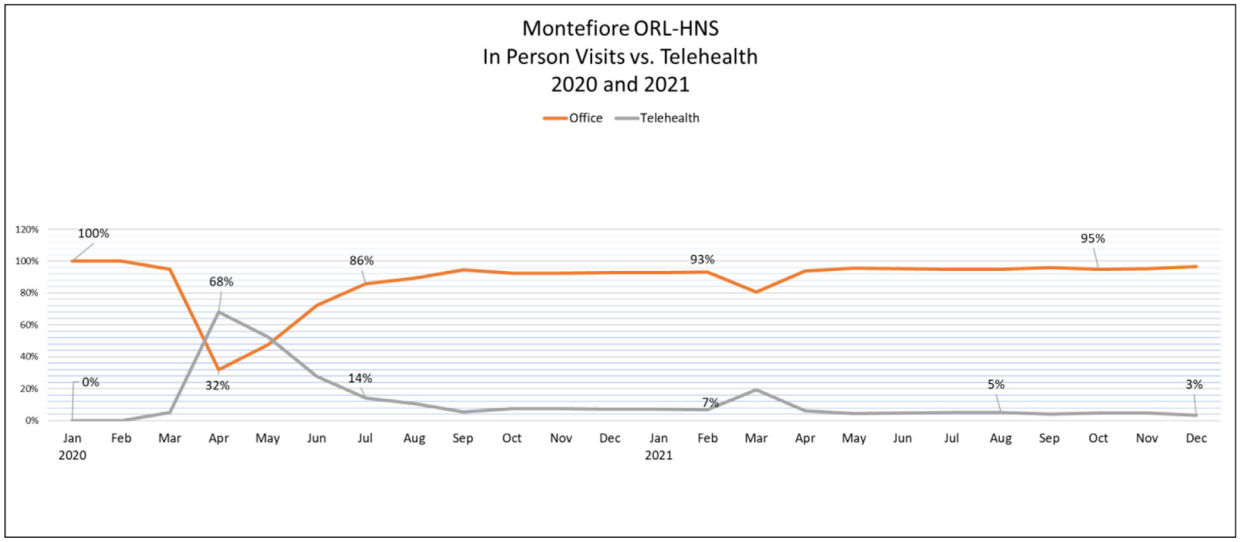


Figure 4 (A) Monthly in-person and telehealth (video and telephone) visits from January 2020 through December 2021 in the Department of Otorhinolaryngology-Head and Neck Surgery at Montefiore Medical Center. (B) Visits noted in Figure A expressed as a percentage of total monthly visits.

into the workflow of healthcare systems is key to transitioning current practices into a sustainable patient care model.[6] The key will be to incorporate remote physical assessment technology and to define which conditions, such as routine ultrasound monitoring of thyroid nodules, can be easily and safely performed using telehealth. Centralizing operations of services and employing dedicated qualified personnel can help solidify the role of telemedicine in the post-pandemic era.[65]

Disclosures

Christina H. Fang, MD – none, Richard V. Smith, MD, FACS – none.

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