

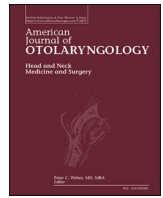


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Telemedicine lessons learned during the COVID-19 pandemic: The augmented outpatient otolaryngology teleconsultation

Anthony P. Sclafani^{a,*}, Andre Shomorony^{a,b}, Michael G. Stewart^a, Eli Grunstein^b, Jonathan B. Overdevest^b

^a Department of Otolaryngology—Head & Neck Surgery, New York-Presbyterian/Weill Cornell Medicine, New York, NY, United States of America

^b Department of Otolaryngology—Head & Neck Surgery, New York-Presbyterian/Columbia University Medical Center, New York, NY, United States of America

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ABSTRACT

Purpose: Telemedicine use in otolaryngology waxed and waned during the COVID-19 pandemic outbreak in the U.S. Assessing the patterns of telemedicine use and its perceived limitations during the COVID-19 outbreak in 2020 allows identification and correction of impediments to consistent telemedicine use by otolaryngologists.

Materials and methods: Full-time faculty of 2 academic otolaryngology departments in New York City were surveyed regarding their telemedicine use from March through August 2020 during the “first wave” of the COVID-19 pandemic. Based on these findings, a method of “augmented outpatient otolaryngology teleconsultation” designed to enhance the quality of the physical examination was developed and employed from August to December 2020. Patients receiving this augmented teleconsult were anonymously surveyed about their telemedical experience.

Results: Telemedicine use by faculty was minimal prior to the pandemic, but as total outpatient volume decreased 65–84% across subspecialties, it was used by all otolaryngologists during COVID-19. Physicians were less confident in making a telemedical diagnosis at all phases of the study in all subspecialties. Patients who had an augmented otolaryngology teleconsultation were satisfied with it, believed it facilitated earlier care, limited the time and cost of travel to the physician’s office and felt their physician was able to perform a sufficient physical examination.

Conclusions: During the COVID-19 crisis, physicians utilized teleotolaryngology to provide care but were less satisfied with their ability to make an accurate diagnosis. Inexpensive direct-to-consumer digital otoscopes can improve the quality of the physical examination provided and can address both patient and physician needs.

1. Introduction

Telemedicine has been described in otolaryngology for over 20 years [1,2]. Proof-of-concept articles [2–4] have shown that still and video images of essential features of the otolaryngological examination can be transmitted with acceptable quality and fidelity to allow remote evaluation of patients with otolaryngological pathologies. While otolaryngology has lagged behind other specialties in incorporating telemedicine, the COVID-19 pandemic led to a significant increase in otolaryngologic teleconsultation.

The COVID-19 crisis led to sudden and radical changes in the practice of medicine in many fields. In otolaryngology, the typical examination risked significant viral exposure to clinicians, staff and other patients and required regular use of personal protective equipment

(PPE) which was in short supply. Additionally, many chronic illnesses were felt to be “deferrable”, and patients avoided seeking medical care for all but the most obvious and life-threatening medical problems. National estimates suggested a 75% decline in outpatient otolaryngology visits near the beginning of the US COVID-19 pandemic in April 2020. As the initial wave, most notably in major northeastern US cities, began to ebb, partial recovery ensued. Visits were decreased by only 35% below baseline in May 2020 and estimates showed that visits plateaued at 17% below baseline from June through early October 2020 [5]. Conversely, otolaryngologic teleconsultations increased quickly in April and May, accounting for 13.8% of baseline (pre-COVID-19) visits in mid-April 2020 but later decreased and plateaued at 6% of baseline visits by September 2020 [5].

The effect of the COVID-19 pandemic on outpatient otolaryngology

* Corresponding author at: 1305 York Avenue, Room Y-511, Weill Greenberg Center, Weill Cornell Medicine, New York, NY 10021, United States of America.

E-mail address: Ans9243@med.cornell.edu (A.P. Sclafani).

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at New York-Presbyterian/Weill Cornell Medical Center (NYP-WCMC) has previously been reported [6]. Being located in the first U.S. epicenter of the COVID-19 outbreak, we realized quite early that telemedicine would play an important part in our department’s response to the restrictions imposed by the pandemic. To better understand the integration, utilization and longitudinal use of teleconsultation in academic otolaryngology practices during the height of the pandemic and as recovery ensued, we performed a prospective longitudinal assessment of telemedicine use among otolaryngologists at NY-P/WCMC and at New York-Presbyterian/Columbia University Irving Medical Center (NY-P/CUIMC). We proposed and trialed a method of otolaryngology teleconsultation that addresses the main reported weakness of the standard otolaryngology televisit. Herein we report the uses, limitations and opportunities for improvement of telemedicine in outpatient otolaryngology.

2. Methods

Full-time faculty of the departments of otolaryngology-head and neck surgery at NY-P/WCMC and NY-P/CUIMC were surveyed periodically over the spring and summer of 2020. Participants were asked to describe features of their typical in-person and telemedical practice, including estimates of volume, examination performed, and perceived advantages, disadvantages and problems encountered both before and after the onset of the COVID-19 pandemic. Survey responses were collected at four times during 2020: 1) April 11–17 (approximately 4 weeks after suspension of all non-urgent/emergent clinical activities, 3 weeks after issuance of a mandatory stay-at-home order by New York State and during a period of dramatic increases in COVID-19 related hospitalizations and deaths); 2) May 3–11 (as hospitalizations and deaths in NYC had begun to plateau and a very limited number of deferred outpatient visits had resumed); 3) June 20–July 1 (approximately 5 weeks after limited numbers of routine in-person office visits resumed, 3 weeks after routine elective surgery resumed and a phased relaxation of New York State-mandated restrictions had begun); and Aug 2–11 (following lifting of most state and city-mandated activity restrictions, Fig. 1). Results were analyzed as an entirety as well as by self-reported subspecialty.

Following the conclusion of the surveys and analysis of the data, alternative solutions were sought to address the perceived weaknesses of outpatient otolaryngology teleconsultation (OOT). Preferred options were discussed and piloted, first internally and later with actual patients after thorough discussion with legal and compliance counsel at NY-P and Weill Cornell Medicine. An inexpensive (many models are available on commercial websites for \$20–30) digital otoscope (focal length 10–30 mm, distal LED lights) is connected to the patient’s computer using a USB connector. Teleconsultation is performed using Zoom (www.zoom.us, San Jose, CA). The patient location and equipment used was what ordinarily available to the patient (generally at the patient’s home or work). Once the history portion of the encounter is complete, the patient is instructed to place the provided disposable otoscope speculum over the distal end of the endoscope. The Zoom camera input is switched to the otoscope and the physician guides the patient in the placement and movement of the scope as appropriate until the areas of interest are visible. Once the exam is complete, the video source is switched back to the PC/laptop camera, the findings are discussed with the patient and a treatment plan is developed. Participating patients were asked to complete an anonymous online survey regarding their experience with this augmented OOT as part of a quality assurance initiative.

Statistical analysis was performed using GraphPad Prism (version 9.0.0 for Mac, GraphPad Software, San Diego, California USA, www.graphpad.com). Categorical data was analyzed using Fisher’s exact test.

This study was approved by both Weill Cornell Medicine and NY-P/CUIMC Institutional Review Boards (Protocol # 20-04021954 and AAAT0890, respectively).

3. Results

Otolaryngology faculty survey responses were above 83% across all time points and included responses from all major subspecialties: comprehensive otolaryngologists (7), pediatric otolaryngologists (Peds ENT) (6), otologist/neurotologists (5), head and neck (H&N) surgeons (5), rhinologists (4), laryngologists (4) and facial plastic surgeons (3). Pre-pandemic telemedicine use was uncommon, with only 6 (18%) surgeons reporting use of virtual visits in their practices. All respondents reported telemedicine use at least once during the pandemic. During the

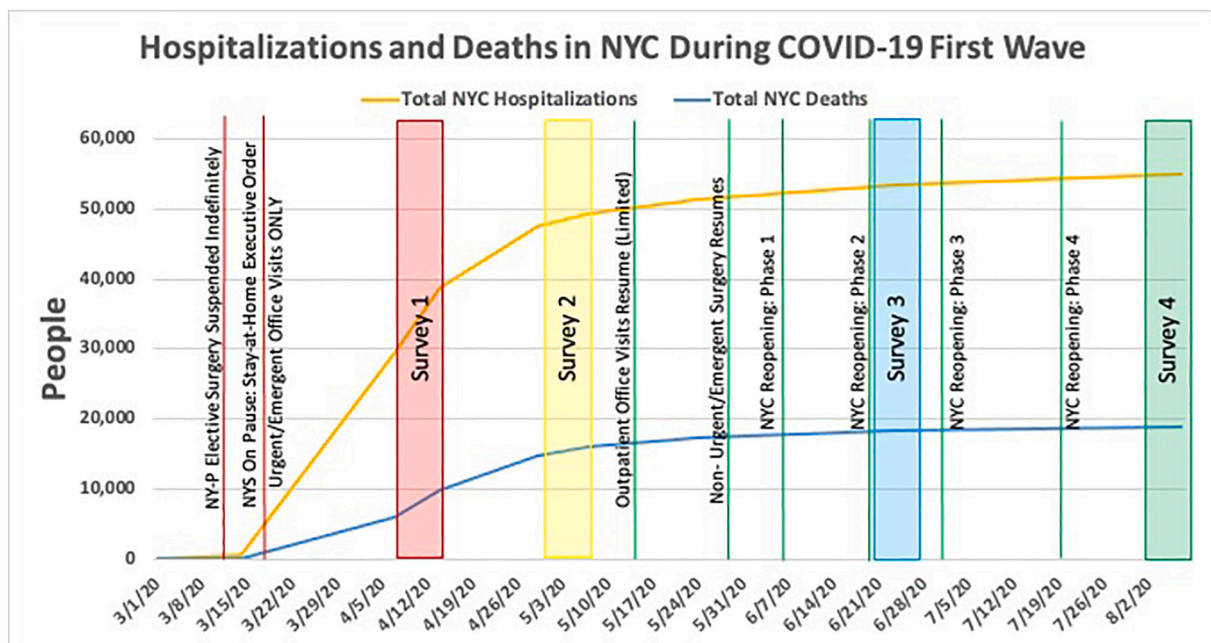


Fig. 1. Timing of surveys in relation to hospitalizations and deaths in New York City due to COVID-19 from March to August 2020 and major social and hospital system decisions affecting outpatient otolaryngology. (Data derived from Dobkin J, Diaz C, Gotteher-Cohen Z. Coronavirus statistics: tracking the epidemic in New York. <https://gothamist.com/news/coronavirus-statistics-tracking-epidemic-new-york>, accessed 11/27/20.)

final survey, a range of use was reported (from 100% of Peds ENT, laryngologists and rhinologists to 40% of H&N surgeons). All subspecialties reported a significant decline in total visits during the pandemic, decreasing to 16–35% of baseline, and while all recovered from these lows, only otology recovered to near (98%) pre-COVID level, while the other subspecialties only reached 57.5–86.0% of their baseline visits. Teleconsultation visits increased from pre-pandemic levels during the first 2 survey periods, with decline from their peak in all subspecialties in the final two surveys (Fig. 2).

Continued telemedicine use was more likely to be reported in the final survey in subspecialties that had recovered to less than 80% (laryngology, Peds ENT, rhinology and comprehensive ENT) of their pre-COVID-19 levels than other subspecialties (95.0% vs. 61.5%, $p = 0.02$). Teleconsultations included visits for new patients, established patients for routine follow-up, pre-operative consultations and post-operative visits. Slightly more than half (55.3%) of telemedicine visits were reported to last less than 15 min, while almost all (95.9%) visits were less than 30 min in length. There was a trend toward shorter (less than 15 min) visits over time. The face was the most commonly examination area, while external ears, oral cavity, nose, neck and scalp were each examined in less than 30% responses.

In the early surveys, physicians were more likely to list patient and safety issues (limiting viral exposure, preserving personal protective equipment (PPE), up to 70% of respondents) as principal benefits of telemedicine, while over time patient convenience (less patient travel, greater access to care, earlier appointment, up to 50% of respondents) became more common physician comments. Fewer than 20% physicians noted that difficulty of physician or patient connection to the consultation, poor video or audio quality, interrupted connections and inadequate physician or patient settings occurred in 25% or more of consults; however, a significant proportion (53–76%) of physicians noted difficulty in performing a sufficient physical examination in at least 25% of teleconsultations. Physicians in all subspecialties remarked that they were less satisfied with their ability to make a correct diagnosis through

telemedicine compared to an in-person visit. There was no difference between subspecialties (Fig. 3).

Sixteen patients were scheduled for an augmented outpatient otolaryngology teleconsultation (AOOT), and 15 patients (11 female, 4 male) ranging in age from 17 to 74 (average 27.3) years completed 18 examinations. Four were new patient encounters while 14 consultations were with established patients. Six encounters were pre-operative visits, 2 were for new problems, 2 were for follow up of existing problems and 8 were post-operative visits. Fifteen consults were for nose/sinus-related issues while the remaining 3 were for ear complaints.

Patients were only allowed to complete one post-encounter survey, with 10 completing the survey (66.7% completion rate). Of those who completed the survey, all except one was seen for sinonasal complaints (one patient seen for an ear complaint). All survey respondents had little to no difficulty connecting to Zoom or connecting the otoscope. Only one patient reported “a little” pain during the examination, while the rest reported no pain. Nine of 10 felt their physician had performed an exam sufficient to make a diagnosis. If an in-person visit had been performed instead of the teleconsult, six of nine respondents reported two-way travel times of at least 60 min and travel costs of at least \$20–\$50, while 5 of 9 respondents noted that at least one person would need miss work. Eight of 9 patients felt they received earlier care with the use of telemedicine. No patient reported preferring an in-person visit.

4. Conclusions

The sudden onset of the COVID-19 pandemic in our area forced an abrupt pivot in practice patterns to provide patient care for non-urgent otolaryngologic problems and created a natural experimental setting to evaluate the use of telemedicine in otolaryngology. Although physicians in our study had access to teleconsultation prior to the COVID-19 pandemic, few providers used this technology; this low utilization rate is consistent with physicians as a whole, with <1% using telemedicine nationally prior to the pandemic [7]. However, with cessation of non-urgent, in-person care and imposition of stay-at-home orders, telemedicine offered a means to provide care to patients remotely. All

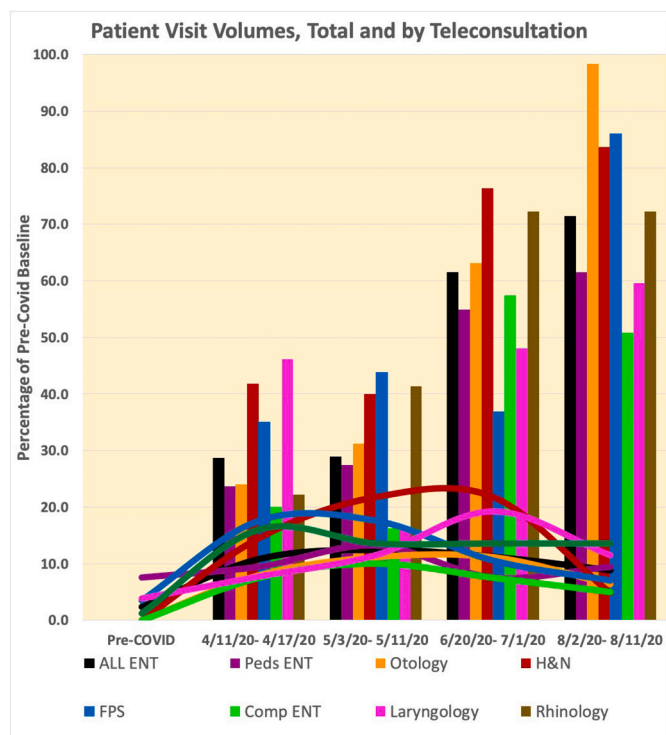


Fig. 2. Outpatient volume, reported by subspecialty, expressed as a percentage of pre-COVID-19 pandemic volume; bars refer to total visits, lines describe teleconsultations.

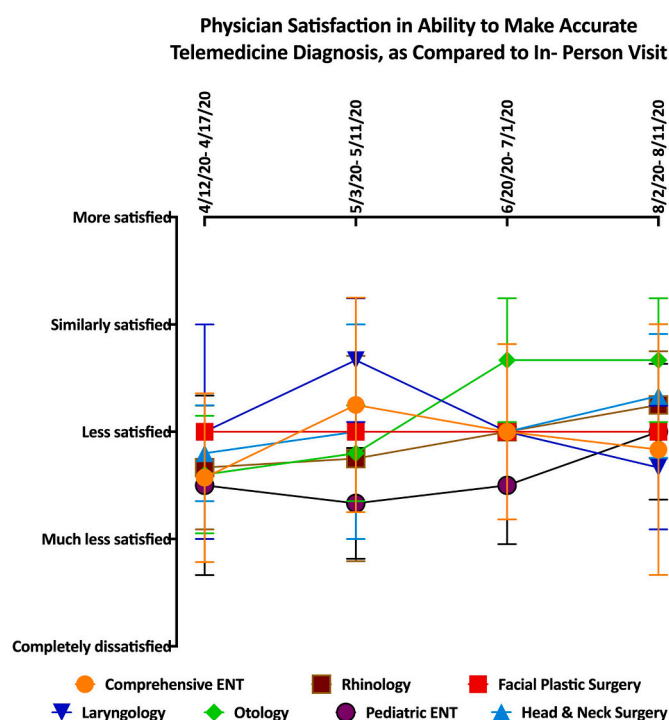


Fig. 3. Physician expressed confidence in making a diagnosis, using OOT by subspecialty, over time.

responding providers reported integrating teleconsultation into their practice at some point during the study period.

Telemedical applications in otolaryngology were first reported more than 20 years ago [1–4]. Initially designed as spoke-to-hub transmission for expert consultation, these early papers identified several hurdles to widespread tele-otolaryngology: availability of high-speed bandwidth, computer processing power, color and texture fidelity of images, payment models and state licensure and malpractice issues. While technological advancements addressed fundamental computing issues, financial and medicolegal obstacles remained. The exigencies caused by the COVID-19 pandemic led to lowering/eliminating these final barriers to widespread adoption.

The severe restrictions placed on in-person outpatient care led to the rapid adoption of teleconsultation among our otolaryngology providers. Early in the response to the pandemic, our otolaryngologists needed to provide post-operative care for recent surgical patients and follow up care for patients whose non-urgent surgery would be deferred (ultimately for 3 months or more). Later, patients who would normally be seen for non-surgical follow up care would also be treated, as well as new patients who did not wish to defer care indefinitely. In-person visits were available for immediate post-operative patients, but intermediate patients would be seen by teleconsultation and come to the office only if absolutely necessary. These patients, as well as non-surgical follow ups, would be evaluated based primarily on symptoms and general physical findings. As recovery from the height of the pandemic progressed, patients were increasingly seen in person and overall telemedical visits dropped. However, by the third and fourth surveys, telemedicine use for routine follow-up, pre-operative and post-operative visits had stabilized, as surgeries had resumed, and these patients could be offered remote visits on a planned basis. OOT for new patients dropped by the final survey. Subspecialties (laryngology, Peds ENT and Comprehensive ENT) still at a volume deficit compared to pre-pandemic levels utilized teleconsultation more. These physicians were, on average, more available, and telemedicine likely served as a “bridge” for patients not yet ready to come to a physician’s office. The physicians’ dissatisfaction with the ability to perform an informative physical examination and render an accurate diagnosis likely lowered the numbers of physicians offering OOT for new patients. Physicians in part utilized teleconsultation for lack of a better solution to provide continuing and timely care. Interestingly, the percentage of physicians reporting difficulty in performing the needed physical examination by teleconsultation dropped over time (>80% to @50%); possible explanations of this trend include that most dissatisfied physicians might have stopped offering telemedicine, physicians had organically identified alternate methods to assess the patient’s physical condition (e.g., comfortable breathing and no whistling consistent with clear nasal passageways after sinus surgery) or physicians had identified and restricted use of telemedicine to situations when a detailed physical examination was not critical (e.g., pre-operative discussion of surgery, interval follow-up visits after institution of medical management or later post-operative visits). Riley et al. noted a fairly high degree of provider satisfaction with tele-otolaryngology, although the providers in this study were “slightly to somewhat concerned” about malpractice exposure in the use of telemedicine [8].

Physicians initially felt the main benefits of telemedicine in the COVID-19 era were safety-related, but over time patient convenience and satisfaction became significant drivers for telemedicine. Nationally, 22% of healthcare consumers in 2020 had a telemedicine visit, with the majority of these having a scheduled visit with a primary care physician. Relevant to otolaryngology, 42% of these patients had a scheduled visit with a specialist with whom they had a pre-existing relationship and 13% had a virtual visit with a specialist new to them [7]. Patients’ view of telehealth is age-related: Gen Z (63%) and Millennials (67%) are more likely than Gen X (50–58%) to use telemedicine more frequently in the future. Of patients who have not had a virtual physician visit but are amenable to it, the most common advantage perceived is time savings

and convenience (58%) and faster service (47%); only 31% mentioned safety, even during the height of the COVID-19 pandemic [7].

A number of prior studies in the literature describe pilot trials of tele-otolaryngology. Initial reports utilized otolaryngologists locally (with the patient) and remotely [1,2]. As recently as 2015, 3 potential scenarios were described: a technician locally (i.e., with the patient) connecting with a remote physician; a local physician connecting with a remote “hub” specialty center; and, local emergency medicine physicians connecting with a remote specialist [9]. Smith et al. found that by videoconferencing pediatrics clinics, decisions made by the remote surgeon regarding pediatric ENT interventions correlated highly with decisions made by the same physician during an in-person consultation with the patient [10]. Yulzari et al. found 79% concordance between the findings by OOT (local non-ENT physician and remote otolaryngologist) and in-person examinations, highest for ear and nose pathologies [11]. McCool and Davies found that by using a local technician connected to a remote otolaryngologist, middle and inner pathologies could reliably be diagnosed [12]. More recently, patients and physicians have been able to interact directly, without a local healthcare provider to act as an intermediary. Otolaryngology video visits connecting patient and physician have been used successfully by Rimmer et al., with 70% of encounters being post-operative visits and the remainder non-operative follow-ups [13].

Goedeke et al. found OOT was time- and cost-effective for post-operative visits after pediatric surgery [14]. Philips et al. calculated that cost-savings could be achieved after a critical threshold of OOT patient encounters is reached to pay for the infrastructure expense [15]. Ashwood et al., after analyzing insurance claims over a 2-year period, cautioned video visits might increase access but not lead to cost-savings, as 88% of these visits represented new utilization [16].

These prior studies either required a local provider to operate an on-site camera for patient examination or simply used a patient-facing camera to allow the patient and physician to converse but provided little detailed physical examination information, particularly from the orifices usually examined by an otolaryngologist. McCool exhorted otolaryngologists to seek the subtle findings present and identifiable during an otolaryngology video visit to enhance their ability to make an accurate diagnosis. Patients can be asked to perform various tasks to replicate a physician’s exam, such as rubbing fingers together near the ear to assess possible hearing loss or tilting his/her head backwards to allow the viewing physician to assess for a caudal septal deviation severe enough to be visible in this way [17]. Unfortunately, this does not bring the physician any closer to an assessment of the state of the tympanic membranes, septum or other head and neck structures accessed through an orifice. Ohlstein, Garner and Takashima evaluated their use of telemedicine during the COVID-19 pandemic and found that 72% of patient offered an OOT declined, almost all because of the inability of the physician to perform a physical exam [18]. Recently, Cai et al. described the use of direct-to-consumer (DTC) otoscopes for remote otoscopic examination and smartphones for oropharyngeal examination in 23 patients. These authors found that otologic images from these scopes were highly acceptable, while a smartphone video was preferred for oropharyngeal examination [19].

4.1. Augmented outpatient otolaryngology teleconsultation

Based on our findings, we implemented an augmented OOT program to improve access, efficiently use resources and develop accurate diagnoses and treatment using digital otoscopes. DTC otoscopes were used for ear, oral cavity (Fig. 4a, Video 1) and nasal (Fig. 4b, Video 2) evaluation as described above. Once the exam is complete, the patient disinfects the speculum and camera with isopropyl alcohol and stores the endoscope for a subsequent visit. Patients generally connected via their personal computers at work or at home, which allowed the presence of family members (limited or not possible due to pandemic restrictions) at the patient’s preference, while the physician connected via wired or

wireless LAN (minimum 300 Mbps) hospital networks in all but one case (one consultation was performed using the physician's smartphone).

Of the patients surveyed after the AOOT encounter, most patients had little difficulty connecting and manipulating the scope and pain was minimal to non-existent. Most felt their physician was able to adequately examine the areas of interest. Most patients would have had to travel for at least 60 min (round-trip), take time off work and spend at least \$20 if an in-person visit had been required, easily offsetting the cost of the scope. Additionally, the scope is reusable over many visits. In one case, a patient's sibling requested a weekend consultation for ear pain, and with the use of the scope, acute otitis media was definitively diagnosed and treatment instituted securely, without the patient seeking care in an emergency department or urgent care center. No patient would rather have had an in-person exam and the majority of patients felt they received earlier care through the use of telemedicine.

We feel augmented OOT can adequately address the major weakness of standard otolaryngology teleconsults from both the patient's and physician's points of view - the inability to make an adequate diagnosis from a limited examination- by expanding the detail of the physical examination. Some otolaryngology subspecialties will benefit more from this approach than others; laryngology, head and neck surgery and pediatric airway evaluations will still require in-person visits to perform the required manual or fiberoptic portions of the examination. However, augmented OOT can reach more patients in a more efficient and convenient fashion, particularly for otologic, sinonasal and oropharyngeal issues. A thoughtful reassessment of examination points and hands-on activities required during visits is necessary to determine when augmented OOT can be most effectively utilized, and patients and physicians must recognize that any limited views or concerning findings identified during AOOT may require immediate, in-person follow-up for traditional examination. With these caveats, however, we feel that augmented OOT can provide better, more thorough remote otolaryngology care during public health crises as well as expand the reach and utility of OOT during more ordinary times. Many new patient visits require only a simple examination and whether the visit is in-person or remote, treatment will be predicated on the results of testing; telemedicine offers an opportunity for earlier triage and initiation of more detailed evaluation. Non-surgical patient follow-up visits may be dominated by a discussion of the patient's interval status and may not require an in-person visit. Certain post-operative visits will require a face-to-face interaction, especially if drains, sutures, packing or casts need to be removed, but later post-operative visits can be performed remotely. We believe our approach to augmented outpatient otolaryngology teleconsultation addresses patient needs and builds on existing telemedical capacity available to most patients and clinicians. Our approach is immediately cost-effective, and a more patient-centric approach will strengthen the connection between patient and physician.

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None.

CRediT authorship contribution statement

Anthony P Scalfani, MD, MBA, FACS: Conceptualization, methodology, validation, formal analysis, investigation, resources, data curation, writing- original draft, writing- review and editing, visualization, supervision, project administration.

Andre Shomorony, MD: Conceptualization, methodology, validation, formal analysis, investigation, data curation, writing- review and editing.

Michael G. Stewart, MD, MPH, FACS: Conceptualization, investigation, resources, writing- review and editing, supervision.

Eli Grunstein, MD: Conceptualization, resources, writing- review and

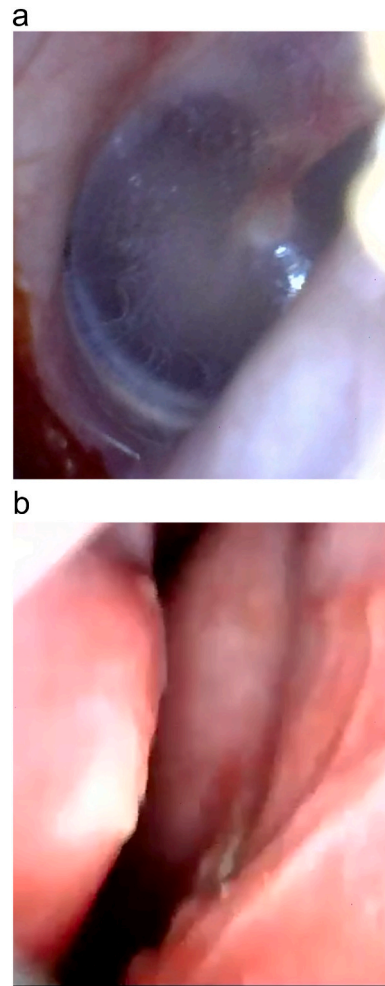


Fig. 4. a. Representative view of right tympanic membrane from patient-performed otoscopy from augmented outpatient otolaryngology teleconsultation.

b. Screen capture from patient-performed nasal endoscopy of nasal septum and right inferior turbinate.

editing, project administration.

Jonathan B. Overdeest, MD, PhD: Conceptualization, resources, writing- review and editing, project administration.

Declaration of competing interest

None.

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