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Telemedicine and the Interdisciplinary Clinic Model: During the COVID-19 Pandemic and Beyond

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The emergence of the novel coronavirus disease (COVID-19) and the subsequent need for physical distancing has necessitated a swift change in healthcare delivery. Clinicians face unprecedented challenges to providing optimal patient care. Prior to the COVID-19 outbreak, many institutions utilized an interdisciplinary clinic model including both a laryngologist and speech-language pathologist for the evaluation of patients with voice, swallowing, and upper airway disorders. This model has been shown to improve voice therapy attendance,[1] voice therapy completion rates,[2] voice therapy outcomes,[1] and departmental billing revenue.[1] With in-person clinic visits nearly eliminated, it is difficult for patients to obtain timely evaluation and management of voice, swallowing and upper airway disorders. In order to improve access, many providers are pursuing the use of individual and interdisciplinary telemedicine to provide individualized, patient-centered care, while also allowing for physical distancing. The purpose of this commentary is to review the current literature regarding telemedicine in laryngology and speech-language pathology as well as the current state of practice for interdisciplinary tele-evaluations.

Telemedicine for speech-language pathology practice. Multiple studies have shown the benefit of telemedicine in providing speech-language pathology services for patients with a variety of disorders, including neurogenic voice disorders,[3,4] muscle tension dysphonia,[5] vocal fold nodules,[6] dysarthria,[4] dysphagia,[4,7,8] and post-laryngectomy care.[4,8] It has also been demonstrated that audio-perceptual evaluation of voice using telemedicine is comparable to in-person audio-perceptual evaluation of voice quality.[9,10] These studies have illustrated feasibility, efficacy, and diagnostic accuracy with the use of telemedicine compared to traditional in-person appointments.

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Telemedicine for laryngology practice. A 2018 study by McCool and Davies found that while an average of 62% of otolaryngology visits could be completed via telemedicine, less than 40% of laryngology visits were appropriate for this method of service delivery due to the need for instrumented laryngeal visualization. Other author groups have demonstrated the efficacy of telemedicine for laryngeal diagnostics when the specialist was located in a physically distant location and reviewed images and videos collected by another qualified professional. Specifically, Furukawa et al (1998) showed that the accuracy of laryngologists utilizing video conference paired with still images of the larynx was comparable to in-person appointments. In a proof of concept article by Bryson and colleagues in 2017, it was demonstrated that interdisciplinary evaluation in a conference setting could be completed using teleconference softwarr.[11] All reports of telemedicine in laryngology to date include either synchronous or asynchronous visualization of the larynx as part of the evaluation. However, the effectiveness, safety, or patient satisfaction of laryngology tele-evaluations without laryngeal visualization is yet to be studied. With the need to restrict aerosol-generating procedures to promote patient and provider safety during the COVID 19 pandemic, generalization of these data to the current telemedicine landscape is challenging.

The interdisciplinary model and telemedicine. The use of telemedicine for real time, synchronous transmission for interactive evaluation and treatment of patients has traditionally occurred between one individual clinician and the patient. However, the inclusion of multiple clinicians and health care professionals is possible with the use of many telemedicine platforms. By using telemedicine for concurrent interdisciplinary appointments, the traditional in-person

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interdisciplinary model can be simulated while also respecting physical distancing recommendations. Out of necessity, many institutions, including those of this author group, have proceeded with rapid implementation of interdisciplinary telemedicine clinic models to continue to provide patient care. Each institution should consider specific clinic logistics as well as software and hardware requirements in order to deliver interdisciplinary care via telemedicine. Through the authors' anecdotal experience, several factors are integral to developing an effective and efficient telemedicine program. These include the clear delineation of the role of support staff including the scheduling team and medical assistants, creation of dedicated telemedicine appointment blocks, delivery of patient reported outcome measures, and development of an evaluation protocol including both the laryngologist and speech-language pathologist.

The importance of audio-perceptual evaluation of the voice in combination with a detailed history, particularly within the setting of telemedicine, cannot be understated. Similar to seeing a patient in person, the clinicians should be able to use these aspects of the tele-evaluation to determine with reasonable certainty whether the patient's dysphonia is predominantly related to impairment in vibration, closure, or resonance as well as whether a primary neurologic issue or functional dysphonia should be suspected. Furthermore, stimulability testing can provide diagnostic value in addition to improved voice therapy outcomes.[12,13] Distraction and facilitative voice techniques can give insight into organic versus non-organic etiologies, particularly if the patient's voice normalizes at any point during the evaluation. The clinicians must also consider the severity of the dysphonia and determine whether suspicion for malignancy is high enough to merit urgent laryngeal videostroboscopy. Regardless, patients should be advised that without

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direct visualization of the larynx, a definitive diagnosis cannot be obtained. Any worsening or ominous symptoms should lead the clinicians to strongly consider in-office evaluation.

Limitations of interdisciplinary tele-evaluations. The most significant limitation of the use of the telemedicine platform is the lack of laryngeal videostroboscopy, which is the gold standard for laryngology diagnosis. However, the risk of spread from aerosol-generating procedures in the current COVID-19 pandemic is forcing clinicians to weigh the benefits of endoscopy versus the risk of transmission, as well as the need to conserve personal protective equipment. Because of this limitation, the application of telemedicine should be carefully considered. For some patient populations, a tele-evaluation alone may be appropriate for a new patient intake visit including patients with chronic cough or inducible laryngeal obstruction. A tele-evaluation may also be an appropriate model for established patients who have previously undergone laryngeal videostroboscopy. In cases like these, empiric trials of pharmacologic or voice therapy could be initiated before elective stroboscopy is safe and accessible. For others, an interdisciplinary tele-evaluation is a way to triage urgent patients who do require in-person appointments, such as those with severe dysphonia, suspicion for malignancy, suspicion of aspiration, or upper airway obstruction.

Current barriers to telemedicine. While the urgency of the COVID-19 pandemic has propelled the use of telemedicine to the forefront, many previous barriers to telemedicine implementation still exist. These barriers include reimbursement policies, state and federal regulations, cyber and HIPAA security, and technology education and utilization, among others. With the widespread use of telemedicine during this time of pandemic, the hope of this author group is that the benefit

of telemedicine will be apparent to insurance companies, hospital administration and government agencies, and lead to the continued prevalence and use of interdisciplinary telemedicine in the future.

Telemedicine beyond the pandemic. Although the efficacy of telemedicine with an interdisciplinary model is unknown, this author group hopes that the same advantages of interdisciplinary clinic models on voice therapy attendance, voice therapy completion rates, voice therapy outcomes, and departmental billing revenue may be realized remotely as well. Future studies are needed to determine feasibility, patient satisfaction, and patient outcomes.

In a post vaccination era, many providers may prefer to return solely to in-person interdisciplinary clinic models to include the use of laryngeal videostroboscopy for more accurate and immediate diagnoses. For clinicians who continue to perform interdisciplinary tele-evaluations, there are validated tools that leverage machine learning to accurately diagnose laryngeal lesions from audio recordings which may improve diagnostic clarity and accuracy without laryngeal videostroboscopy.[14] The further development of similar tools and their application to telemedicine may broaden the reach and access to quality interdisciplinary voice care in the future.

Conclusion. The use of an interdisciplinary telemedicine clinic model has emerged as a solution for maintaining individualized, comprehensive, and specialized care for patients while observing appropriate physical distancing protocols in the face of the COVID-19 pandemic. As clinicians adapt to daily changes in providing care for patients, the solutions developed in necessity of this

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crisis may influence the complex and changing landscape of how care is delivered even beyond the COVID-19 pandemic.

References:

1. Litts JK, Gartner-Schmidt JL, Clary MS, Gillespie AI. Impact of laryngologist and speech pathologist coassessment on outcomes and billing revenue. The Laryngoscope 2015; 125:2139-2142.
2. Starmer HM, Liu Z, Akst LM, Gourin C. Attendance in voice therapy: can an interdisciplinary care model have an impact? Ann Otol Rhinol Laryngol 2014; 123:117-123.
3. Tindall LR, Huebner RA, Stemple JC, Kleinert HL. Videophone-delivered voice therapy: a comparative analysis of outcomes to traditional delivery for adults with Parkinson's disease. Telemed J E Health 2008; 14:1070-1077.
4. Weidner K, Lowman J. Telepractice for Adult Speech-Language Pathology Services: A Systematic Review. Perspectives of the ASHA Special Interest Groups 2020; 5:326-338.
5. Rangarathnam B, McCullough GH, Pickett H, Zraick RI, Tulunay-Ugur O, McCullough KC. Telepractice Versus In-Person Delivery of Voice Therapy for Primary Muscle Tension Dysphonia. Am J Speech Lang Pathol 2015; 24:386-399.
6. Fu S, Theodoros DG, Ward EC. Delivery of Intensive Voice Therapy for Vocal Fold Nodules Via Telepractice: A Pilot Feasibility and Efficacy Study. Journal of voice : official journal of the Voice Foundation 2015; 29:696-706.
7. Mashima PA, Brown JE. Remote management of voice and swallowing disorders. Otolaryngologic clinics of North America 2011; 44:1305-1316, viii.

This manuscript has been accepted for publication in Otolaryngology-Head and Neck Surgery.

8. Burns CL, Ward EC, Hill AJ, Kularatna S, Byrnes J, Kenny LM. Randomized controlled trial of a multisite speech pathology telepractice service providing swallowing and communication intervention to patients with head and neck cancer: Evaluation of service outcomes. Head Neck 2017; 39:932-939.

9. Mashima PA, Birkmire-Peters DP, Syms MJ, Holtel MR, Burgess LP, Peters LJ. Telehealth: voice therapy using telecommunications technology. Am J Speech Lang Pathol 2003; 12:432-439.

10. Duffy JR, Werven GW, Aronson AE. Telemedicine and the diagnosis of speech and language disorders. Mayo Clin Proc 1997; 72:1116-1122.

11. Bryson PC, Benninger MS, Band J, Goetz P, Bowen AJ. Telemedicine in laryngology: Remote evaluation of voice disorders-setup and initial experience. The Laryngoscope 2018; 128:941-943.

12. Gillespie AI, Gartner-Schmidt J. Immediate Effect of Stimulability Assessment on Acoustic, Aerodynamic, and Patient-Perceptual Measures of Voice. Journal of voice : official journal of the Voice Foundation 2016; 30:507 e509-507 e514.

13. Dejonckere PH, Lebacq J. Plasticity of Voice Quality. Journal of Voice 2001; 15:251-256.

14. Fang SH, Tsao Y, Hsiao MJet al. Detection of Pathological Voice Using Cepstrum Vectors: A Deep Learning Approach. Journal of voice : official journal of the Voice Foundation 2019; 33:634-641.

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