Telemedicine in ORL

Duong xuan Tung

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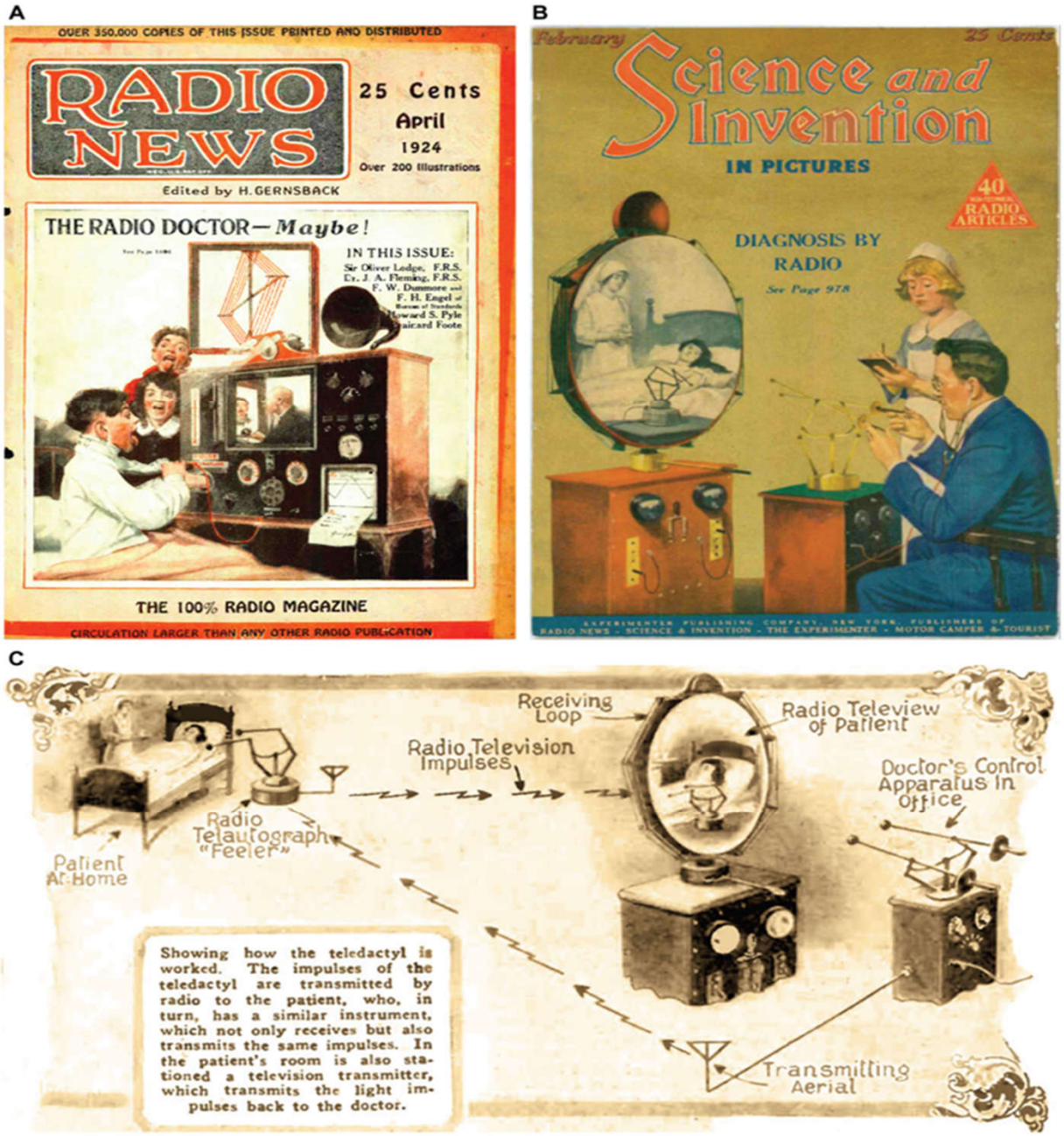


Figure 1. (a) The cover of *Radio News* magazine, April 1924. (b) The cover of *Science and Invention* magazine, February 1925. (c) Schematic representation of the "teledactyl," a theoretical telemedicine tool that doctors might use to evaluate patients at a distance. *Science and Invention* magazine, February 1925.

The Very Early Years

1879

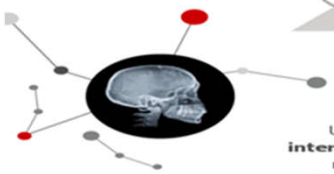
Lancet article talks about using the **telephone to reduce unnecessary office visits**[1]

1925

Radio and publishing pioneer Hugo Gernsback predicts that doctors would someday use **radio and TV to communicate with patients**[2]

1948

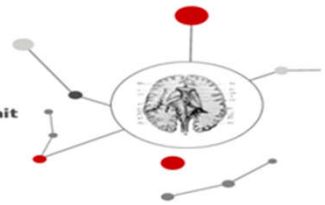
First **radiologic images sent via telephone** across 24 miles in eastern Pennsylvania[3]



The Later Early Years

1959

University of Nebraska uses **interactive telemedicine to transmit neurological examinations**[4]



1959

Canadian radiologist reports **diagnostic consultations** based on **fluoroscopy images** transmitted by **coaxial cable**[5]

Late 1950s/Early 1960s

Closed-circuit television link established between Nebraska Psychiatric Institute and Norfolk State Hospital **for psychiatric consultations**[1]

1961

U.S. Space Program performs test flights using animals attached to medical monitoring systems, **sending animals' biometric data to scientists on Earth via telemetric link**[6]

Journal *Anesthesiology* reports on **radiotelemetry for patient monitoring**[5]

1967

Physicians at University of Miami School of Medicine and the City of Miami Fire Department report use of existing **voice radio channels to transmit EKG rhythms** from fire rescue units to Jackson Memorial Hospital[5]

Late 1960s

Telemedicine begins as form of healthcare delivery, propelled by NASA and the Nebraska Psychology Institute[7]

Late 20th Century

1970s

Kaiser Foundation International, in partnership with Lockheed Missiles and Space Company, create a **remote monitoring** system capable of providing **healthcare delivery**[7]

1973–77

NASA tests STARPAHC (Space Technology Applied to Rural Papago Health Care) program where **mobile support units** in rural Tohono O'odham reservation **link patients with physicians** in Indian Health Service hospitals[6]

1980s

Radiologists begin using **teleradiology systems to receive images** for telemedicine consultations[4]

1990s

Rise of the **Internet allows support** for practically all information and traffic **needed for telemedicine**[4]

Modern Times

2009

ARRA and HITECH Act propel medical technology advances and **drive digital connectivity**[7]

2010

Patient Protection and Affordable Care Act spurs **formation of ACOs,** in which **telemedicine and remote monitoring play important roles**[7]

CMS publishes final rule on **Meaningful Use,** prompting EHR adoption and further **laying the digital groundwork for telemedicine growth**[8]

2014

President Obama signs **National Defense Authorization Act,** which **expands telemedicine services** specifically designed to **help military members** transition back to civilian life[9]

2016

More than **$16 million awarded** by the Health Resources and Services Administration (HRSA) **to improve access to quality healthcare in rural communities,** including funds that will expand use of telehealth technology for veterans and other patients[10]

Now

Increased bandwidth, better security, cloud, the rise of mobility and the push to improve patient care converge to create a **perfect storm of telemedicine adoption** for hospital use, remote monitoring, chronic disease monitoring, physician consultation, population health initiatives and more!

Nearly 2/3 of providers rank telehealth as a top priority in 2016 with top objectives of:[11]

The WHO describes telemedicine as follows:

"…using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities."

This broad description can be summarized as the use of virtual communication methods in order to facilitate patient care. The methods of communication can be synchronous or asynchronous [6]. A synchronous form of telemedicine refers to a real-time audiovisual interaction such as a Zoom call [6]. Asynchronous is a term that describes store-and-forward methods of communications, such as images or video recorded by the patient and reviewed by the provider at a later time [6].

aryngology-Head & Neck Surgery | Original Investigation

edicine Services Provided to Medicare Beneficiaries laryngologists Between 2010 and 2018

er, MD, MBA; Vinay K. Rathi, MD; Elliott D. Kozin, MD; Matthew R. Naunheim, MD, MBA; MS; Stacey T. Gray, MD

Table 1. Examples of Telemedicine Modalities and Applications[a]

Modality	Explanation	Example
Store and forward	Transmission of recorded health history (eg, prerecorded videos and digital images) through a secure electronic communications system to a practitioner, who uses the information to evaluate the case or render a service outside of a real-time or live interaction[1]	Intraoperative pathologic examination (permanent sections) Skin examinations for dermatology review Radiology review of imaging from remote hospitals
Live video conferencing	A 2-way interaction between a person (patient, caregiver, or clinician) and a clinician using audiovisual telecommunications technology, performed in real time[1]	Video conferencing between primary care clinicians and specialists Live patient examinations that are limited owing to remote barriers
Remote monitoring	Use of digital technologies to collect medical and other forms of health data from individuals in one location and electronically transmit that information securely to health care professionals in a different location for assessment and recommendations[1]	Monitoring of vital signs in intensive care units Cardiac monitoring from home for patients with heart conditions
Mobile health	The provision of health care services and personal health data via mobile devices, such as cell phones and tablet computers[1]	A mobile app allowing a secure exchange of information, enabling patients to communicate health-related issues remotely

Implementation of Telemedicine in Otorhinolaryngology

Hrvoje Mihalj [1, 2], Željko Zubčić [1, 2], Andrijana Včeva [1, 2], Željko Vranješ [1, 2], Josip Maleš [1,2], Darija Birtić [1, 2], Tihana Mendeš [1, 2], Stjepan Grga Milanković [2], Tin Prpić [1, 2], Vjeran Bogović [1, 2], Ivan Abičić [1, 2], Matej Rezo [2], Miroslav Moguš [3], Anamarija Šestak [*2]

1. Telecommunication infrastructure and technology
2. Training
3. Cultural factor
4. Legal boundaries

Concordance between real-time telemedicine assessments and face-to-face consultations in paediatric otolaryngology

Anthony C Smith, Samuel Dowthwaite, Julie Agnew and Richard Wootton

1 The regional paediatrician uses a video-otoscope to send images to the specialist via videoconference

2 Images sent via videoconference are viewed by the specialist at Brisbane's Royal Children's Hospital

ls of four cases where surgical management recommended during the oconference consultations and during the face-to-face consultations were ent*

st's initial endations from nference	Subsequent recommendations from face-to-face consultation	Rationale for change in management
onsillectomy	Adenotonsillectomy and grommets	Developed ear problems during waiting period
onsillectomy mination of ears haesthesia	Adenotonsillectomy and grommets	Fluid detected on examination, then decision to insert grommets
onsillectomy mmets	Adenotonsillectomy	Fluid resolved spontaneously during waiting period
ets	No treatment	Fluid resolved spontaneously during waiting period

atient had an operation after planned conservative management failed. ◆

3 Diagnoses made and management plans established during paediatric ear, nose and throat telemedicine consultations ($n = 97$)

	n
Diagnosis	
Recurrent tonsillitis	26
Bilateral glue ear or serous otitis media	17
Obstructive sleep apnoea	12
Recurrent otitis media	11
Review of grommets	9
Rhinitis or sinusitis	6
Other*	16
Management	
Adenotonsillectomy	32
Referral to general practitioner or paediatrician, and/or medication	19
Grommets	11
Tonsillectomy	9
Adenoidectomy and grommets	7
Adenotonsillectomy and grommets	7
Other†	12

* Tinnitus, impacted ear wax, headaches, febrile convulsions and recurrent epistaxis.
† Bronchoscopic examination, lateral neck x-rays, referrals to other specialists and removal of wax. ◆

Review Article

Telemedicine in Otolaryngology: A Systematic Review of Image Quality, Diagnostic Concordance, and Patient and Provider Satisfaction

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Table 1. Characteristics of the Included Studies Assessing Image Adequacy.

Author	Subspecialty	Study Design	Study Population	n	Telemedicine Platform	Outcomes Assessed	Images Taken	Images Considered Adequate for Remote Diagnosis	Images Taken by
Biagio et al[8]	Otology	Prospective	Children	140	Asynchronous	Diagnostic capability of video-otoscopy recordings	Otoscopic	87%	Trained telehealth facilitator
Biagio et al[9]	Otology	Prospective	Adults	61	Asynchronous	Video-otoscopy by a general practitioner	Otoscopic	83.6% (otolaryngologist, sensitivity 0.80/specificity 0.85, diagnostic OR 41) 75.4% (general practitioner, sensitivity 0.91/specificity 0.89, diagnostic OR 46)	Otolaryngologist OR general practitioners without special training
Lundberg et al[10]	Pediatric (otology)	Prospective	Children	64	Asynchronous	Digital imaging of the tympanic membrane in telemedicine	Otoscopic	82.30%	Trained nurse
Likelboom et al[11]	Pediatric (otology)	Prospective	Children	66	Asynchronous	Sufficiency of still images of the tympanic membrane to diagnose disease	Otoscopic	2.96 out of 4 (average rating on a scale where 2 = adequate)	Experienced video-otoscopist
Mbao et al[12]	Otology	Prospective	Adults and children	22	Asynchronous	Quality of different video-otoscopes (MedRX recommended)	Otoscopic	87%	Experienced video-otoscopist
Stern et al[13]	General	Prospective	Adults	45	Combined	Interactive and store-and-forward telemedicine for ENT exam	Nasopharyngo-laryngoscopic	62%	Otolaryngology chief resident
Furukawa et al[14]	Laryngology	Retrospective	Adults	29	Asynchronous	Telemedicine for laryngology consultation	Laryngoscopic	100%	Laryngologist

Table 2. Characteristics of the Included Studies Assessing Diagnostic Concordance.

Author	Subspecialty	Study Design	Study Population	n	Telemedicine Platform	Outcomes Assessed	Diagnostic Concordance (%)
Yulzari et al[15]	General	Prospective	Adults	48	Synchronous	Synchronous telehealth consultations in general otolaryngology clinic	79.20%
Shah et al[16]	Pediatric (otology)	Prospective	Children	80	Asynchronous	Interrater agreement using parent recorded videos compared to pneumatic otoscopy	k = 0.71 (physician) k = 0.42 (parent)
Seim et al[17]	General	Prospective	Adults	21	Synchronous	Synchronous telehealth consultations in general otolaryngology clinic	95%
Wu et al[18]	General	Prospective	Adults	6	Asynchronous	Quality of smartphone-based otorhinoendoscope	94.4% (without clinical context) 100% (with clinical context)
Lundberg et al[19]	Pediatric (otology)	Prospective	Children		Asynchronous	Video-otoscopy to assess normal TM and secretory otitis media	kappa range 0.85 to 0.88 (intraprovi 0.69 to 0.72 (interprovider)
Biagio et al[8]	Otology	Prospective	Children	140	Asynchronous	Diagnostic capability of video-otoscopy recordings	first review: otologist kappa = 0.70 a kappa = 0.68; second review: otolo kappa = 0.74 and GP kappa = 0.75
Kokesh et al[5]	Otology	Prospective	Adults	###	Asynchronous	Efficacy of store-and-forward telemedicine in otolaryngology	89%
Smith et al[20]	Pediatric	Retrospective	Children	97	Synchronous	Agreement of telemedicine ENT diagnoses/decisions with face-to-face consultations	99%
Kokesh et al[21]	Otology	Prospective	Adults	70	Asynchronous	Video-otoscopy images for post-tympanostomy tube follow up	Interprovider 89% (kappa 0.83) Intraprovider 77% to 88% (kappa 0.6
Eikelboom et al[11]	Pediatric (otology)	Prospective	Children	66	Asynchronous	Sufficiency of still images of the tympanic membrane to diagnose disease	$p < 0.005$ for ETD* $p < 0.001$ for AO OME, OME vs ETD, and CSOM* p-value not significant for cholestea
Patricoski et al[22]	Pediatric (otology)	Prospective	Children	40	Asynchronous	Efficacy of telemedicine for post-tympanostomy tube placement followup	Intraprovider 79% to 85% Interprovider 84%, 89% after exclu poor quality images
Ullah et al[23]	General	Prospective	Adults and children	42	Synchronous	Efficacy of telemedicine consultations	81%
Stalfors et al[24]	HNS	Prospective	Adults	80	Synchronous	Telemedicine in multidisciplinary tumor boards	91%
Sclafani et al[25]	General	Prospective	Adults	45	Combined	Asynchronous versus synchronous telemedicine	Synchronous 85% Asynchronous 64%
Furukawa et al[14]	Laryngology	Retrospective	Adults	29	Asynchronous	Telemedicine for laryngology consultation	100%

Abbreviations: ETD, Eustachian tube dysfunction; AOM, acute otitis media; OME, otitis media with effusion; CSOM, chronic suppurative otitis media. *presented as chi square values.

Table 3. Characteristics of the Included Studies Assessing Patient Satisfaction.

Author	Subspecialty	Study Design	Study Population	N	Telemedicine Platform	Outcomes Assessed	Patients (n)	Patient Satisfaction (%)	Reason Dissatisf
Yulzari et al[15]	General	Prospective	Adults	48	Synchronous	Synchronous telehealth consultations in general otolaryngology clinic	48	9.5 out of 10	Not repor
Seim et al[17]	General	Prospective	Adults	21	Synchronous	Synchronous telehealth consultations in general otolaryngology clinic	21	96%	Felt encou was signif lengthene
Rimmer et al[26]	HNS	Retrospective	Adults	250	Synchronous	Patient attitudes and time savings in a synchronous telemedicine model	78	95%	Not repor
Wall et al[27]	HNS	Prospective	Adults	15	Asynchronous	Patient perception of SwallowIT during CRT (cited comfort and confidence w/system as cons)	15	87%	Personal preferenc face-to-fa delivery c
Burns et al[28]	HNS/Speech pathology	Prospective	Adults	18	Synchronous	Telehealth in speech pathology services	18	100%	Not repor
Head et al[29]	HNS	Prospective	Adults	45	Asynchronous	Telehealth intervention for patients undergoing treatment for head and neck cancer	44	80.0%	Not repor
Mishra et al[30]	HNS	Prospective	Adults	34	Synchronous	Feasibility of tele follow-up for postoperative thyroid and parathyroid diseases	34	100%	Not repor
van den Brink et al[31]	HNS	Prospective	Adults	36	Asynchronous	Use of an electronic health information support system in head and neck cancer care	36	8.0 out of 10	Not repor
Stalfors et al[32]	HNS	Prospective	Adults	84	Synchronous	Patient satisfaction with telemedicine	45	100%	Pace of me was too f
Made et al[33]	General	Prospective	Adults	32	Synchronous	Feasibility of telemedicine for specialist consultation	—	5.7 out of 6	Not repor
Pedersen and Holand[34]	General	Prospective	Adults	26	Asynchronous	Patient satisfaction with telemedicine	24	96%	Not repor

Table 4. Characteristics of the Included Studies Assessing Provider Satisfaction.

Author	Subspecialty	Study Design	Study Population	n	Telemedicine Platform	Outcomes Assessed	Providers (n)	Provider Satisfaction (%)	Reasons fo Dissatisfact
Yulzari et al[15]	General	Prospective	Adults	48	Synchronous	Synchronous telehealth consultations in general otolaryngology clinic	—	8.7 out of 10	Not reporte
Seim et al[17]	General	Prospective	Adults	21	Synchronous	Synchronous telehealth consultations in general otolaryngology clinic	—	100%	Not reporte
Kohlert et al[35]	HNS	Prospective	Adults and children	109	Asynchronous	Feasibility and wait times in an asynchronous telemedicine model	—	92%	Not reporte
Burns et al[28]	HNS/Speech pathology	Prospective	Adults	18	Synchronous	Telehealth in speech pathology services	2	100%	Not reporte
van den Brink et al[31]	HNS	Prospective	Adults	36	Asynchronous	Use of an electronic health information support system in head and neck cancer care	8	5.6 out of 10	Not reporte
Melcer et al[36]	General	Prospective	Adults/ Military	193	Synchronous	Use of telemedicine in shipboard medical departments	8	1.8 out of 5 (0 = most satisfied)	Not reporte

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Establishing an Office-Based Framework for Resuming Otolaryngology Care in Academic Practice During the COVID-19 Pandemic

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Abstract

Objective. The COVID-19 health crisis abruptly disrupted the practice of otolaryngology. This article aims to define the changes needed to operate an academic otolaryngology practice safely and efficiently from within the epicenter of the pandemic. We define the areas of normal patient workflow that have been affected by COVID-19, and we offer mitigation strategies with attention paid to the specific needs of subspecialties.

and retrieval, disinfection, fomites, laryngoscopes, endoscopes, infection control, disinfectants, hand sanitizers, decontamination, sneezing, personal protective equipment, universal precautions, adult, child, humans, polysomnography, nose, hypoglossal nerve, cerumen, crying, tracheotomy

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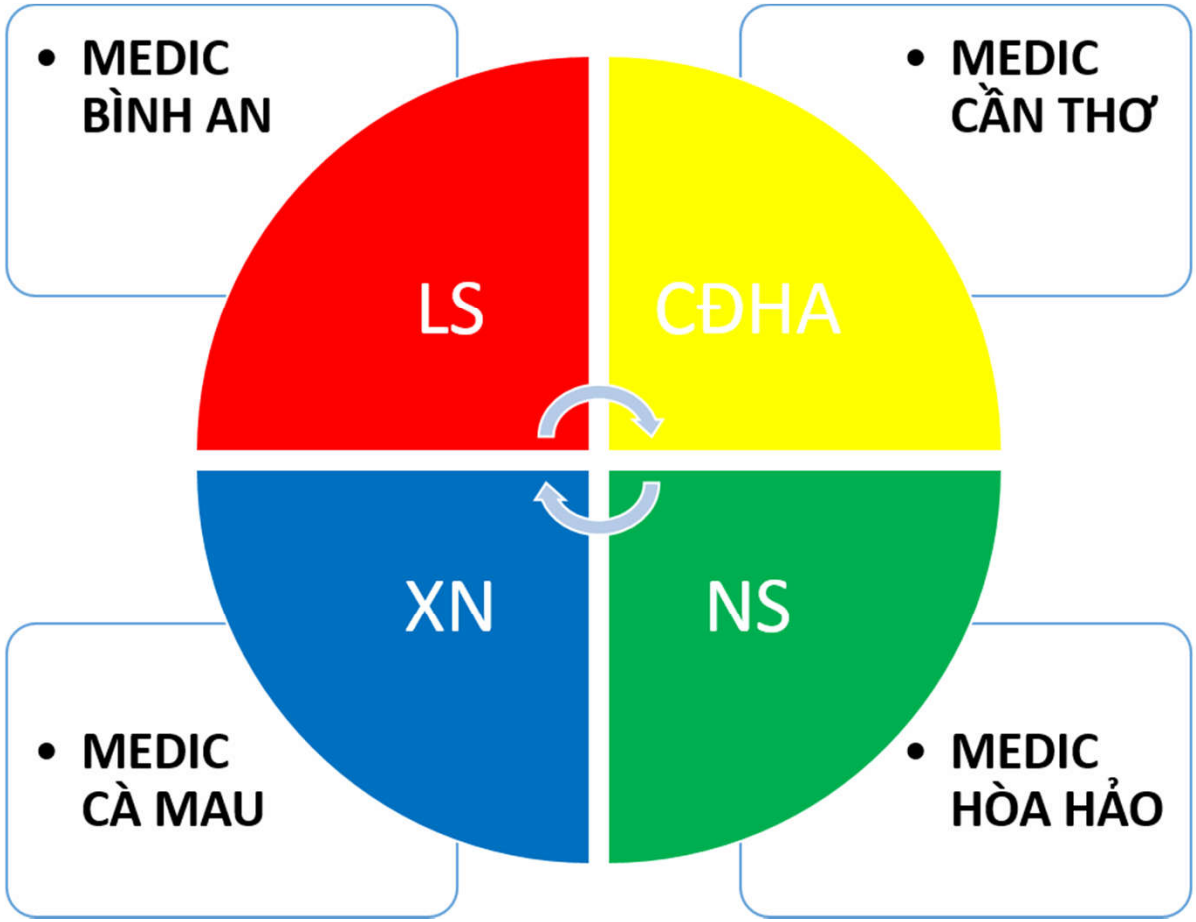
Providing otolaryngologic care during the coronavirus

Table 2. Role of Telemedicine in Common Clinical Disorders Based on Subspecialty.

	Clinical presentation for telemedicine	
Subspecialty	Appropriate for telemedicine[a]	May not be appropriate for telemedicine
Rhinology	• Viral upper respiratory tract symptoms (including suspected COVID-19) • Acute rhinosinusitis (noncomplicated) • Hyposmia (including suspected COVID-19) • Established patients with well-controlled chronic sinonasal disease (chronic rhinosinusitis, rhinitis, nasal obstruction)	• Persistent or worsening sinusitis symptoms • Symptoms atypical for sinusitis, concerning f neoplasm or complicated inflammatory dise • Epistaxis • Recent postoperative patients • Sinonasal tumor evaluation and surveillance
Otology	• Long-term stable symptoms (hearing loss, tinnitus, known tympanic membrane perforation) • Follow-up for conditions that generally do not have significant examination findings (tinnitus, Ménière's syndrome) • Asymptomatic cerumen	• Symptoms concerning for acute process (otorrhea, sudden hearing loss, severe acute hearing loss, otalgia, fever, facial paresis, vert • Escalation of hearing loss and tinnitus • Initial evaluation of complex otologic disease (cholesteatoma, acoustic neuroma)
Laryngology	• Stable, chronic symptoms (chronic dysphonia, long-standing cough, mild dysphagia, globus, and excessive mucous) • Follow up patients with stable/improved symptoms without clinical disorders or prior examination findings that require serial examination (eg, neurogenic sensory complaints)	• Urgent symptoms (airway complaints, hemoptysis, severe dysphagia) • Hoarseness in smokers • Sudden-onset hoarseness

Pediatric	• New patient history of nonacute, long-term health issues (obstructive sleep apnea, chronic tonsillitis, failed hearing screening, recurrent otitis media) • Routine postoperative visit with limited examination need (adenoidectomy, tonsillectomy)	• Acute symptoms or conditions • Urgent symptoms • Worsening chronic symptoms requiring an examination
Head and neck	• Initial history and review of medical records (office examination to follow) • Efficient determination of additional testing and consultations • Review of diagnostic tests (biopsy, imaging) • Triaging of long-term cancer follow-up and patients with benign neoplasm	• New patient with cancer (examination and office procedures) • Concerning symptoms in a patient with a history of cancer (hoarseness, shortness of breath, enlarging tumors, worsening dysphagia)
Facial plastics	• Initial consultation (followed by in-person evaluation) • Preoperative counseling • Routine postoperative follow-up	• New patient examination, photography following initial telemedicine consultation, prior to surgery • Postoperative follow-up requiring examination/ procedures
Sleep medicine	• Initial patient consultation, review of diagnostic testing, coordination of care, review of test results • Follow-up of patients treated with positive airway pressure devices, dental devices • Discussion after home sleep testing	• Examination of new patients and preoperative patients • Postoperative examination • Hypoglossal nerve stimulator activation, adjustment, troubleshooting
Audiology and speech-language pathology	• Failed newborn hearing screen counseling prior to testing • Hearing aid, cochlear implant counseling • Hearing aid management and troubleshooting • Assessment of device repair, followed by sending the device to the office • Speech therapy consultation and therapy	• Routine and emergency audiology testing • Speech therapy for patients with laryngectomy dysphagia

[a]Need for subsequent evaluation is individualized after initial screening visit.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