

Telehealth and oropharyngeal dysphagia: An integrative review

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ABSTRACT

Purpose: to analyze the telehealth speech therapy approach in patients with oropharyngeal dysphagia and determine the applications and effects of this practice.

Methods: the following descriptors were used for selection: Telerehabilitation, Telemedicine, "Remote Consultation", "Healthcare Delivery", "Distance Counseling", "Therapy, Computer-Assisted", "Speech-Language Pathology", "Speech Therapy", "Swallowing Disorders", Dysphagia, "Bottle Feeding" and "Enteral Nutrition" in PubMed, MedLine, Scopus and Web of Science databases and in the gray literature, by Google Scholar and ProQuest. Studies were selected without time limits, in Portuguese, English and Spanish, that described the applicability and/or effects of telehealth in speech therapy practice in patients with swallowing disorders/dysphagia, regardless of gender and age. For analysis, the following were considered: level of scientific evidence and recommendation, telehealth modality, objectives, methods and results/conclusion.

Literature Review: 490 articles were found and, after exclusion of duplicates, analysis of titles, abstracts and reading of full articles, 22 studies were selected. The articles were classified into telehealth modalities: tele-education, telediagnosis, teleconsulting, teleregulation and telemonitoring.

Conclusion: the telehealth modalities described had a great potential to promote significant improvements in patients presented with swallowing disorders/dysphagia, suggesting them as viable for speech therapy services. Among them, teleconsultation was the least addressed.

Descriptors: Swallowing; Swallowing Disorders; Telemedicine; Telerehabilitation; Speech-Language Pathology

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INTRODUCTION

For human survival, food is a fundamental source for the achievement of nutrients, energy and pleasant and sensorial experiences. There are several types of feeding routes, with oral route being the physiological type. However, some people have limitations in oral intake, requiring the use of an alternative route, posture maneuvers and/or management to encourage oral feeding¹. These procedures are needed in cases with changes in swallowing, called oropharyngeal dysphagia, with damage to the neural, motor and/or sensory systems that regulate the function of safely transporting food from the mouth to the stomach²⁻⁴.

Regardless of the etiology of dysphagia, there may be health risks, increasing the likelihood of malnutrition, lung infection, difficulties in chewing, nasal regurgitation, saliva control, coughing and/or choking, which affect the mortality and morbidity rates and hospital costs^{1,5,6}. Therefore, dysphagic patients require longitudinal care that can meet their demands, minimizing the damage caused by the manifestations of dysphagia. For that purpose, a multidisciplinary team with integrative and humanized work is necessary, which includes the participation of the speech-language pathologist at different healthcare levels^{7,8}.

Due to the frequent demand for care of patients with dysphagia in the Intensive Care Unit (ICU), Hospital Speech Therapy allows early intervention by evaluation and differential diagnosis, aiming at preventing and reducing clinical complications⁹. In this sense, this may also involve the rehabilitation of aspects of cognition and communication, besides integrating Tele Speech Therapy into the hospital environment^{10,11}.

To provide health for everyone and everywhere, in 2019, the World Health Organization (WHO) began developing the global Digital Health strategy. In this plan, Digital Health is understood as all concepts related to Information and Communication Technology (ICTs), understood as tools that use technological advances to enhance the access to health¹². Integrated into digital Health, Telehealth was included in this concept, and, by the publication of Decree N. 9795 of May 17th 2019, the Ministry of Health assigned the responsibilities for Telehealth in Brazil to the Department of Digital Health within SUS^{13,14}.

In the United States of America (USA), in 2005, as a result of advances in information and communication technology, the American Speech Language Hearing Association (ASHA) promoted the use of telepractice to offer speech therapy services, besides

distance education activities, being an appropriate model for assessment, intervention, telesupervision and continuing education^{15,16}. The first documentation on the application of telehealth in speech and language disorders in the USA dates back to 1987. However, the provision of this service in Brazil is recent¹⁷.

Faced with social isolation resulting from the COVID-19 pandemic, health services reorganized the manner of assistance delivery to users¹⁸. Thus, Speech Therapy was reinvented during the pandemic, advancing practices by telehealth as a manner of serving the population, enabling the use of technologies and promoting health¹¹.

From this perspective, the present study aimed at analyzing the speech therapy approach by telehealth in patients presented with oropharyngeal dysphagia and determining the applications and effects of this practice.

METHODS

This is an integrative literature review. To define the research question, the PECO strategy¹⁹ was used – 1) Population/patients = individuals of all ages, both sexes, with changes/difficulties in swallowing/dysphagia; 2) Exposure = telehealth applied by Speech Therapy aimed at changes/difficulties in swallowing/dysphagia; 3) Comparison/control = not applicable; 4) Outcome (clinical outcome) = applicability and/or effects on swallowing function/dysphagia.

The location and selection of studies were conducted by surveying published texts on the subject, in the following databases: MedLine (PubMed), Scopus and Web of Science. Additionally, the gray literature was searched in Google Scholar and ProQuest databases, to retrieve all studies on the topic. There were no limits of the collection period/date of publication of studies. The following descriptors were used, in English, Spanish and Brazilian Portuguese: *Telerehabilitation*, *Telemedicine*, *“Remote Consultation”*, *“Delivery of Health Care”*, *“Distance Counseling”*, *“Therapy, Computer-Assisted”*, *“Speech-Language Pathology”*, *“Speech Therapy”*, *“Deglutition Disorders”*, *Dysphagia*, *“Bottle Feeding”* and *“Enteral Nutrition”*. The search was conducted in September 2020 based on combinations and crossings of descriptors, using the logical operator AND, to combine descriptors and terms used to track publications, besides the OR operator to search for similar terms (Appendix A). The search was conducted independently by two researchers, aiming to minimize possible citations losses.

The analysis of each retrieved citation was performed independently by three researchers. Initially, the titles and abstracts of citations were read, aiming at evaluating the relevance of their selection and inclusion in the study. Subsequently, the full texts of the selected citations were analyzed.

References were managed and duplicates were removed using EndNote X7 software (Thomson Reuters, Philadelphia, Pennsylvania)²⁰. Titles and abstracts were read using Rayyan software (Qatar Computing Research Institute, Doha, Qatar)²¹.

The research selected studies that described the applicability and/or effects of telehealth in speech therapy practice on individuals with swallowing disorders/dysphagia, of both sexes, regardless of age. Studies that did not address speech therapy by telehealth, did not focus on the habilitation/rehabilitation of swallowing/dysphagia, reviews, letters, editorials, conference proceedings, written in languages other than Portuguese, English or Spanish were excluded, as well as repeated studies by overlapping of keywords.

The articles that composed the study sample were analyzed by two manners. The first assessed the scientific evidence and recommendation levels using the *Oxford Centre for Evidence-based medicine* instrument²² (Oxford); and the second comprised a critical analysis, based on the review objectives. The *Oxford*²² instrument is a method based on research design and classifies citations in relation to scientific evidence levels – 1a, 1b, 1c, 2a, 2b, 2c, 3a, 3b, 4 and 5 – and in recommendation degrees – A, B, C and D.

During critical analysis, the articles were evaluated regarding the applicability and effects of telehealth in Speech Therapy applied to the swallowing/dysphagia function. The following markers were extracted from the full texts: telehealth modality (tele-education, telediagnosis, teleconsulting, teleregulation and telemonitoring); goals; methods; and results/conclusion.

LITERATURE REVIEW

A total of 460 scientific articles were analyzed, 22 of which were considered valid to be included in the review (Figure 1).

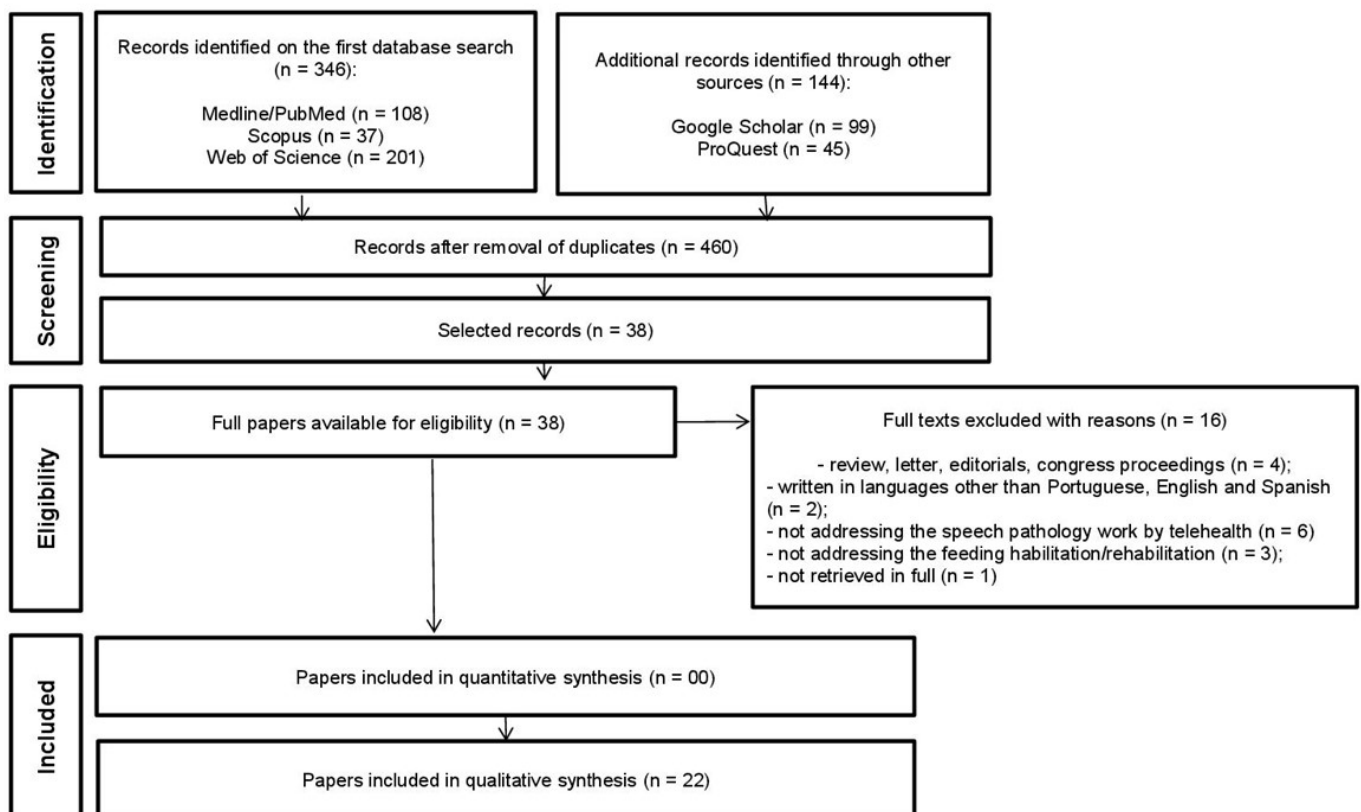


Figure 1. Flowchart of article selection for the review

The scientific evidence level and recommendation degree²² of studies are described in Table 1. Studies that address speech therapy by telehealth in patients with swallowing disorders/dysphagia are still scarce, especially concerning the application and effects of this practice. Research with small number of participants and lack of description of assessment and treatment methodologies in depth reduce the scientific evidence level. It is necessary to expand the scientific production

in this area, especially randomized clinical trials and systematic reviews, to establish evaluation criteria and treatment methodologies¹⁹. In the selected articles, there was predominance of observational studies or clinical trials with lower methodological quality, which usually do not allow generalizations. Some studies cite techniques/manners of applying telehealth⁴⁵ with small-scale tests.

Chart 1. Scientific evidence level and degree of recommendation of selected articles

Reference	Evidence level	Degree of recommendation
Brady et al., 2018 ²³	2B	B
Cassel and McIlvaine, 2017 ²⁴	2B	B
Catalini et al., 2020 ²⁵	2C	B
Malandraki et al., 2011 ²⁶	2C	B
Malandraki et al., 2014 ²⁷	4	C
Raatz et al., 2019 ²⁸	2C	B
Burns et al., 2019 ²⁹	2C	B
Burns et al., 2017 ³⁰	2B	B
Davis and Copeland, 2005 ³¹	2B	B
Ferguson, 2018 ³²	2B	B
Kantarcigil et al., 2017 ³³	2C	B
Mayadevi et al., 2018 ³⁴	2C	B
Morrell et al., 2017 ³⁵	2C	B
Sharma et al., 2011 ³⁶	2C	B
Wall et al., 2016 ³⁷	2B	B
Ward; Burns et al., 2014 ³⁸	2C	B
Ward; Sharma et al., 2012 ³⁹	2C	B
Bidmead et al., 2015 ⁴⁰	2C	B
Constantinescu et al., 2018 ⁴¹	4	C
Perlman and Witthawaskul, 2002 ⁴²	5	D
Wall et al., 2015 ⁴³	4	C
Wall et al., 2018 ⁴⁴	2B	B

Chart 2 presents the results of the critical analysis stage. The articles were separated by telehealth modality - tele-education, telediagnosis, teleconsulting and telemonitoring⁴⁵.

Analyzing the articles that addressed teleeducation as a telehealth modality (n=4), all of them used ICT-assisted training, one of them for professional team training³¹ and the other three for professional training/education^{23,25,32}.

Researchers³¹ verified the effectiveness of a swallowing safety module applied to the nursing team at medical centers, by applying pre- and post-training knowledge tests. Also, they recorded a 59.6% decrease in hospital pneumonia rates after applying the program, not evidencing other known changes in hospital policy, suggesting that dysphagia management training is necessary and aid healthcare professionals to qualify by teleeducation.

Chart 2. Critical analysis of articles that made up the review, according to telehealth modality^(12,45)

Modality	References	Objectives	Methods	Results/Conclusion
Teleeducation (n = 4)	Davis and Copeland, 2005 ³¹	To determine if there are changes in knowledge levels after swallowing safety training and to explore the effects of training on nurses who assist individuals with swallowing disorders.	<ul style="list-style-type: none"> - Experimental study involving 123 nurses and nursing assistants, divided into experimental group (EG) (n=60) and control group (CG) (n=63). - EG: implemented a training program in swallowing safety, using an interactive lecture developed by a team of speech-language pathologists, and applying a pre- and post-training knowledge test; - CG: application of the same knowledge test in two moments, without training. 	<ul style="list-style-type: none"> - 82% of individuals in EG improved their scores in the post-training test compared to 49% in the CG; - Pre x post: statistically significant difference was found in EG, while the CG score did not change significantly.
	Brady et al., 2018 ²³	To evaluate the effectiveness of an online course designed to increase the ability to accurately interpret the fiberoptic endoscopic evaluation of swallowing (FEES) and compare it to the traditional (in-person) procedure.	<ul style="list-style-type: none"> - Experimental study involving 108 postgraduate Medicine and Speech-Language Pathology students divided into: group 1 – online course (n=57) and group 2 – in-person course (n=51). - Both groups underwent three stages: pre-knowledge test, FEES training program and post-knowledge test. 	<ul style="list-style-type: none"> - The change in knowledge observed in both groups was significant in the pre- and post-training test comparison, without difference between them; - The positive points of the online course were the flexibility of schedule and the control of pace for content access.
	Ferguson and Estis, 2018 ³²	To test video simulation as a method to meet the training needs to develop clinical expertise and skills to safely assess the feeding of premature infants.	<ul style="list-style-type: none"> - Experimental study involving 108 Nursing students and Speech-Language Pathology postgraduate students, divided into two groups: didactic training (DT) (n=51) and didactic training with video simulation (DTVS) (n=43); - The groups underwent training by an online research platform and the DTVS received a simulated video recording of behavioral signs of disorganization; - Students were evaluated before and after training. 	<ul style="list-style-type: none"> - The knowledge of students increased in the post-training test, without differences in scores between the two types of training; - The DTVS group interpreted simulated feeding behaviors of premature babies more accurately than the DT group.
	Catalini et al., 2020 ²⁵	To verify the effectiveness of using distance learning, combined with in-person learning, in the dysphagia learning process of undergraduate Speech-Language Pathology students.	<ul style="list-style-type: none"> - Experimental study involving 15 undergraduate Speech-Language Pathology students, divided into group 1 (n=8) – who attended the course in person, and group 2 (n=7), who attended the course in a hybrid form; - Participants answered a questionnaire with questions about the content addressed, and an assessment protocol on skills and competences was applied. 	<ul style="list-style-type: none"> - There was statistically significant difference between scores obtained by students in the questionnaire on the content addressed in the pre- and post-moments only for students in group 2; - Regarding the skills and competences protocol, the scores were similar for students in both groups.
Telediagnosis (n=7)	Perlman and Witthawaskul, 2002 ⁴²	To develop an internet system to allow the evaluation of oral and pharyngeal phases of swallowing in real time and interactively - TESS.	<ul style="list-style-type: none"> - Descriptive study presenting an equipment with two components: 1) a computer connected to the videofluoroscopy service in a hospital – image capture + transmission + storage; 2) a computer for control and analysis in a location with capacity for remote management and analysis of exams. 	<ul style="list-style-type: none"> - A delay was identified between the two images - image captured in the hospital and the controller (3 to 5 seconds). - The image was subjected to analysis, allowing to use the equipment in future studies.
	Malandraki et al., 2011 ²⁶	To test the feasibility and clinical usefulness of a telefluoroscopy protocol – by an internet system, remote and in real time – for swallowing assessment.	<ul style="list-style-type: none"> - Analytical cohort study involving 32 patients diagnosed with stroke or head and neck cancer, between 50 and 75 years of age; - Participants underwent two fluoroscopic assessments - traditional and by the Teledynamic Assessment Software System (TESS). 	<ul style="list-style-type: none"> - The results demonstrated good general agreement in the subjective severity ratings (k = 0.636) and in the penetration-aspiration scale ratings between the assessment modes; - Agreement on treatment recommendations was moderate to high, ranging from 69.3% to 100%.
	Sharma et al, 2011 ³⁶	To provide initial information (pilot study) on the feasibility and validity of performing clinical assessments of dysphagia by telerehabilitation.	<ul style="list-style-type: none"> - Ten actors portraying patients with a variety of swallowing difficulties were involved in the study; - Dysphagia was assessed simultaneously by a speech-language pathologist by clinical examination and telerehabilitation; - Each simulated patient was evaluated using a clinical swallowing examination protocol. For telerehabilitation, the protocol was adapted and administered with the support of an assistant. 	<ul style="list-style-type: none"> - The results revealed that telerehabilitation allowed the clinical assessment of swallowing in a manner not much different from the traditional assessment; - There was high agreement between the results of remote and traditional assessments.

Modality	References	Objectives	Methods	Results/Conclusion
Telediagnosis (n=7)	Ward and Sharma et al, 2012 ³⁹	To evaluate the validity of performing clinical assessments of dysphagia by telerehabilitation. To determine the agreement level between online and in-person assessment regarding food safety.	- Forty dysphagic patients, with mean age 66 years; - Simultaneous clinical assessments by a speech-language pathologist in person and a speech-language pathologist remotely; - Dysphagia was assessed using a clinical examination protocol in both cases, involving the use of an assistant for remote assessment.	- The agreement levels between in-person and remote assessment revealed that most parameters reached clinically acceptable levels: aspects of oral, oromotor and laryngeal function revealed levels that varied between 75 and 100% (kappa = 0.36-1.0); parameters related to food varied between 79 and 100% (kappa = 0.61-1.0); and parameters related to the risk of aspiration and swallowing management varied between 79 and 100% (kappa = 0.49-1.0).
	Morrell et al., 2017 ³⁵	To report the development, implementation and reliability testing of a hospital telehealth assessment for patients with acute stroke.	- Prospective study with participation of 100 volunteers. Each patient was evaluated sequentially by an audiologist at bedside and a telehealth audiologist; - Telehealth assessments used the RP-7i remote presence system (InTouch Health); - Both speech-language pathologists completed a data form documenting the patient's clinical factors and recommended diet based on the speech-language pathology assessment.	- The mean time between telehealth and bedside assessments was 43 minutes; - Bedside and telehealth speech-language pathologists agreed 91% on liquid diet recommendations and 87% on solid diet recommendations.
	Ward et al., 2014 ³⁸	To examine if the severity of dysphagia impacts: a) clinical decision-making for the safety of oral intake, b) perceptions of clinical swallowing examination conducted by telerehabilitation.	- Descriptive study involving 100 volunteers, divided into 4 groups – 1) non-dysphagic, 2) mildly dysphagic, 3) moderately dysphagic, 4) severely dysphagic; - Participants were assessed remotely and in person, simultaneously; - Dysphagia was classified according to the Dysphagia Outcome and Severity Scale (DOSS).	- Acceptable agreement levels between examiners were observed for decisions regarding safe levels of oral intake of food and liquids, as well as more than 90% of items in the clinical swallowing assessment; - Agreement levels were not negatively affected by the severity of dysphagia; - However, the perceptions from online clinicians indicated that a greater proportion of patients in the severe group had more complex signs and were more difficult to assess.
	Kantarcigil and Malandraki, 2017 ³³	To develop an electronic case history tool/form (e-HiT) for adult patients with oropharyngeal dysphagia and examine its effectiveness compared to its printed version in relation to completion time, integrity level, independence level, and patient satisfaction.	- Experimental study involving 40 adults with scores above 3 on the EAT-10 instrument, divided into groups A and B, in a randomized manner. The two groups were exposed to the same procedures, in alternate order – filling the e-HiT form and printing the instrument. - A satisfaction survey was completed after the experiment.	- Participants had mean age of 40 years, with a mean score of 10.27 on the EAT-10; - There were no statistically significant differences for completion time (p = 0.743), completeness (p = 0.486) and independence (p = 0.738); - The satisfaction level indicated significantly greater responses in favor of e-HiT.
Teleconsulting (n=1)	Raatz et al., 2020 ²⁸	To establish the current perceptions of speech-language pathologists on the types of food services by telepractice, their current use of telepractice in providing pediatric food services and explore barriers and facilitators.	- Analytical study involving 84 speech-language pathologists with experience in pediatric feeding in Australia; - Participants completed an electronic questionnaire consisting of items such as demographic data, feeding services and experiences, telepractice experience, and perceptions and experiences of providing pediatric feeding services via telepractice.	- Only 20% were offering pediatric feeding services by telepractice; - Participants commented that telepractice could help them offer more frequent assessments, provide services to families who would not otherwise have access to services, increase access to specialized services for families, and conduct consultations in the natural environment of the child.
Telemonitoring (n=10)	Cassel and McIlvaine, 2017 ²⁴	To compare the results of traditional dysphagia intervention with teledysphagia intervention, measuring correct and incorrect responses to visual and auditory cues presented by a speech-language pathologist.	- Thirty participants with stroke and confirmed dysphagia divided into 2 groups, with one group receiving intervention by teledysphagia and the other traditional intervention.	- Efficacy measurements revealed that 87% of teledysphagia participants achieved their clinical goal compared to 80% of traditional intervention participants. - It can be concluded that the teledysphagia method can produce effective clinical results similar to a traditional in-person method.

Modality	References	Objectives	Methods	Results/Conclusion
Telemonitoring (n=10)	Malandraki et al., 2014 ²⁷	To examine the feasibility of providing dysphagia treatment by telepractice in a pediatric patient; and secondarily, to examine if this program was effective.	<ul style="list-style-type: none"> - 6-year-old male child, with primary diagnoses of Opitz BBB/G and Asperger Syndrome, post tracheostomy with decannulation ten months before the program onset; - The intensive treatment program consisted of 8 sessions, each session lasting 1 hour and daily home practice; - Post-intervention assessment (four weeks) and follow-up family interview four weeks after program completion. 	<ul style="list-style-type: none"> - After the intervention, the patient was accepting to ingest 5.25 times more food and 11.25 times more food; - The progress in accepting a variety of foods in pureed consistency was evident after the intervention; - There was reduction in saliva swallowing time post-treatment; - The results of the tele satisfaction questionnaire showed that the family seemed very satisfied with this program and mode of delivery and scored the online rehabilitation approach as equal to traditional in-person approaches.
	Burns et al., 2019 ²⁹	This study involved the multi-site implementation of a model for conducting adult clinical swallowing assessments by telepractice and examined its service outcomes, costs and consumer satisfaction.	<ul style="list-style-type: none"> - Five telepractice services were established, encompassing 18 facilities in a public health service; - Support for the implementation of services, including the training of speech-language pathologists in telepractice and support health workers at each site, was facilitated by an experienced project manager; - References of published protocols for dysphagia assessments by telepractice were managed by experienced speech-language pathologists; - Patient demographics, referral information, outcomes, costs, and satisfaction with telepractice were collected. 	<ul style="list-style-type: none"> - The first 50 sessions were analyzed; - Telepractice assessments were completed successfully with only minor technical issues; - Food/fluid changes were required after assessment to optimize safety or progress of oral intake in 64% of patients; - Service and cost were achieved with an average 2-day reduction in wait time and a benefit of \$218 per session when using the telepractice service; - High clinician and patient satisfaction were reported.
	Burns et al., 2017 ³⁰	To examine the efficiency of a telepractice service model and the satisfaction of service participants.	<ul style="list-style-type: none"> - Patients undergoing treatment for head and neck cancer participated in the study - divided into telepractice and in-person care; - The Functional Assessment of Satisfaction with Chronic Illness Therapy questionnaire (FACIT-TS, version 1.0) was completed to assess patient satisfaction with speech therapy treatment. 	<ul style="list-style-type: none"> - There were no significant differences between care models in relation to the time elapsed from referral to the first session; - Regarding the number and duration of events to manage clinical problems, a significantly smaller number was needed in the telepractice group; - High satisfaction levels were reported across all evaluation parameters by patients in favor of the telepractice service.
	Mayadevi et al., 2018 ³⁴	To verify the effectiveness of interdisciplinary discussions in improving the food intake of dysphagic patients, using the Functional Oral Intake Scale (FOIS) as a parameter for comparing results.	<ul style="list-style-type: none"> - Twenty-six patients with persistent dysphagia after treatment for head and neck pathology, from an institute in India; - The cases were discussed in the telemedicine meeting between the host institute and a second unit in the United States; - A monthly meeting was organized using a videoconferencing system. Swallowing and management problems were presented and, by discussions, a plan for further management was formulated; - The Intake Scale (FOIS) was measured before and after implementing the plan. 	<ul style="list-style-type: none"> - The recommendations coincided with those of the reception unit in 18, differed for three and were reformulated in five patients; - The mean FOIS was 1.46 (± 0.989) pre-treatment and 3.92 (± 1.809) post-treatment, with significant improvement ($p=0.0001$).
	Wall et al., 2017 ³⁷	To examine if adherence to therapy is influenced by the service delivery method.	<ul style="list-style-type: none"> - Adult patients diagnosed with oropharyngeal squamous cell carcinoma, with radiotherapy planning with non-surgical curative aim; - Three service delivery models: (1) traditional therapy, (2) technology-assisted therapy using an asynchronous telepractice app - SwallowIT, and (3) independently self-directed therapy. - The FOIS scale, MD Anderson Dysphagia Inventory (MDADI), Hospital Anxiety and Depression Scale (HADS), Multidimensional Fatigue Inventory (MFI) and multidimensional scale Health Locus of Control (HLC) were used. 	<ul style="list-style-type: none"> - The overall adherence rates were low (31 and 71%), with most patients completing no more than 25% of their exercises, with a particularly sharp drop in the fourth week. - Although radiotherapy-related toxicities impact adherence, adopting service delivery models with greater structure/support and providing extra assistance to patients with known risk factors can help optimize adherence to therapy. Telepractice may provide an alternative to support adherence where service restrictions limit intensive therapy.

Modality	References	Objectives	Methods	Results/Conclusion
Telemonitoring (n=10)	Bidmead et al., 2015 ⁴⁰	To report a second pilot project on the application of Teleswallowing.	<ul style="list-style-type: none"> - Application of the Teleswallowing program was conducted on 17 patients from 5 nursing homes with a demand to evaluate swallowing, with the participation of 6 speech-language pathologists who conducted the consultations, conducted over three months; - Training was provided to 10 nursing home nurses, which consisted of anatomy and mechanics of swallowing and use of equipment. The home team was prepared for the assessment before the tele-link; this included the patient's posture, oral hygiene and the attached pulse oximeter, thus allowing the speech-language pathologist to be in control and focus solely on the assessment, guiding the nurse. 	<ul style="list-style-type: none"> - Teleswallowing benefited both patients and participating nursing homes. Better use of professional time and cost savings were demonstrated, and evidence showed that the service could be scaled up successfully; - Improved knowledge increased confidence among nurses and allowed them to provide better quality of care for patients by improved feeding techniques and quicker recognition of signs of dysphagia; - Notwithstanding, a series of barriers were identified - problems with technology and the attitude of speech-language pathologists towards these barriers.
	Constantinescu et al., 2018 ⁴¹	To conduct the first usability test of a mobile health device for swallowing therapy at home.	<ul style="list-style-type: none"> - Five patients with head and neck cancer participated in the evaluation of the mobile therapy program (Mobili-T); - Participants were scheduled for individual sessions with a speech-language pathologist, where they were introduced to the study and the system; - Pairing the device with the app and navigating the tutorial were demonstrated. After that, participants were asked to complete five tasks: pair the device with their smartphone; place the device correctly; perform a set of exercises; interpret progress screens; and close the application. 	<ul style="list-style-type: none"> - In application efficiency, task 1 required five instances of assistance for three participants. Tasks 2 and 4 required assistance once; - Regarding satisfaction, participants scored the app favorably for the ease of completing a task, the time for that purpose, and the support information provided.
	Wall et al., 2016 ⁴³	To evaluate user perceptions of a new asynchronous telepractice application, 'SwallowIT', designed to support patients to remotely complete intensive swallowing therapy during chemoradiotherapy treatment.	<ul style="list-style-type: none"> - Fifteen patients with oropharyngeal cancer used SwallowIT; - A 12-item questionnaire was administered: (a) immediately after SwallowIT orientation; and (b) at the conclusion of chemotherapy (treatment completion). 	<ul style="list-style-type: none"> - The majority of patients reported positive initial perceptions regarding SwallowIT for comfort (87%), confidence (87%), motivation (73%) and support (87%); - No statistically significant changes in perceptions were observed at the two assessment moments.
	Wall et al., 2019 ⁴⁴	To investigate the costs to the healthcare service and patients associated with the SwallowIT model, compared to two alternative methods of service delivery: (1) traditional and (2) independent patient-directed.	<ul style="list-style-type: none"> - 75 patients with oropharyngeal cancer receiving radiotherapy were randomized to receive therapy via: traditional means (n = 24); patient-directed (n = 26) or SwallowIT-assisted (n = 25) care model; - Data regarding healthcare service costs (service time, consumables, therapy resources), patient-attributable costs (travel and wages) and health-related quality of life were collected. 	<ul style="list-style-type: none"> - SwallowIT provided a more cost-effective care model than the professional-directed model (equivalent results at reduced cost) and greater cost-effectiveness than the patient-directed model (improved results achieved at an acceptable cost).

Captions: EG = experimental group; CG = control group; FEES = fiberoptic endoscopic evaluation of swallowing; DT = didactic training; DTVS = didactic training with video simulation; e-HIT = electronic case history form/tool; FACOT-TS = Functional Assessment of Satisfaction with Chronic Illness Therapy; FOIS = Functional Oral Intake Scale; MDAD = MD Anderson Dysphagia Inventory; HADS = Hospital Anxiety and Depression Scale; MFI = Multidimensional Fatigue Inventory; HLC = Multidimensional scale Health Locus of Control.

In the search for training professionals, a study²³ concluded that the incorporation of technology in postgraduate programs in Medicine and Speech-Language Pathology yielded gains comparable to traditional lectures in relation to the ability to learn how to accurately interpret the endoscopic fiberoptic swallowing exam (FEES). Another study³² identified that the use of video simulation allows students to effectively apply premature infant feeding principles and practice critical thinking skills before entering related clinical internships. The study mentions that, in the current educational environment, training opportunities with high-risk premature babies are limited due to the

difficulty in accessing specialized health services and the availability of experienced clinical supervisors, and also indicates high costs of patient simulators.

Finally, another study²⁵ concluded that hybrid teaching was effective for the training of Speech-Language Pathology students in relation to the supervised internship discipline aimed at oropharyngeal dysphagia, only applied in the in-person modality.

Seven studies were classified as telediagnosis^{26,33,35,36,38,39,42}. Among these, two studies applied videofluoroscopic (VFS) examination of swallowing associated with telehealth^{26,42}. One of them⁴² presented a real-time internet system for interactive assessment

of the oral and pharyngeal phase of swallowing – TESS. Even though a delay was identified between the image captured in the hospital and the image from the controller, swallowing assessment was possible. The other²⁶ tested the viability of TESS, a system presented in a previously described study. There was agreement for classification and recommendation between the evaluations conducted by the system and by the traditional method.

In three other studies, swallowing was clinically evaluated using remote and in-person modes^{35,36,39}. One³⁶ demonstrated no differences in agreement between the two modalities, indicating the feasibility of clinical assessment in remote mode. The other study³⁹ showed high agreement levels between in-person and remote assessments regarding the safety of feeding dysphagic patients. The authors³⁹ highlight that the oral hygiene aspect presented a lower reliability index than that determined by the study (80%). Similarly, a study³⁵ evaluated patients with acute stroke in person at bedside and remotely with the RP-7i system (InTouch Health). Although it was not possible to palpate the patient remotely, the researchers felt comfortable judging without this procedure, using the system's zoom feature, which was enough to observe the laryngeal elevation³⁵.

Another study³⁸ examined if the severity of dysphagia impacted clinical decision-making for the safety of oral intake and clinical perceptions during clinical swallowing examination conducted by telerehabilitation. The results support the use of telerehabilitation to provide valid diagnoses for patients with any severity of dysphagia and highlight the importance of clinicians to perform adequate training and preparation before evaluating more complex patients.

A study³³ also documented the effectiveness of an electronic form (e-Hit) for outpatients with dysphagia and provided evidence that the first stage of a swallowing assessment – completing the case history – can be effectively completed by telehealth by individuals with a reliable internet connection and basic computer literacy skills.

In the teleconsulting modality, only one study was found²⁸, in which an online survey was conducted to determine the perceptions of speech-language pathologists of pediatric food services by telepractice and identify obstacles and facilitators. Only 17% of the sample demonstrated confidence in offering clinical services, indicating the need for training. Although the majority of respondents reported access to technology,

most had difficulty accessing it on a daily basis to establish regular telepractice services. Concerns regarding the safety and effectiveness of conducting pediatric feeding assessments by telepractice were also reported. They concluded that continued efforts to improve clinician access to technology and other evidence of the effectiveness of this pediatric feeding service delivery model will aid its clinical implementation.

The studies identified as components of telemonitoring were prevalent in relation to other telehealth modalities^{24,27,29,30,34,37,40,41,43,44}. Among these, four studies^{24,30,37,44} compared remote care with in-person care to list the weaknesses and potential of each modality, as well as the implementation of monitoring methods and applications.

One study³⁷ compared three treatment models: in-person, by the SwallowIT app and patient self-directed therapy. The percentage of exercises completed by participants was 27%, regardless of the model. Common reasons for non-adherence were pain, nausea, thick saliva, difficulty swallowing, fatigue, depression, and difficulties adapting in practice around life and work commitments. Considering the SwallowIT model, comparable levels of adherence to professional-directed treatment and superior adherence to self-directed therapy were found.

Another study³⁰ compared the remote care model with traditional care in a population of patients undergoing treatment for head and neck cancer to identify the satisfaction level of participants. There were no differences between service models in relation to waiting time. However, professionals who assisted the group remotely did not spend with travel costs. Providing specialized speech therapy services remotely to patients undergoing head cancer treatment who live in rural areas has been shown to be effective with a high level of patient satisfaction.

With the same objective, a study²⁴ compared the results of dysphagia treatment in patients with stroke by in-person and online modalities. In the latter, the sessions were conducted by two speech-language pathologists using video conference via FaceTime and patients received visual and auditory cues to facilitate the understanding of strategies. All sessions were recorded and viewed by a third certified speech-language pathologist for interexaminer reliability. The teledysphagia method produced effective results.

Assessing the treatment delivered by different modalities, another study⁴⁴ investigated the costs for

health service using the SwallowIT model compared to weekly in-person model with the speech-language pathologist and independent treatment directed to the patient. SwallowIT provided better cost-effective care than the professional-directed and had higher cost-effectiveness than the patient-directed model.

Also using SwallowIT, a study⁴³ evaluated users' perception of the application, which was designed to support patients with oropharyngeal cancer to remotely complete intensive swallowing therapy and with support during chemoradiotherapy treatment. The application was available on a tablet that contained guidelines for swallowing exercises with the support of educational videos, images and texts. The results did not indicate statistically significant changes in perceptions at the two assessment moments. However, users reported easy utilization of SwallowIT and considered the method effective and functional in applying the exercises.

From another perspective, a case report was conducted²⁷ to identify the feasibility of a telehealth method in a pediatric patient. The patient was completely dependent on gastrostomy tube for food, nutrition and hydration for four years. For evaluation, the Eating Assessment Tool (EAT-10) protocol and videofluoroscopy were used. After that, the patient underwent an intensive telepractice program which eliminated the sensation of trapped food, previously identified as a serious problem by the family. The family was satisfied and indicated a preference for the remote program and modality, classifying it similarly as the in-person method.

The Teleswallowing program was used in a study⁴⁰ and conducted in five nursing homes to assess swallowing remotely. The assessment was performed by video call, in which the speech-language pathologist observed the patient and directed nurses to assist with the participants' posture and use of equipment. This program showed positive results in reducing costs, optimizing time, reducing the waiting list for speech therapy, besides increasing the nurses' confidence in identifying signs of dysphagia.

A mobile home telemonitoring device was evaluated in a study⁴¹ that subjected five patients to mobile therapy (Mobili-T). Participants were scheduled with a speech-language pathologist to be introduced to the system and the application browsing tutorial. The interpretation of progress screens was characterized as the task that required the most support from the speech-language

pathologist. Overall, patients were satisfied with the application and the supporting information.

Conversely, a study³⁴ evaluated the effectiveness of interdisciplinary discussions in the treatment of dysphagic patients after treatment of head and neck disorders. For that purpose, teleconferences were promoted between teams from two institutes from different countries – India and the USA – to discuss clinical history, physical examination and swallowing assessment. It was observed that 77% of patients had their oral route suspended before the meetings, and after them 70% were able to eat exclusively orally. The results suggest the feasibility of monthly telemedicine conferences between a multidisciplinary team, with benefits for the patient and specialized clinical training.

Finally, in one study²⁹, implementation of the telepractice model by speech-language pathologists with experience in telehealth services in dysphagia was reported. Operational issues such as incomplete routing documentation and technical issues such as camera and microphone position were reported. Notwithstanding, no appointments were canceled, and high satisfaction levels were reported by patients and professionals.

No studies were found on the teleregulation modality.

CONCLUSION

Studies were found in four modalities of telehealth: tele-education, telediagnosis, teleconsulting and telemonitoring. No studies were identified on teleregulation. The modality with the largest number of studies was telemonitoring, followed by telediagnosis, tele-education, and finally, teleconsulting.

Telemonitoring can produce effective clinical results similar to those of the in-person method. The use of programs, systems and applications to assist in the rehabilitation of swallowing disorders has demonstrated telemonitoring as a care facilitator, especially in remote areas, with reduction in the waiting list for speech therapy consultations and greater patient autonomy in treatment. The application of telediagnosis in clinical practice has proven challenging, due to technological barriers. However, compared to in-person diagnosis, it demonstrated a similar reliability level between professionals and greater satisfaction of users, due to the low travel cost and time optimization.

Tele-education may help and enhance the professional qualification and continuing education of speech-language pathologists and other health professionals,

besides being a great aid for educational institutions. Only one study was classified as teleconsulting, being related to consultation on the provision of clinical services.

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CAF: study co-supervisor, responsible for study conception and design, data collection, analysis and interpretation and manuscript writing;

LDM: study supervisor, responsible for study conception and design, data collection, analysis and interpretation, manuscript writing and critical review of the manuscript.

APPENDIX A. SEARCH STRATEGIES IN DATABASES AND GRAY LITERATURE.

Database	Search
Medline (PubMed)	<p>#1 Search: (((((((«Telerehabilitation»[Mesh]) OR «Telerehabilitation/methods»[Mesh]) OR «Telemedicine»[Mesh]) OR «Remote Consultation»[Mesh]) OR «Delivery of Health Care»[Mesh]) OR «Delivery of Health Care/therapeutic use»[Mesh]) OR «Distance Counseling»[Mesh]) OR «Therapy, Computer-Assisted»[Mesh]) OR «Therapy, Computer-Assisted/therapeutic use»[Mesh]</p> <p>#2 Search: (((«Speech-Language Pathology»[Mesh]) OR «Speech-Language Pathology/methods»[Mesh]) OR «Speech Therapy»[Mesh])</p> <p>#3 Search: (((((((«Deglutition Disorders»[Mesh]) OR «Deglutition Disorders/rehabilitation»[Mesh]) OR «Deglutition Disorders/therapy»[Mesh]) OR («Bottle Feeding»[Mesh] OR «Enteral Nutrition»[Mesh])) OR «Diet/therapeutic use»[Mesh]</p>
Scopus	<p>TITLE-ABS-KEY (telerehabilitation OR telehealth OR telediagnosics OR telemonitoring OR telemedicine)</p> <p>TITLE-ABS-KEY («swallowing disorders» OR «deglutition disorders» OR «dysphagia» AND therapy OR «deglutition therapy»)</p>
Web of Science	<p># 1 TS= (Telerehabilitation OR Telehelth OR Telemedicine OR Teletherapy OR Remote Consultation OR Distance Counseling OR Delivery of Health Care OR Telemonitoring OR Telediagnosis OR Therapy Computer Assisted)</p> <p>#2 TS= (Speech Language Pathology OR Speech Therapy AND Swallowing Disorders OR Deglutition Disorders OR Dysphagia Therapy OR Deglutition Therapy AND Bottle Feeding OR Enteral Nutrition)</p>
Google Scholar	<p>Tudo no título: « Telerehabilitation OR Telehelth AND Deglutition Disorders OR Dysphagia AND Speech Language Pathology”</p>
ProQuest	<p>TI,AB (Telerehabilitation OR Telehelth OR Telemedicine OR Teletherapy OR Remote Consultation OR Distance Counseling OR Delivery of Health Care OR Telemonitoring OR Therapy Computer Assisted) AND (Speech Language Pathology OR Speech Therapy) AND (Swallowing Disorders OR Deglutition Disorders OR Dysphagia Therapy OR Deglutition Therapy OR Bottle Feeding OR Enteral Nutrition)</p>