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# Provider and Patient Satisfaction with Telemedicine Voice Therapy During the COVID-19 Pandemic

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**Abstract: Objectives.** The COVID-19 pandemic expanded the use of telemedicine, but there is no literature exploring both patient and provider satisfaction specifically in the provision of voice therapy. This study aims to investigate patient and provider satisfaction with virtual voice therapy, its associated factors, and any correlation between the two.

**Methods.** Cross-sectional study. Participants included 226 adults who underwent voice therapy delivered via telepractice at the USC Voice Center between April and October 2020. Patients and providers self-reported their level of satisfaction on a visual analog scale (VAS; range 0-100). Patient satisfaction was additionally measured using a previously validated Telemedicine Satisfaction Questionnaire (TSQ; range 1-5), and a binary question about their desire to choose telemedicine over in-person therapy in the future. Three speech-language pathologists rated provider satisfaction for all 226 patients. Patient satisfaction survey was completed by 55 patients. Multi-variable linear regression analyses and linear mixed-effects models were used to assess the results.

**Results.** Patient and provider mean (SD) VAS satisfaction scores were 86.8 (18.6) and 80.6 (19.7), respectively. The mean (SD) TSQ score was 4.4 (0.6). In a multivariable model, patient satisfaction levels were significantly higher for hypofunctional than for hyperfunctional dysphonia diagnoses. Forty-four (73%) patients reported they would prefer telemedicine voice therapy over in-person appointments, which was significantly correlated with internet reliability ( $P = 0.04$ ). For providers, satisfaction was significantly lower for patients whose diagnosis had changed after initiation of voice therapy ( $\Delta = -16.0$  [95% CI: -28.7 to -3.2]) and for encounters with Asian patients compared to White patients ( $\Delta = -11.6$  [95% CI: -18.9 to -4.2]). Patient and provider satisfaction scores were weakly correlated ( $r = 0.19$ ).

**Conclusions.** Our findings suggest that virtual voice therapy is not simply an alternative to in-person service, but rather an effective method useful beyond the current pandemic with proper diagnosis and technical support.

**Key words:** Telemedicine—Telepractice—Voice therapy—COVID-19—Satisfaction.

**Abbreviations:** TSQ, telemedicine satisfaction questionnaire—USC, University of Southern California—VAS, visual analog scale.

## INTRODUCTION

Telemedicine involves the use of technology for the communication and delivery of healthcare. Prior to the emergence of COVID-19, telemedicine had already been established as a reliable and important alternative to in-person services during natural disasters and public health emergencies.<sup>1</sup> Given the high transmissibility of COVID-19 and its rapid evolution into a pandemic that put significant strain on all available healthcare resources, the Centers for Disease Control (CDC) released a statement in April 2020 encouraging the limitation of all non-essential in-person care.<sup>2</sup> Thus, healthcare systems began to rely increasingly on telemedicine for non-emergent services; it offered the opportunity to reduce COVID-19 transmission and conserve limited personal protective equipment while still providing the care

that patients require.<sup>3-7</sup> It was strongly recommended to utilize telemedicine for voice therapy in particular, given the high-risk nature of any respiratory tract complaint.<sup>8,9</sup>

The use of telemedicine during the ongoing pandemic has yielded good clinical outcomes and evidence that telemedicine platforms are easy to adopt for both patients and providers within all fields of medicine.<sup>10</sup> Telemedicine platforms are well supported by robust technological infrastructure,<sup>11</sup> even in rural areas that usually suffer from limited access to in-person care.<sup>5</sup> Within the field of otolaryngology, patients report high levels of satisfaction with telemedicine care.<sup>12-15</sup> A recent study performed at this institution demonstrated high concordance rates in both diagnosis and management between initial telemedicine visit and subsequent laryngoscopy findings obtained at an in-person visit<sup>16</sup>; thus, although laryngoscopy is ultimately needed for definitive diagnosis of vocal pathologies, empiric voice therapy can be offered via telepractice in certain situations until in-person evaluation is safely performed.

Patient satisfaction with in-person voice therapy is generally high,<sup>17,18</sup> but patient adherence to therapy is limited. Numerous studies report rates of dropout up to 40%,<sup>19-22</sup> with distance to therapy cited as one of the main reasons for lack of follow-up.<sup>22</sup> There is significant evidence that virtual voice therapy provides comparable outcomes to in-person

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sessions,<sup>23-29</sup> with telepractice allowing increased access to care for patients who may be geographically restricted.<sup>30</sup> Furthermore, several studies report that patients actually prefer virtual therapy over in-person sessions, citing decreased travel time as a noted benefit.<sup>20,31</sup> However, to our knowledge, there are currently no studies simultaneously investigating *both* patient and provider satisfaction in the provision of voice therapy via telepractice. Insight from both perspectives can help improve the care offered to patients and is critical to help direct future applications of virtual voice therapy. The aims of the current study included: (1) to determine and compare patient and provider satisfaction with voice therapy delivered via telepractice during the COVID-19 pandemic, and (2) to identify correlations between levels of satisfaction and patient demographic factors.

## MATERIALS AND METHODS

This study was conducted under the University of Southern California (USC) Institutional Review Board approval (HS-20-02853) and adhered to the tenets of the Declaration of Helsinki.

### Participants

Participants included adult patients (18 years or older) with a diagnosis of dysphonia who underwent more than one session of voice therapy delivered via telepractice at the USC Voice Center during the COVID-19 pandemic between April and October of 2020. Inclusion criteria required no disclosed cognitive impediment to participate in behavioral therapy delivered via telepractice as well as the ability to read and write in English. Patients received services from one of three speech-language pathologists specializing in voice disorders working at the USC Voice Center at the time. All three speech-language pathologists were female, aged between 27 and 40, and had completed a one year fellowship specializing in the diagnosis and treatment of voice disorders with at least one year of prior clinical experience.

### Demographic Data Collection and Diagnosis Classification

Demographic data collected included age, gender, race/ethnicity, insurance type, level of education, income, employment, and length of commute to clinic's physical location in minutes. A chart review was conducted to obtain an initial diagnosis as well as any change in diagnosis following laryngeal imaging. Patient dysphonia diagnoses were classified as (1) hyperfunctional (including phonotrauma, scar/sulcus, muscle tension dysphonia, spasmodic dysphonia, laryngospasm, and vocal process granuloma), (2) hypofunctional (including vocal fold atrophy, presbyphonia, unilateral vocal fold paralysis, and unilateral vocal fold paresis), or (3) other (including tremor, malignant vocal fold lesion, paradoxical vocal fold motion, throat clearing, throat pain, chronic laryngitis, postnasal drip, globus sensation, chronic

cough, hyodynia, and dyspnea). Scar/sulcus, spasmodic dysphonia, and vocal process granuloma were categorized as hyperfunctional diagnoses because primary goals for treatment targeted secondary maladaptive muscle tension dysphonia for those particular patients.

### Patient and Provider Satisfaction Surveys

Satisfaction surveys were completed by both patients and providers at the conclusion of the second therapy session; satisfaction surveys were not completed during any subsequent encounters. Patients and providers self-reported their level of satisfaction on a visual analog scale (VAS; range 0-100) with end anchors indicating 'not at all satisfied' or 'extremely satisfied'. Patient satisfaction was additionally measured using the Telemedicine Satisfaction Questionnaire (TSQ; range 1-5), a patient-reported outcome measure that has been shown to be both reliable and valid.<sup>32</sup> Used in numerous studies investigating patient satisfaction with telemedicine,<sup>15,33-41</sup> the TSQ consists of 14 items scored on a 5 point Likert scale and assesses satisfaction across the quality of care provided, similarity to face-to-face encounter, and overall perception of the interaction. Patients also answered two binary questions about (1) their desire to choose telemedicine over in-person therapy in the future and (2) their internet reliability.

### Statistical Analysis

Mean VAS provider satisfaction score (range 0-100) was estimated using a linear mixed-effects model. A random effect at the provider level was included to model provider-level deviation from the overall score and to account for clinician's rating encounters with multiple patients. Results from self-reported satisfaction scores obtained with the use of a VAS for providers and patients (range 0-100) were additionally reported using descriptive measures including means and standard deviations.

Two-way scatter plots were used to graphically explore the correlation between provider and patient satisfaction. Pearson  $r$  correlations were calculated to measure the degree of correlation between (1) VAS provider and VAS patient satisfaction scores, (2) VAS provider and TSQ patient satisfaction scores, and (3) VAS and TSQ patient satisfaction scores. Pearson  $r$  correlation coefficients were interpreted based on previous literature ( $\leq 0.35$ : weak correlations, 0.36-0.67: moderate correlations, 0.68-1.0: strong correlations).<sup>42</sup>

Univariable and multivariable mixed effect models were used to explore factors associated with the VAS provider satisfaction scores. Linear regression models were used to explore factors associated with the VAS patient satisfaction scores. Logistic regression models were used to explore factors associated with the patients' preference of choosing telemedicine for future visits. All analyses were conducted using Stata 16 (StataCorp, College Station, Texas). Significance was set at  $P < 0.05$ , two-tailed.

## RESULTS

## Patient and Provider Satisfaction

Our study cohort included 226 patients who completed one or more voice therapy sessions via telemedicine during the study period at a tertiary care center. Three speech-language pathologists rated provider satisfaction for all 226 patients. Patient satisfaction survey was completed by 55 patients

(24.3%). The majority of patients were diagnosed with hyperfunctional disorders on the basis of prior laryngeal imaging. Detailed demographic and diagnostic information can be found in [Table 1](#).

Mean (SD) VAS satisfaction scores (range 0-100) for telemedicine voice therapy sessions were high at 86.8 (18.6) for patients and 80.6 (19.7) for providers ([Figure 1A](#)). Mean

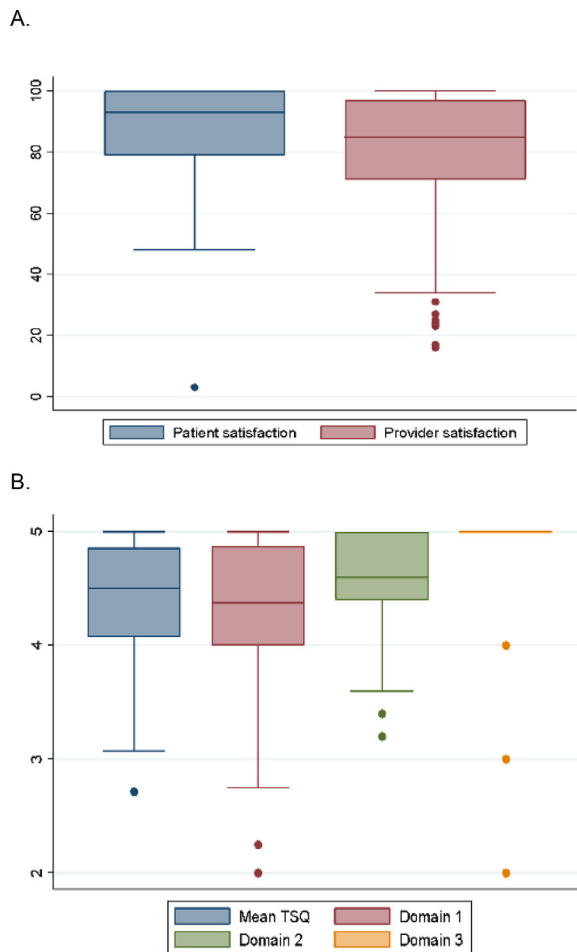
TABLE 1.

Summary of Patient Characteristics of Study Cohort (n = 226) and Subgroups of Patients Who Completed Satisfaction Questionnaire (n = 55)

	Total	Patients Who Completed Satisfaction Questionnaire
	N = 226	N = 55
Age, mean (SD)	48.1 (17.3)	47.9 (17.6)
Gender, n (%)		
Male	90 (29.8)	16 (29.1)
Female	134 (59.2)	37 (67.3)
Transgender female	1 (0.4)	1 (1.8)
Nonbinary	1 (0.4)	1 (1.8)
Race/Ethnicity, n (%)		
White	136 (60.2)	34 (61.2)
Black	21 (9.3)	4 (7.3)
Hispanic	14 (6.2)	5 (9.1)
Asian	32 (14.2)	8 (14.5)
Others or unknown	23 (10.2)	4 (7.3)
Insurance, n (%)		
Private insurance	160 (70.8)	39 (70.9)
Nonprivate insurance (medicare/medi-cal/worker's comp)	66 (29.2)	16 (29.1)
Provider		
1	13 (5.8)	1 (1.8)
2	114 (50.4)	31 (56.4)
3	99 (43.8)	23 (41.8)
Diagnosis		
Hyperfunctional	135 (59.7)	32 (58.2)
Hypofunctional	53 (23.5)	14 (25.5)
Others	38 (16.8)	9 (16.4)
Diagnosis changed? <sup>*</sup> (yes)	9 (4.0)	4 (7.3)
Laryngeal imaging? <sup>†</sup> (yes)	198 (87.6)	43 (78.2)
At least 1 in-person session? (yes)	67 (29.7)	16 (29.1)
Education (n=55)	n/a	
High school or less		6 (10.9)
College/university		27 (49.1)
Graduate school		22 (40.0)
Income (n=55)	n/a	
<\$45,000		9 (16.4)
\$45,000-100,000		19 (34.5)
>\$100,000		23 (41.8)
Unknown or refused		4 (7.3)
Employment (n=55)	n/a	
Currently working		28 (50.9)
Unemployed or currently not working		26 (47.3)
Unknown or refused		1 (1.8)
Commute to clinic (min), mean (SD) (n=55)	n/a	28.1 (24.6)
Internet reliable? (n=55)	n/a	49 (89.1)
Choose telemedicine again? (n=55)	n/a	40 (72.7)

\* Patients whose initial diagnosis at presentation was changed after receiving laryngeal imaging.

† Laryngeal imaging available prior to voice therapy? *Abbreviations:* min, minutes; SD, standard deviation.

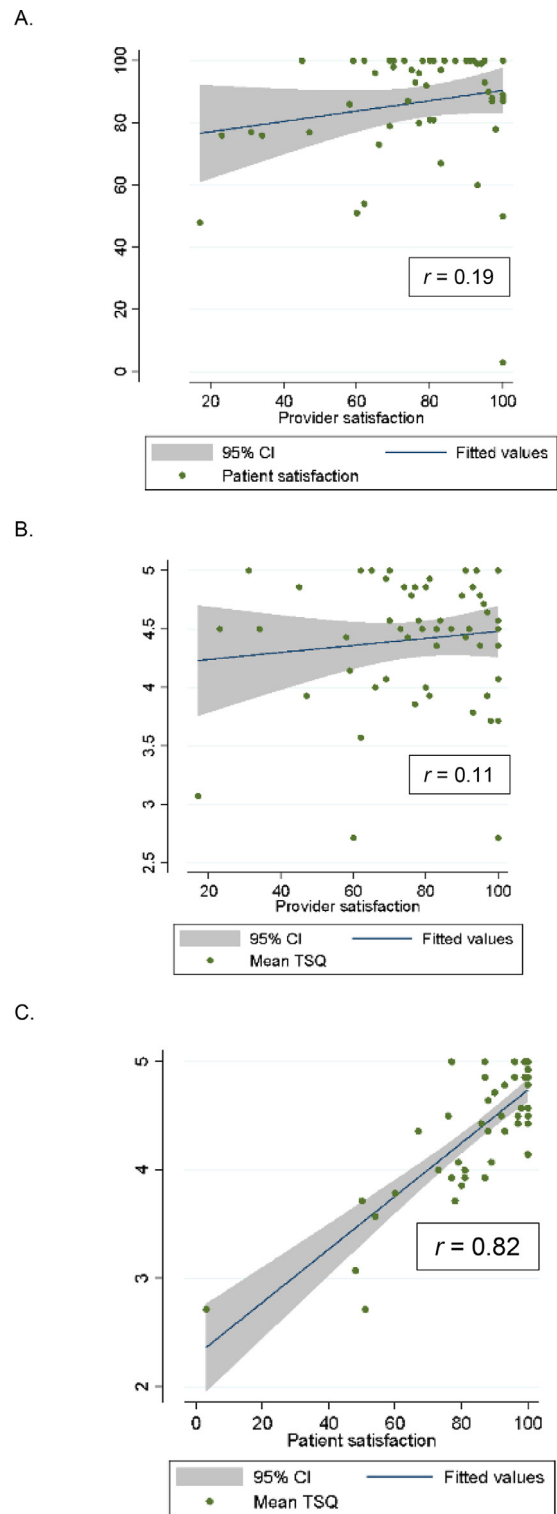


**FIGURE 1.** Boxplots summarizing patient and provider satisfaction. (A) Patient and provider satisfaction measured on a Visual Analog Scale (score range: 0 - 100). (B) Patient satisfaction measured on the Telemedicine Satisfaction Questionnaire (TSQ) (score range: 1 - 5). Mean TSQ is an average score for all 14 questions, domain 1 queries quality of care provided, domain 2 queries the similarity to a face-to-face encounter, and domain 3 queries the overall perception of the interaction. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

VAS provider satisfaction scores were additionally estimated using a mixed effect model to account for a random effect at the provider level to be at 79.5 [95% CI: 67.5-91.5]. The mean TSQ score (SD) (range 1-5) rated by the subset of the cohort who completed the patient satisfaction survey ( $n = 55$ ) was 4.4 (0.6) (Figure 1B). Correlations between provider and patient satisfaction scores were weakly positive for both VAS patient satisfaction scores (Figure 2A;  $r = 0.19$ ) and TSQ patient scores (Figure 2B;  $r = 0.11$ ). Correlation between VAS patient satisfaction and TSQ patient scores was strongly positive (Figure 2C;  $r = 0.82$ ).

#### Factors Associated with Provider Satisfaction

Univariable and multivariable linear mixed effects models were used to examine factors associated with provider



**FIGURE 2.** (A) Correlation between provider and patient satisfaction quantified on Visual Analog Scale (VAS;  $r = 0.19$ ). (B) Correlation between provider and patient satisfaction quantified on Telemedicine Satisfaction Questionnaire (TSQ;  $r = 0.11$ ). (C) Correlation between VAS patient satisfaction and TSQ patient score ( $r = 0.82$ ). ( $\leq 0.35$ : weak correlations, 0.36-0.67: moderate correlations, 0.68-1.0: strong correlations). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

**TABLE 2.**  
**Univariable and Multivariable Linear Mixed Effect Models Exploring Factors Associated With Provider Satisfaction**

	Univariable b-Coeff	P-Value	Multivariable b-Coeff	P-Value
Age	0.02 [-0.1 - 0.2]	0.767	0.02 [-0.2 - 0.2]	0.862
Gender				
Male	ref		ref	
Female	-0.6 [-5.8 - 4.5]	0.805	-0.8 [-5.9 - 4.2]	0.750
Transgender female	-32.9 [-70.9 - 5.2]	0.091	-17.1 [-55.0 - 20.8]	0.376
Nonbinary	17.3 [-20.8 - 55.3]	0.89	12.3 [-24.4 - 49.1]	0.511
Race				
White	ref		ref	
Black	-6.4 [-15.1 - 2.4]	0.154	-7.5 [-16.1 - 1.2]	0.090
Hispanic	-0.2 [-10.7 - 10.3]	0.970	-1.4 [-11.7 - 8.8]	0.782
Asian	<b>-11.6 [-18.9 - -4.2]</b>	<b>0.002</b>	<b>-11.9 [-19.1 - -4.6]</b>	<b>0.001</b>
Others or unknown	-0.5 [-8.9 - 7.9]	0.905	-0.6 [-8.8 - 7.6]	0.889
Insurance				
Private insurance	ref		ref	
Non-private insurance	-0.2 [-5.8 - 5.4]	0.938	-1.6 [-8.3 - 5.2]	0.652
Diagnosis				
Hyperfunctional	ref		ref	
Hypofunctional	-0.7 [-6.8 - 5.4]	0.831	-0.8 [-6.7 to -11.2]	0.804
Others	<b>-7.5 [-14.4 - -0.5]</b>	<b>0.034</b>	-4.2 [-11.2 - 2.8]	0.238
Diagnosis changed				
No	ref		ref	
Yes	<b>-16.0 [-28.7 - -3.2]</b>	<b>0.014</b>	<b>-15.2 [-28.1 - -2.3]</b>	<b>0.021</b>
Laryngeal imaging				
No	ref		ref	
Yes	<b>8.1 [0.4 - 15.8]</b>	<b>0.040</b>	4.8 [-2.9 - 12.5]	0.219
In-person visit				
No	ref		ref	
Yes	1.7 [-3.9 - 7.2]	0.552	-0.5 [-6.0 - 5.1]	0.869

Bolded values are those that reached statistical significance ( $P < 0.05$ ).

satisfaction (Table 2). Provider satisfaction was significantly lower in voice therapy sessions with Asian patients than in those with White patients ( $\Delta = -11.6$ , 95% CI: [-18.9 to -4.2]), for patients whose diagnoses changed after initiation of voice therapy as compared to those whose diagnoses remained unchanged ( $\Delta = -16.0$ , 95% CI: [-28.7 to -3.2]), and for patients who did not have a laryngeal exam prior to initiation of voice therapy compared to those who did ( $\Delta = 8.1$ , 95% CI: [0.4 - 15.8]). Provider satisfaction was significantly higher for patients diagnosed with hyperfunctional diagnoses as compared to those diagnosed with other (nonhyperfunctional and nonhypofunctional) ( $\Delta = -7.5$ , 95% CI: [-14.4 to -0.5]). Upon multivariable analysis, provider satisfaction scores remained significantly lower for sessions with Asian patients and for patients whose diagnoses changed following initiation of voice therapy (Table 2).

### Factors Associated with Patient Satisfaction

Factors associated with patient satisfaction scores were explored using linear regression models (Table 3). VAS patient satisfaction scores did not differ based on any patient demographic factors, diagnostic classification, or internet reliability. Patients with hypofunctional diagnoses

had significantly higher mean TSQ scores as compared to those with hyperfunctional diagnoses ( $\beta = 0.4$ , 95% CI: [0.1 - 0.8]).

Among the 55 participants who completed the patient satisfaction survey, 40 (72.7%) reported that they would choose to do voice therapy via telemedicine, even when safe in-person appointments become available. Patient preference of choosing telemedicine for future visits was significantly higher among patients reporting reliable internet (OR = 6.9, 95% CI: [1.1 - 42.9],  $P = 0.04$ ) and among Asian patients ( $\beta = 0.4$ , 95% CI: [0.02 - 0.7]) in comparison to White patients.

### DISCUSSION

Herein we present patient and provider satisfaction with voice therapy delivered via telepractice during the COVID-19 pandemic at a tertiary care center and its associated factors. Our study evaluated both patient and provider satisfaction for virtual voice therapy simultaneously and additionally identified demographic and clinical factors that were associated with their levels of satisfaction. Overall, both patients and providers were highly satisfied with their telemedicine voice therapy encounters, with over 70% of

**TABLE 3.**  
**Multivariable Regression Models Exploring Factors Associated With Patient Satisfaction**

	VAS Patient Satisfaction (range 0-100)		TSQ Scores (range 1-5)		Likelihood of Choosing Telemedicine Again in the Future(yes/no)	
	b-Coeff	P-Value	b-Coeff	P-Value	b-Coeff	P-Value
Age	0.2 [-0.1 - 0.5]	0.132	0.006 [-0.002 - 0.015]	0.153	0.001 [-0.006 - 0.008]	0.746
Gender						
Female (%)	-1.8 [-10.6 - 7.1]	0.690	-0.2 [-0.5 - 0.01]	0.06	-0.2 [-0.4 - 0.01]	0.062
Race						
White	ref		ref		ref	
Black	13.1 [-6.3 - 32.4]	0.181	0.3 [-0.3 - 0.9]	0.3	0.4 [-0.1 - 0.8]	0.112
Hispanic	9.1 [-8.4 - 26.7]	0.301	0.2 [-0.3 - 0.7]	0.5	0.4 [-0.04 - 0.7]	0.08
Asian	-4.7 [-19.1 - 9.7]	0.517	-0.1 [-0.5 - 0.3]	0.7	<b>0.4 [0.02 - 0.7]</b>	<b>0.034</b>
Others or unknown	-13.7 [-33.1 - 5.7]	0.162	-0.4 [-1.0 - 0.2]	0.2	-0.4 [-0.8 - 0.04]	0.075
Insurance						
Private insurance	ref		ref		ref	
Non-private	5.9 [-5.1 - 17.0]	0.285	0.1 [-0.2 - 0.5]	0.439	-0.1 [-0.4 - 0.1]	0.284
Education						
High school or less	ref		ref		ref	
College/university	-8.1 [-25.0 - 8.8]	0.342	-0.1 [-0.6 - 0.4]	0.577	-0.2 [-0.6 - 0.2]	0.228
Graduate school	-3.5 [-10.8 - 13.7]	0.684	0.05 [-0.47 - 0.56]	0.860	0.03 [-0.4 - 0.4]	0.881
Income						
<\$45,000	ref		ref		ref	
\$45,000-100,000	-0.5 [-16.0 - 14.9]	0.945	-0.01 [-0.47 - 0.45]	0.971	0.2 [-0.2 - 0.5]	0.298
>\$100,000	-3.4 [-18.4 - 11.6]	0.647	0.1 [-0.3 - 0.6]	0.610	0.3 [-0.02 - 0.7]	0.067
Unknown or refused	2.5 [-20.4 - 15.5]	0.826	-0.1 [-0.8 - 0.6]	0.839	-0.3 [-0.8 - 0.2]	0.238
Employment						
Currently working	ref		ref		ref	
Unemployed or currently not working	3.8 [-6.5 - 14.1]	0.466	0.01 [-0.29 - 0.32]	0.928	-0.2 [-0.4 - 0.03]	0.095
Unknown or refused	2.0 [-36.4 - 10.5]	0.916	0.6 [-0.5 - 1.7]	0.294	0.2 [-0.7 - 1.1]	0.694
Commute to clinic (min)	-0.1 [-0.3 - 0.1]	0.364	-0.003 [-0.009 - 0.003]	0.341	-0.001 [-0.006 - 0.004]	0.596
Provider						
1	ref		ref		ref	
2	-7.5 [-44.8 - 29.8]	0.687	-0.1 [-1.2 - 1.0]	0.856	-0.3 [-1.2 - 0.6]	0.534
3	-16.7 [-54.2 - 20.8]	0.376	-0.2 [-1.4 - 0.9]	0.678	-0.3 [-1.2 - 0.7]	0.578
Diagnosis						
Hyperfunctional	ref		ref		ref	
Hypofunctional	8.4 [-3.5 - 20.3]	0.161	<b>0.4 [0.1 - 0.8]</b>	<b>0.011</b>	0.3 [-0.01 - 0.6]	0.06
Others	-2.8 [-16.7 - 11.2]	0.694	-0.1 [-0.5 - 0.3]	0.477	0.01 [-0.3 - 0.3]	0.95
Diagnosis change						
No	ref		ref		ref	
Yes	-1.7 [-21.2 - 17.9]	0.866	-0.04 [-0.62 - 0.54]	0.889	-0.2 [-0.7 - 0.2]	0.298
Prior laryngeal imaging						
No	ref		ref		ref	
Yes	8.8 [-3.3 - 20.8]	0.149	0.2 [-0.1 - 0.6]	0.205	0.1 [-0.2 - 0.4]	0.602
In-person voice therapy sessions						
No	ref		ref		ref	
Yes	6.1 [-4.9 - 17.2]	0.271	0.2 [-0.1 - 0.5]	0.248	0.1 [-0.1 - 0.4]	0.373
Internet reliability						
No	ref		ref		ref	
Yes	4.1 [-12.2 - 20.3]	0.618	0.3 [-0.2 - 0.8]	0.190	<b>0.4 [0.1 - 0.8]</b>	<b>0.021</b>

Note: Internet reliability was significantly associated with high likelihood of choosing telemedicine in the future (Odds ratio: 6.90 [1.11-42.86],  $P = 0.04$ ). Bolded values are those that reached statistical significance ( $P < 0.05$ ).

patients reporting that they would elect to complete voice therapy via telemedicine even when safe in-person appointments become available. These high levels of patient satisfaction are consistent with previous publications highlighting the favorable patient experience with voice therapy delivered via telepractice.<sup>23-28,30</sup>

Having reliable internet was significantly associated with patients reporting an intent to continue treatment via telemedicine over in-person therapy. Prior studies have described similar findings, with poor audiovisual quality resulting in decreased patient engagement and satisfaction with telemedicine.<sup>43-45</sup> Given the importance of robust technology for a successful telemedicine encounter,<sup>11</sup> we argue that having access to reliable internet is crucial for wider implementation of telemedicine in the future. Institutions offering care via telepractice should provide education to support patients with limited digital literacy and financial resources (i.e., tutorials for patients on how to complete a virtual visit, information about free high-speed internet access, etc.). Other previously described disadvantages of telemedicine for patients include a lack of insurance coverage as well as out-of-state service restrictions that are placed on virtual visits.<sup>43-45</sup> In the current study, there were no differences in patient satisfaction based on type of insurance coverage, nor were there any patients included who were prevented from receiving care due to out-of-state residence; however, future studies should explore these barriers further.

Patient satisfaction with telemedicine measured by TSQ was significantly higher for those diagnosed with hypofunctional as compared to hyperfunctional disorders. This may be due to the greater need for manual therapy services, specifically digital laryngeal manipulation and/or manual circumlaryngeal techniques, for patients with hyperfunctional diagnoses; these techniques can be difficult to teach via telemedicine. Anticipating this challenge, we adapted our protocols during the COVID-19 pandemic to develop an informational sheet, guide, and training formats to teach self-administered manual therapy techniques. However, in-person provision as well as hand-on-hand training of this skill may be more suitable for this subgroup of patients as evidenced by their significantly lower satisfaction scores. Another important consideration is that because older patients and those with more involved medical comorbidities have a higher risk of contracting serious illness in the event of COVID-19 infection, these patients may have seen a greater benefit in the provision of services via telepractice than those who are otherwise young and healthy. As the majority of patients with hypofunctional diagnoses (ie. presbyphonia, vocal fold atrophy, vocal fold paralysis or paresis) are either elderly or have significant medical comorbidities, this may have confounded the higher satisfaction seen within this cohort. Future research not subject to potential pandemic confounders should explore the difference between hypofunctional and hyperfunctional patient satisfaction further.

For providers, satisfaction was found to be significantly lower for voice therapy sessions with Asian patients.

Interestingly, there was no difference based on race for patient satisfaction; however, Asian patients were significantly more likely than White patients to choose telepractice over in-person care when queried about how they would prefer to seek care in the future. It is important to note that only English-speaking patients were included in this study to control for language differences and/or interpreter usage. Regardless, this does not preclude the possibility that there was still a language barrier experienced between the provider and patient that caused the provider to be less satisfied with the visit—if English was not the patient's first language or if the patient spoke with an accent, for example. Unfortunately, we are unable to assess if the lower provider satisfaction seen for encounters with Asian patients is related to the telepractice modality or to the experience of providing voice therapy itself as we do not have matched in-person visit satisfaction scores for comparison. From the patient perspective, previous studies have shown that Asians generally demonstrate high levels of satisfaction with telemedicine.<sup>46</sup> However, Asian patients, in particular, have expressed concern that virtual healthcare relies on patients' own abilities to monitor and manage their health conditions.<sup>47</sup> As the patient generally accepts less authority within patient-provider relationships in many Asian cultures, this highlights the need for culturally sensitive care. Future efforts to address potential disparities in providing voice therapy for racial minorities should be explored.

Our findings also revealed that provider satisfaction was significantly lower for patients whose diagnoses changed following the initiation of voice therapy. These diagnoses changed because patients obtained laryngeal imaging between voice therapy visits, due to limitations placed by the COVID-19 pandemic, which altered their original diagnoses. It follows that clinicians have greater confidence with the plan of care when developed and supported based on pathology visualized via laryngeal imaging. This highlights the importance of following best practice guidelines in the treatment of patients with dysphonia, which recommend obtaining laryngeal imaging prior to initiating voice therapy.<sup>48</sup>

Lastly, only a weak positive correlation was found between provider and patient satisfaction scores. This may be explained by a difference in criteria between patients and providers used to determine subjective satisfaction with telemedicine. For example, clinicians may base their satisfaction scores on how successfully they were able to explore various therapy techniques with patients to achieve their goals, while patients may base their satisfaction scores on how convenient the telemedicine therapy was or how well they connected with a certain provider. Furthermore, while different aspects of patient satisfaction were explored using various questionnaires, provider satisfaction was assessed using one question rated on a VAS as there is no validated questionnaire for provider satisfaction with telemedicine encounters. Given the increasing reliance on telemedicine inspired by the COVID-19 pandemic, we advocate that a questionnaire for clinicians should be developed.



Acknowledging the higher rates of patient dropout that are traditionally seen with in-person voice therapy,<sup>19-22</sup> this study was intentionally designed to include patients who attended at least two sessions of virtual voice therapy. Although this study did not explore duration of patient attendance to virtual voice therapy, this would be important to investigate in the future. Patients previously have reported the distance of travel to their voice therapy appointments as rationale for dropout<sup>22</sup>; virtual voice therapy offers a solution to this.

There are several limitations in this study. Although provider satisfaction surveys were filled out for 226 patient encounters, only 55 (25%) patients completed patient satisfaction surveys. Our reliance on patients and providers to self-report their levels of satisfaction means that recall and participation bias are important factors to consider. This study is also limited in that our study cohort comes from a single tertiary care center with three specialized speech-language pathologists in a large urban setting with a high risk of COVID-19 exposure and infection. Therefore, our results may not be generalizable (1) to other voice centers that exist in different healthcare settings or geopolitical locations and (2) outside of the COVID-19 pandemic. Furthermore, it is possible that providers suffered burnout from providing therapy solely via a screen towards the latter months of the study period, but also likely that their increased experience with virtual appointments provided increased satisfaction over time; these may be confounding factors with competing effects for provider satisfaction. The current study examined provider satisfaction during the early period of the COVID-19 pandemic. Future follow-up studies are needed to assess changes in provider satisfaction with telemedicine as they gain more experience with providing virtual care; this information is crucial to better understand the utility of telemedicine voice therapy beyond the pandemic. Despite these limitations, our study is a valuable first assessment of patient and provider satisfaction with virtual voice therapy.

## CONCLUSION

Virtual voice therapy has previously been shown to have comparable outcomes to in-person therapy with high levels of patient satisfaction.<sup>23-28,30</sup> The current study evaluated both provider and patient satisfaction with voice therapy delivered via telepractice during the COVID-19 pandemic. Both patients and providers reported overall high levels of satisfaction, with the majority of patients preferring telemedicine over in-person therapy especially when they had reliable internet connection. Our findings further support that telepractice is a viable and beneficial method for delivering voice therapy services, not simply an alternative to in-person service provision.

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