

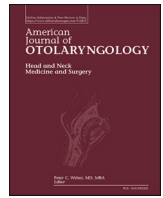


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Effects of COVID-19 on telemedicine practice patterns in outpatient otolaryngology

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ABSTRACT

Objective: Otolaryngology is considered high risk for Coronavirus Disease 2019 (COVID-19) exposure and spread. This has led to a transition to telemedicine and directly impacts patient volume, evaluation and management practices. The objective of this study is to determine the impact of COVID-19 on patient characteristics in relation to outpatient attendance, ancillary testing, medical therapy, and surgical decision making.

Methods: A retrospective case series at an academic medical center was performed. Outpatient appointments from October 2019 (pre-COVID) and March 16–April 10, 2020 (COVID) were analyzed. Prevalence rates and odds ratios were used to compare demographics, visit characteristics, ancillary tests, medication prescribing, and surgical decisions between telemedicine and in-person visits, before and during COVID.

Results: There was a decrease in scheduled visits during the COVID timeframe, for both in-person and telemedicine visits, with a comparable proportion of no-shows. There was a higher overall percentage of Hispanic/Latino patients who received care during the COVID timeframe (OR = 1.43; 95% CI = 1.07–1.90) in both groups, although primary language was not significantly associated with attendance. There were fewer ancillary tests ordered (OR = 0.54) and more medications prescribed (OR = 1.59) during COVID telemedicine visits compared with pre-COVID in-person visits.

Conclusion: COVID-19 has rapidly changed the use of telemedicine. Telemedicine can be used as a tool to reach patients with severe disease burden. Continued healthcare reform, expanded access to affordable care, and efficient use of resources is essential both during the current COVID-19 pandemic and beyond.

Level of evidence: IV.

1. Introduction

The coronavirus disease 2019 (COVID-19) first presented in December 2019 in Wuhan, Hubei Province China [1–3]. With rapid transcontinental spread, by March 11, 2020 the World Health Organization (WHO) declared the COVID-19 outbreak to be a global pandemic [4]. The first confirmed positive case in Massachusetts occurred in February 2020. At the time of this study, Massachusetts ranked third in total COVID-19 cases in the United States [5–8].

Otolaryngologists are at high risk for COVID-19 exposure due to the high viral load in the upper aerodigestive tract and risk of aerosolization during commonly performed procedures [9,10]. Given this risk, many

clinics transitioned to primarily telemedicine visits at the peak of COVID incidence, and only urgent appointments were schedule in-person. In accordance with a national response to the pandemic [9], the Otolaryngology – Head and Neck Surgery (OHNS) Department at BMC cancelled all non-urgent operations and transitioned to primarily telemedicine visits starting March 16, 2020. These measures were intended to conserve personal protective equipment and avoid exposure of both patients and personnel. As expected, a recent study by the Yale School of Medicine Division of Otolaryngology found a decrease in completion rates for scheduled visits and an increase in telemedicine visits [11].

Access to care during the pandemic becomes increasingly salient when considering socioeconomically disadvantaged and immigrant

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populations. Among immigrants, there are reports of avoidance of healthcare due to fear of deportation or risk of losing future legal status under new federal “public charge” regulations [12]. Furthermore, national reports detail the disparate effects of COVID-19 on lower-income Black/African American and Hispanic/Latino communities and show that these populations had higher rates of infection, morbidity, and mortality [13]. These factors result in decreased access to care for already disadvantaged populations, and it becomes even more important to identify and eliminate barriers to care given the limitations of in-person evaluation during the COVID-19 pandemic.

The primary objectives of this study were to examine patient characteristics and chief complaints, visit characteristics, and management decisions in the setting of COVID restrictions and the advent of telemedicine in the OHNS clinic.

2. Materials & methods

2.1. Data collection

A retrospective review of scheduled outpatient appointments in the OHNS Department of a single academic tertiary institution was conducted from October 1–October 31, 2019 (pre-COVID) and March 16, 2020–April 10, 2020 (COVID). October was chosen due to new hiring of providers that had occurred earlier in 2019 as well as to avoid national holidays from November through January. The study was exempt from Institutional Review Board approval at Boston University Medical Center. Study investigators queried the electronic medical records (EMR) system during a standard, pre-COVID timeframe and during the initial weeks of the pandemic when telemedicine visits became the standard for clinic evaluations. We examined the outpatient visits of all board-certified OHNS surgeons and Advanced Practice providers. Patient demographic variables obtained from this search are listed in Table 1. Race/ethnicity and primary language were self-reported by patients. Collaboration with interpreters during the visit was determined using provider documentation. Distance from the hospital was determined by using patient reported zip codes to obtain latitude and longitude data from Google Maps. The Haversine formula was used to calculate the distance between the two coordinates. Median household income was estimated using the 2010 United States Census data based on zip code [14]. Telemedicine visits were defined as being outpatient appointments

Table 1
List of patient data variables obtained from EMR.^a

Patient variables
Age
Sex
Date of birth
Race/ethnicity
Primary language
Interpreter use during visit
Town of residence
State
Zip code
Marital status
Insurance
Subspecialty
Provider
Date of appointment/consultation
Reason for appointment/consultation
Telemedicine or in-person
Type of appointment
Attendance status
Endoscopy indicated
Endoscopic findings
Surgical plan
Number of ancillary tests ordered
Number of medications ordered

^a EMR, electronic medical record.

conducted over the telephone or a video platform. Ancillary tests included additional diagnostic measures such as laboratory tests, computed tomography, ultrasound, and magnetic resonance imaging.

2.2. Statistical analysis

Python 3.7.4 in a Jupyter Notebook was used to conduct data analysis [15,16]. SciPy, NumPy, pandas, Matplotlib, icd10, and uszipcode were Python packages used for data analysis [17–22]. Appointments listed as “cancelled,” “no show,” and “left without being seen” were excluded from statistical analysis to only include completed appointments. Prevalence rates and odds ratios (ORs) were used to quantify associations between demographics, outpatient visits, and visit outcomes in the COVID population when compared to the pre-COVID population. A chi-squared test was used to determine if ORs were statistically significant (two-tailed, $P < 0.05$). An independent *t*-test (two-tailed, $P < 0.05$) was used to compare mean values for age (in years) and median household income. Mann-Whitney *U* test was used to compare the median distance from BMC based on zip code, as data was right skewed.

3. Results

The complete demographics and characteristics are listed in Table 2. There were 4522 outpatient visits scheduled in the pre-COVID period and 3491 outpatient visits scheduled in the COVID timeframe. Pre-COVID, 56.7.0% (2566) of visits were completed, 16% (772) were no-shows, and 27.2% (1231) were cancelled. In comparison, during COVID, 22% (764) were completed, with 598 telemedicine visits and 166 in person visits, 7.5% (264) were no-shows, and 70.3% (2454) were cancelled (Fig. 1). There was no significant difference in no-show rates for the timeframes.

There was a higher proportion of Hispanic/Latino patients seen during the COVID timeframe when compared to pre-COVID, (OR = 1.43; 95% CI = 1.07–1.90). There were no significant differences in primary languages spoken, age, mean and median distance from the hospital, or median household income (Table 2).

A lower percentage of endoscopies were performed at in-person visits in the COVID versus pre-COVID timeframe (OR = 0.60; 95% CI = 0.40–0.89.) Ancillary tests were ordered during fewer visits in the COVID timeframe (OR = 0.50; 95% CI = 0.40–0.63.) More medications were ordered in the COVID group (OR = 1.42; 95% CI = 1.19–1.70.) A lower percentage of visits resulted in a surgical plan in the COVID group (OR = 0.61; 95% CI = 0.46–0.83) (Table 3 Fig. 2).

To further characterize significant associations found in our results above, all demographics and visit characteristics included in prior analysis were compared in the pre-COVID visits, COVID in-person visits, and COVID telemedicine visits (statistically significant results reported in Table 4). Differences in visits based on Hispanic/Latino race/ethnicity are reported in Fig. 3.

Regarding interpreter usage, including in-person and telephone, a lower percentage of in-person visits utilized interpreters in COVID when compared to the pre-COVID cohort, while a higher percentage of visits used interpreters in COVID telemedicine visits when compared to the pre-COVID and COVID in-person cohorts (OR = 0.57; 95% CI = 0.35–0.92) (Fig. 4). Table 3 demonstrates ancillary test, medication prescribing, and surgical decision-making for the two cohorts.

4. Discussion

In response to the COVID-19 pandemic, healthcare delivery has shifted from in-person to virtual visits, making telemedicine a critical component of the current healthcare system. Telemedicine has been utilized successfully to remotely access patients in rural areas, residential institutions or those who are incarcerated [23]. Despite the increase in the use of telemedicine over the last decade, in 2018 only half of

Table 2
Comparing demographics in the pre-COVID and COVID timeframes with odds ratio.

Demographics	Pre-COVID percentage	COVID percentage	Odds ratio	95% CI
Female sex	56.04	57.59	1.07	0.90–1.25
Race/ethnicity				
White	28.53	28.53	1.00	0.84–1.20
Black/African American	27.32	25.39	0.91	0.75–1.09
Hispanic/Latino	6.70	9.29	1.43	1.07–1.90
Asian	4.91	3.80	0.76	0.51–1.15
American Indian/Native American	0.82	0.92	1.12	0.47–2.64
Other	0.86	1.31	1.53	0.72–3.25
Unknown	30.87	30.63	0.99	0.83–1.18
Primary language				
English	62.63	63.74	1.05	0.89–1.24
Spanish	20.89	21.47	1.04	0.85–1.26
Portuguese	3.70	3.66	0.99	0.64–1.52
Haitian Creole	3.74	2.49	0.66	0.40–1.08
Cape Verdean/Port. Creole	2.42	2.36	0.97	0.57–1.66
Vietnamese	1.95	1.57	0.80	0.43–1.52
Arabic	1.25	0.79	0.63	0.26–1.50
Other	3.39	3.66	1.08	0.70–1.67
Interpreter used	19.39	20.81	1.09	0.89–1.34

	Pre-COVID mean	COVID mean	Pre-COVID SD	COVID SD	P
Age	41.58	42.68	21.86	21.45	0.222 ^a
Median household income for zip code	\$58,134	\$56,968	\$22,330	\$20,830	0.200 ^a

	Pre-COVID mean (mi.)	COVID mean (mi.)	Pre-COVID median (mi.)	COVID median (mi.)	P
Distance from BMC	18.28	18.83	5.25	5.05	0.335 ^b

^a Calculated using independent *t*-test.

^b Calculated using Mann-Whitney *U* test.

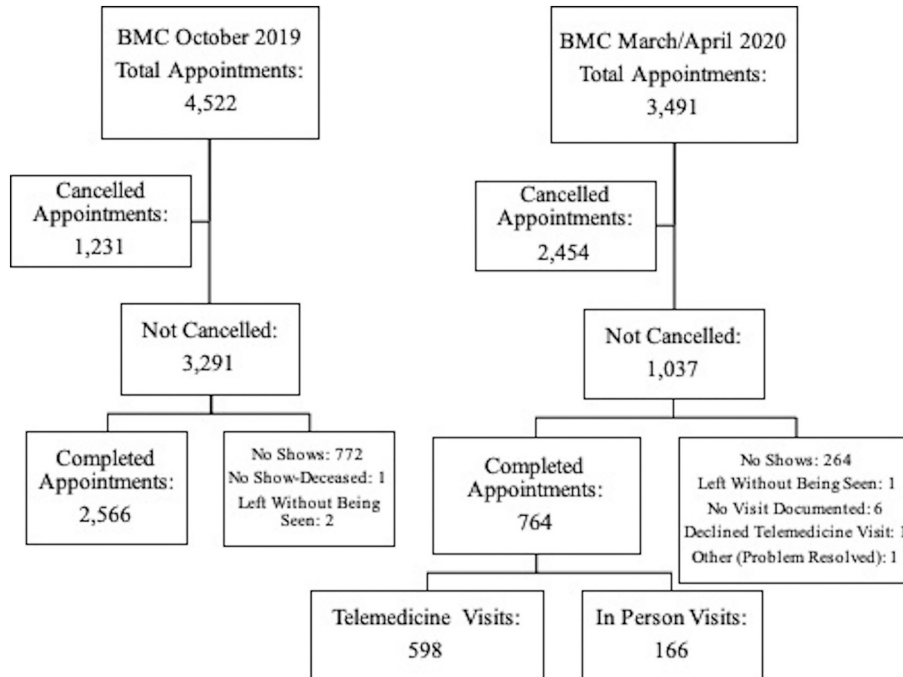


Fig. 1. CONSORT diagram of outpatient appointments in the BMC OHNS Department during October 2019 and March/April 2020.

hospitals in the United States had the ability to engage in telemedicine visits and only 25% of those with intensive-care units had telemedicine access [24]. During the COVID-19 pandemic, the regulatory barriers that had prevented expansion of telemedicine were waived. Centers for Medicare and Medicaid Services made telemedicine accessible during

the pandemic by paying physicians the same rate for telemedicine services as in-person visits for all diagnoses [25]. Thus, telemedicine has been widely implemented and is now being studied across various subspecialties through evaluation of patient satisfaction and utilization rates [26].

Table 3
Comparing visit outcomes in the pre-COVID and COVID timeframes with odds ratio.

Outpatient visit outcomes	Pre-COVID percentage	COVID percentage	Odds ratio	95% CI
Endoscopy performed	27.75	18.67 ^a	0.60	0.40–0.89
Ancillary tests ordered	25.64	14.79	0.50	0.40–0.63
Medications ordered	22.80	29.58	1.42	1.19–1.70
Surgical plan	11.42	7.33	0.61	0.46–0.83

^a Only including in-person visits.

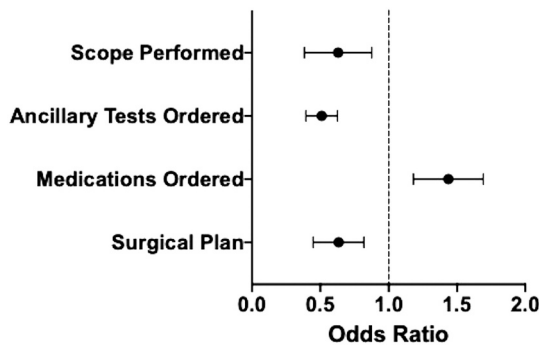


Fig. 2. Odds ratio plot with 95% C.I. for outcomes (endoscopy performed, ancillary tests ordered, medications ordered, and surgical plan) of outpatient visits in Mar/Apr 2020 when compared to the Oct 2019 cohort.

Out of necessity, the COVID-19 pandemic has allowed for evaluation of the utility of telemedicine across all specialties and clinical settings. This study in particular had the unique opportunity to analyze telemedicine in especially vulnerable patient populations.

Telemedicine did not affect the no-show rates as the pre-COVID and COVID rates were comparable (23.5% vs. 25.5%) (Fig. 1.) Interpretation of the COVID timeframe no-show data must be viewed with the understanding that the majority of in-person visits required cancellation before any re-scheduling. Additionally, every rescheduled or telemedicine visit required multiple communications from the department for scheduling, selecting for patients who had consistent access to telephone communication. This is in comparison to in-person visits, which are scheduled both at the time of prior in-person appointments as well as via telephone communication. The telemedicine no-show rates were lower compared to the in-person no-show rates during the COVID timeframe. There may be a higher success of visit completion for telemedicine visits during this time due to the need to schedule appointments using the same modality as telemedicine.

There was a significantly higher volume of care to Hispanic/Latino patients during the COVID timeframe when compared to the pre-COVID timeframe. The overall percentage of in-person Hispanic/Latino visits remained the same, however, the proportion of Hispanic/Latino COVID access to medical care increased compared to the pre-COVID in-person visits (Fig. 3). This was based solely on race/ethnicity, despite no significant difference in primary languages spoken between the timeframes. This is in contrast to a similar study in a large health system in New York City, which demonstrated Black/African American and Hispanic/Latino patients have lower odds of using telemedicine in comparison to White or Asian patients [27]. These disparities have been explained by lack of digital access, digital literacy, and mistrust of the telemedicine system.

The increased volume of telemedicine interaction with Hispanic/Latino patients shows telemedicine has the potential to expand care to

Table 4
Comparing selected characteristics in telemedicine and in-person visits with odds ratio.

Characteristic	Pre-COVID in-person percentage	COVID in-person percentage	Odds ratio	95% CI
White race/ethnicity	28.53	34.94	1.35	0.97–1.87
Asian race/ethnicity	4.91	6.63	1.37	0.73–2.60
Hispanic/Latino race/ethnicity	6.70	7.83	1.18	0.66–2.13
Interpreter used	19.39	12.05	0.57	0.35–0.92
Ancillary tests ordered	25.64	15.66	0.54	0.35–0.83
Medications ordered	22.80	21.08	0.90	0.62–1.33
Surgical plan	11.42	9.64	0.83	0.49–1.41

Characteristic	Pre-COVID in-person percentage	COVID telemedicine percentage	Odds ratio	95% CI
White race/ethnicity	28.53	26.76	0.92	0.75–1.12
Asian race/ethnicity	4.91	3.01	0.60	0.36–0.99
Hispanic/Latino race/ethnicity	6.70	9.70	1.49	1.09–2.04
Interpreter used	19.39	23.24	1.26	1.01–1.56
Ancillary tests ordered	25.64	14.55	0.49	0.39–0.63
Medications Ordered	22.80	31.94	1.59	1.31–1.93
Surgical Plan	11.42	6.69	0.56	0.39–0.78

Characteristic	COVID in-person percentage	COVID telemedicine percentage	Odds ratio	95% CI
White race/ethnicity	34.94	26.76	0.68	0.47–0.98
Asian race/ethnicity	6.63	3.01	0.44	0.20–0.95
Hispanic race/ethnicity	7.83	9.70	1.26	0.67–2.37
Interpreter used	12.05	23.24	2.21	1.33–3.66
Ancillary tests ordered	15.66	14.55	0.92	0.57–1.48
Medications ordered	21.08	31.94	1.76	1.16–2.65
Surgical plan	9.64	6.69	0.67	0.37–1.23

Note: Black/African American, American Indian/Native American, Other, and Unknown race/ethnicities were excluded from this table to eliminate excess content.

patients. Black/African American race/ethnicity is a known prognostic indicator for delays in head and neck cancer treatment, more advanced tumor stage presentation, and delays in treatment initiation [28]. Employment status and social support are both factors, which are believed to contribute to reduced access to care for this population [28]. Telemedicine can be used as a tool to help reach patients who find it difficult to be seen in-person due to social or employment factors. By improving access to care, we may be able to intervene sooner in highly morbid conditions such as head and neck malignancy. This data shows telemedicine may provide access to care for our most at-risk patient population and can be utilized as a protective measure to keep patients at home when possible.

A higher percentage of telemedicine visits during the COVID period were facilitated by interpreters compared to in-person visits conducted during both the pre-COVID and COVID timeframes. Although there was no significant correlation between telemedicine usage and primary language spoken, a high proportion of interpreter use for telemedicine

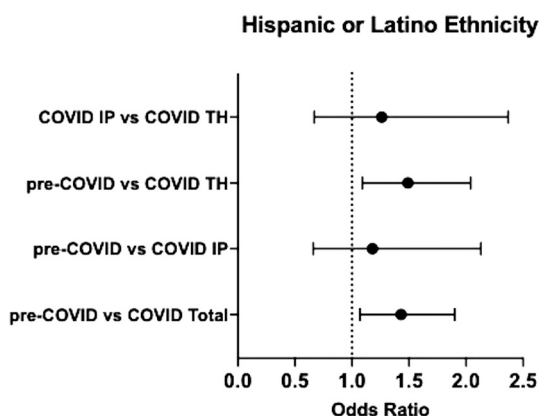


Fig. 3. Odds ratio plot with 95% C.I. for outpatient visits with patients of Hispanic or Latino ethnicity in the pre-COVID, COVID total, COVID in-person (IP), and COVID telehealth (TH) cohorts.

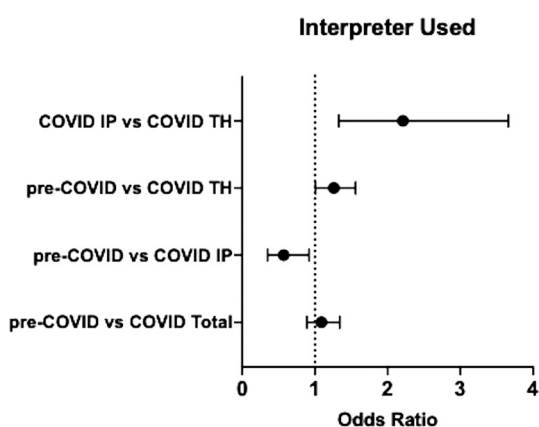


Fig. 4. Odds ratio plot with 95% C.I. for outpatient visits with an interpreter used in the pre-COVID, COVID total, COVID in-person (IP), and COVID telehealth (TH) cohorts.

demonstrates language interpretation as an accessible adjunct to telemedicine. Interpreter collaboration is an important factor, which has been shown to affect telemedicine use by non-English speaking patients. A recent publication by Jian et al. found Spanish-speaking families needed to reschedule their telemedicine visits more often, which the authors attributed to technological barriers to telemedicine access [29]. Currently, no other studies have shown interpreter use as a factor in telemedicine satisfaction, outcomes, or effectiveness, and further studies are needed to be completed for better understanding. The authors of this study, however, hypothesize that the increased use of interpreters may aid in patient education and understanding of their diagnoses and treatment. Further work must be done to understand if this contributes to adherence to treatment and improved outcomes.

Patient residence distance from the hospital did not significantly impact attendance with in-person visits in either timeframe. Similarly, mean and median household income based on patient zip code did not impact attendance rates for in-person visits. Prior studies, however, have shown that community factors can play a significant role in access to care, and telemedicine has been shown to be a useful adjunct in reducing urban-rural disparities in healthcare [23,30].

Healthcare utilization in conjunction with telemedicine practices poses another unique question. In this study, there was a lower percentage of ancillary tests ordered during the COVID timeframe in comparison to the pre-COVID cohort. This can be most likely attributed to a desire to limit patient exposure to hospital facilities in the short term, however, following these patients long-term to evaluate for future in-

person evaluation and ancillary testing for the same chief complaint, would help truly clarify this question. In contrast, however, a higher percentage of visits resulted in medications being ordered during COVID telemedicine visits when compared to the pre-COVID and COVID in-person cohorts. This can be explained by empiric medication prescribing based on symptomology. In smaller studies, telemedicine video visits have been shown to have no difference in clinical outcomes while allowing for lower costs and higher patient satisfaction, in comparison to in-person consultations [26]. It is unclear whether greater patient satisfaction in prior studies could be tied to increased medication prescribing or satisfaction with telemedicine itself, and further studies on patient satisfaction with telemedicine are warranted in the future.

There are several inherent limitations to this study. The data is from a single, safety-net institution from one city in the early stage of the global pandemic, and it is possible that our results are not generalizable to other regions or specialties. Additionally, the COVID cohort was only tracked over 4-weeks, and it is likely these trends will continue to evolve as with continued understanding of the COVID-19 virus, exposure precautions, and streamlining of telemedicine practices. The COVID data may have been better compared to the same months the prior year (March–April 2019) as there are natural fluctuations in patient volumes throughout the year. However, the October 2019 timeframe was chosen based on recent hiring changes resulting in an increase of patients with head and neck oncology. Further studies comparing longitudinal telemedicine use after the early period of rapid expansion to a pre-COVID timeframe would be useful. Nonetheless, quantitative data and significant findings from this study may be useful as other institutions and departments navigate telemedicine development.

When implementing a new healthcare delivery system like telemedicine it is easy to identify the advantages: improved resource utilization, decreased costs, and potential for improved access. However, in today's political climate, during a pandemic with over 200,000 deaths that continues to expose long-standing social injustices including systemic racism and socioeconomic disparities, physicians must remain vigilant and critical throughout the rollout of these programs for inherent biases, the ways in which patients may or may not benefit, and potential harms that might be incurred. As a digital platform, it is important to recognize telemedicine has the potential to marginalize patients with digital barriers to care, including those with limited broadband internet access, age > 65 years with limited digital literacy, homelessness, and undocumented immigrants who fear the repercussions of becoming registered to any digital system. When the threat of COVID is diminished, it will be up to physicians to advocate for the appropriate proportion of telemedicine visits that should outlast the pandemic. Additionally, although Hispanic/Latino patients in our study population demonstrated expanded access to care with telemedicine, we did not collect information regarding the quality of care and how it compares to the standard of care provided at an in-person visit. In Otolaryngology, the standard of care often relies heavily on physical examination including endoscopy findings. In this specialty, improved access through telemedicine may not translate to improved quality or more equitable care. One potential blind spot of this study is being unable to quantify the potential harm of not examining patients in person. In order for telemedicine to not widen disparities, it is imperative to improve identification of these vulnerable patients when possible and develop other bridges to access. Overall telemedicine offers much promise including the ability to significantly improve access to care, however, the way we customize and interpret findings from those visits will require continued refinement in a patient-centered manner in order to provide equitable care.

5. Conclusion

COVID-19 has rapidly changed the use and impact of telemedicine. During the early months of the pandemic, a majority of our outpatient OHNS practice was transitioned to telemedicine with comparable no-

show rates. There was a higher proportion of Hispanic/Latino patients who received telemedicine care, a group that has been shown to present later with more significant disease burden. This demonstrates the increased access to care that telemedicine may provide. Interpreters were utilized more frequently, which may improve patient education and communication. Further understanding of the benefits of telemedicine including qualitative measures of care must be investigated to engage in continued healthcare reform, expand universal access to affordable care, and maximize efficient use of resources during the current COVID-19 pandemic and beyond.

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None.

Declaration of competing interest

There are no conflicts of interest to report.

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