Demographic Disparity in Use of Telemedicine for Ambulatory General Surgical Consultation During the COVID-19 Pandemic: Analysis of the Initial Public Health Emergency and Second Phase Periods

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BACKGROUND: Surgical patients with limited digital literacy may experience reduced telemedicine access. We investigated racial/ethnic and socioeconomic disparities in telemedicine compared with in-person surgical consultation during the coronavirus disease 2019 (COVID-19) pandemic.

STUDY DESIGN: Retrospective analysis of new visits within the Division of General & Gastrointestinal Surgery at an academic medical center occurring between March 24 through June 23, 2020 (Phase I, Massachusetts Public Health Emergency) and June 24 through December 31, 2020 (Phase II, relaxation of restrictions on healthcare operations) was performed. Visit modality (telemedicine/phone vs in-person) and demographic data were extracted. Bivariate analysis and multivariable logistic regression were performed to evaluate associations between patient characteristics and visit modality.

RESULTS: During Phase I, 347 in-person and 638 virtual visits were completed. Multivariable modeling demonstrated no significant differences in virtual compared with in-person visit use across racial/ethnic or insurance groups. Among patients using virtual visits, Latinx patients were less likely to have video compared with audio-only visits than White patients (OR, 0.46; 95% CI 0.22–0.96). Black race and insurance type were not significant predictors of video use. During Phase II, 2,922 in-person and 1,001 virtual visits were completed. Multivariable modeling demonstrated that Black patients (OR, 1.52; 95% CI 1.12–2.06) were more likely to have virtual visits than White patients. No significant differences were observed across insurance types. Among patients using virtual visits, race/ethnicity and insurance type were not significant predictors of video use.

CONCLUSION: Black patients used telemedicine platforms more often than White patients during the second phase of the COVID-19 pandemic. Virtual consultation may help increase access to surgical care among traditionally under-resourced populations. (J Am Coll Surg 2022;234:191–202.

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Abbreviations and Acronyms
COVID-19 = coronavirus disease 2019
EDW = Enterprise Data Warehouse
EHR = electronic health record

The coronavirus disease 2019 (COVID-19) pandemic dramatically transformed the healthcare delivery landscape and fundamentally shifted the ways in which patients access healthcare. Digital literacy, access to technology, and the ability to effectively communicate with providers through virtual platforms have now become critical social determinants of health.[1] The surge in telemedicine use has focused attention on the digital divide in America, which describes the limited ability of racial/ethnic minority, low-income, and other vulnerable populations to access and effectively use technology.[2] Recent estimates suggest that more than 21 million people in the US lack broadband internet, and many low-income individuals depend on smartphones as their primary method of internet access.[3,4] Although approximately 81% of Americans own a smartphone and nearly 75% own a desktop or laptop computer, significant disparities exist in device ownership, especially for low-income and older individuals.[4] Furthermore, digital literacy is lower in individuals who are Black or Hispanic, older adults, and those with lower education level.[2]

Early in the pandemic, elective and nonemergent surgical cases were suspended nationally based on recommendations from the Centers for Medicare and Medicaid, the American College of Surgeons, and state governments.[5] Additionally, primary care and surgical consultations were limited in-person and were mainly deferred or delivered through telemedicine platforms.[6] In the primary care setting, disproportionate decreases in visits by patients from racial/ethnic minority groups, patients over age 65, and patients with non-English language preference were observed after the initial implementation of telemedicine, raising concerns of disruptions in chronic disease screening and management.[7,8] Furthermore, these vulnerable groups are disproportionately less likely to use telemedicine platforms for primary and ambulatory medical specialty care and are less likely to use video streaming when participating in virtual visits.[9]

In certain surgical subspecialities, similar demographic and socioeconomic inequities have been observed in the use of telemedicine services for ambulatory care during the COVID-19 pandemic.[10] Previous work has also examined broad trends in the use of telemedicine for general and subspeciality surgical consultation during the pandemic.[11] However, few investigations of potential telemedicine access disparities in ambulatory general surgical care have been performed. Furthermore, little is known about patterns of virtual health engagement for surgical consultation after the initial Public Health Emergency. The present study examined racial/ethnic and other sociodemographic disparities in the use of telemedicine compared with in-person surgical consultation at a large, tertiary academic medical center during the initial and second phases of the COVID-19 pandemic.

METHODS

Study design

A retrospective cohort analysis was conducted using the Enterprise Data Warehouse (EDW), a clinical database containing electronic health record (EHR) information for a tertiary academic medical center in Boston, MA. All patients aged 18 and older who completed a new consultation at an ambulatory clinic affiliated with the Division of General and Gastrointestinal Surgery between March 24 and June 23, 2020 (Phase I, Massachusetts Public Health Emergency) and June 24 through December 31, 2020 (Phase II) were included. New visits to physicians and advanced practice providers from 8 affiliated ambulatory clinics were analyzed. Return visits by established patients and all visits by patients under age 18 were excluded.

Given the potential for telemedicine to expand surgical access to under-resourced communities during the pandemic, this academic hospital implemented initiatives in March and April 2020 to increase access to patient-facing digital health platforms. These efforts continued during the spring 2020 months and included targeted enrollment of patients from under-resourced communities in the patient portal system, dissemination of internet-enabled devices, and integration of a secure video conferencing platform into the electronic health record system to streamline virtual visit use.

The Phase I and Phase II dates were selected according to these institutional digital health equity initiatives as well as Massachusetts state and national policies that affected the delivery of nonemergent surgical services, including outpatient consultation. On March 24, 2020, an emergency order was issued by the Massachusetts state governor, which mandated closure of all businesses and organizations not providing COVID-19 essential services and initiated a stay-at-home advisory.[12] On June 24, 2020, the Massachusetts Department of Public Health enacted reopening guidelines authorizing the resumption of nonessential elective surgical procedures and in-person consultation.[13] Between these dates, elective surgical care was suspended per recommendations of the American College of Surgeons and other organizations.[5] Thus, the Phase I dates represent the initial Public Health Emergency

in Massachusetts. The Phase II period included a gradual increase in healthcare operations until additional, although less stringent, restrictions were placed on elective inpatient procedures and other healthcare services in early December 2020 in response to the increasing number of COVID-19 cases and hospitalizations during the holiday season.[14]

Variables

Visit modality (telemedicine/phone vs in-person) and demographic data (age, sex, race/ethnicity, insurance type, education level, primary language, interpreter requirement flag, ICD-10-CM diagnosis code) were extracted from the EDW database. Age was analyzed as a continuous variable. Patient race/ethnicity, education level, and primary language were self-reported in the EDW database. Race/ethnicity categories used for analysis were defined using descriptions listed in EDW with the exception of the Latinx category, which includes patients who self-identify as Hispanic and those who identify their ethnicity as that of a predominantly Spanish- or Portuguese-speaking country in Central or South America. Data denoting interpreter need were excluded from analysis owing to significant collinearity with the primary language variable (variance inflation factor [VIF] = 6.14 for Phase I; VIF = 4.70 for Phase II). Primary ICD-10-CM diagnosis category codes were extracted for all patient encounters and tabulated according to frequency among the combined, virtual, and in-person visit cohorts (**Supplemental Digital Content 1 and 2**, available at http://links.lww.com/XCS/A19. Clinically related ICD-10 codes were grouped into diagnosis categories to enable inclusion as a covariate in the multivariable models. Diagnosis categories included Hernia, Bariatric (obesity- and nutrition-related codes), Hemorrhoids, Gallbladder Disease, Benign Gastrointestinal (nonmalignant gastrointestinal disease other than the previously denoted diagnoses), Gastrointestinal Malignancy, and Other. Visit modality was defined by the visit type description associated with the patient encounter in EDW. For new in-person visits, encounter type descriptions included "office visit," "initial consult," and "appointment." For new virtual visits, encounter type descriptions included "telemedicine" (virtual visits with video streaming) and "telemedicine – audio-only" (phone visits, virtual visits without video).

Statistical analysis

Bivariate analysis of demographic variables and visit modality was performed using Student's *t*-test for continuous variables and chi-square tests for categorical variables at a significance level of 0.05. Multivariable logistic regression was used to test for associations between patient demographic characteristics and visit modality at a two-sided significance level of 0.05. Two patient-level visit modality comparisons were performed for new consultations during both Phase I and Phase II: 1) virtual visits compared with in-person visits and 2) video virtual visits compared with audio-only/phone virtual visits. Based on *a priori* hypotheses regarding digital literacy, all demographic variables were included in the final multivariable models for all visit modality comparisons. Encounters with missing demographic data were excluded from the corresponding visit modality analysis during multivariable modeling. Patients with insurance other than commercial, Medicare, and Medicaid, as well as patients who were uninsured, were excluded from analysis owing to small cell sizes that would destabilize the multivariable models. For the Phase II video compared with audio-only virtual visit analysis, the Hemorrhoids diagnosis was included in the Benign GI category owing to small cell sizes that would similarly destabilize the multivariable model.

For Phase I, 768 patients had complete demographic data and were included in the final multivariable model for virtual vs in-person visits, and 517 patients were included in the model for video vs audio-only visits. For Phase II, 3,109 patients had complete demographic data and were included in the final multivariable model for virtual vs in-person visits, whereas 848 patients were included in the model for video vs audio-only visits. All analyses were performed using Stata/MP, version 14.2 statistical software.

RESULTS

Primary patient diagnoses

A total of 4,908 new visits were analyzed; 985 visits occurred during Phase I, and 3,923 visits occurred during Phase II. During Phase I, patients were most commonly evaluated for bariatric or nutrition-related conditions, hernias, hemorrhoids, gallbladder disease, benign anorectal disease, and colorectal malignancy (**Supplemental Digital Content 1** at http://links.lww.com/XCS/A19). These clinical conditions frequently accounted for similar proportions of virtual and in-person visits (within 5%). Exceptions included patients with hemorrhoids and perianal venous thrombosis, who were primarily seen in-person, and patients with obesity, who were typically seen virtually (**Supplemental Digital Content 1** at http://links.lww.com/XCS/A19). During Phase II, patients were most commonly evaluated for bariatric or nutrition-related conditions, hernias, hemorrhoids, gallbladder disease, benign anorectal disease,

and colorectal malignancy (**Supplemental Digital Content 2** at http://links.lww.com/XCS/A19). These clinical conditions accounted for similar proportions of virtual and in-person visits (within 5%). Exceptions included patients with inguinal hernias, who were primarily seen in-person, and patients with bariatric or nutrition-related conditions, who were typically seen virtually (**Supplemental Digital Content 2** at http://links.lww.com/XCS/A19).

Phase I, virtual compared with in-person new visits

A total of 347 in-person visits (174 female [50.1%], median age, 56) and 638 virtual visits (412 female [64.6%], median age, 52) were completed between March 24 and June 23, 2020. White patients constituted 67.4% of in-person and 67.1% of virtual visits. Black patients constituted 5.5% and 9.7% of in-person and virtual visits, respectively. Latinx patients represented 8.9% of in-person visits and 13.5% of virtual visits (Table 1). During the Public Health Emergency, the majority of general surgical consultations were conducted virtually. Visit data from earlier weeks in March are provided for reference (Fig. 1). On bivariate analysis, age, sex, insurance type, and diagnosis were significantly associated with visit modality (Table 1).

After multivariable adjustment, no significant association was observed between race/ethnicity and visit modality or between insurance type and visit modality. Women were more likely to have a virtual visit than men. Compared with patients with hernias, patients with hemorrhoids and those with gastrointestinal malignancy were less likely to have a virtual visit (Table 2).

Phase I, video compared with audio-only virtual new visits

The 638 telemedicine visits comprised 228 video visits and 410 audio-only visits. White patients constituted the majority of both video and audio-only visits. Black patients represented 8.8% and 10.2% of video and audio-only visits, respectively. Latinx patients accounted for 8.8% and 16.1% of video and audio-only visits, respectively. On bivariate analysis, age, race/ethnicity, insurance type, and education level were significantly associated with video use (Table 3).

After multivariable adjustment, Latinx patients were less likely to have a video visit compared with an audio-only visit than White patients (OR, 0.46; 95% CI 0.22–0.96). Insurance type, age, and education level were not significant predictors of video use on multivariable analysis (Table 4).

Phase II, virtual compared with in-person new visits

A total of 2,922 in-person visits (1,546 female [52.9%], median age, 56) and 1,001 virtual visits (723 female [72.2%], median age, 49) were completed between June 24 and December 31, 2020. White patients constituted 71.2% of in-person and 61.5% of virtual visits. Black patients represented 6.1% and 13.2% of in-person and virtual visits, respectively. Latinx patients accounted for 9.0% of in-person visits and 17.1% of virtual visits (Table 1). In contrast to Phase I, in-person consultation was the predominant visit modality during Phase II (Fig. 1). On bivariate analysis, age, sex, race/ethnicity, insurance type, education level, and diagnosis were significantly associated with visit modality (Table 1).

After multivariable adjustment, Black patients (OR, 1.52; 95% CI 1.12–2.06) were more likely to have virtual visits than White patients. No significant differences in visit modality were observed across insurance groups. Women were more likely to have virtual visits than men. Compared with patients with hernias, patients with bariatric diagnoses and those with gallbladder disease were more likely to have virtual visits, whereas patients with hemorrhoids were less likely to have virtual visits (Table 2).

Phase II, video compared with audio-only virtual new visits

During the second phase, 640 video visits and 361 audio-only virtual visits were completed. White patients accounted for the majority of both forms of telemedicine visits. Black patients represented 14.4% and 11.1% of video and audio-only visits, respectively. Latinx patients constituted 15.9% and 19.1% of video and audio-only visits, respectively. On bivariate analysis, age, insurance type, education level, primary language, and diagnosis were significantly associated with video use (Table 3).

After multivariable adjustment, no significant association was observed between race/ethnicity or insurance type and video use during virtual visits. Older age, lower education level, and having non-English primary language were significantly associated with decreased odds of video use. Compared with patients with hernias, patients with gallbladder disease also had lower odds of video use (Table 4).

DISCUSSION

We evaluated demographic disparities in the use of virtual compared with in-person surgical consultation at a tertiary academic medical center during the Public Health Emergency (Phase I, March 24 through June 23, 2020) and second period (Phase II, June 24 through December 31, 2020) of the COVID-19 pandemic. Importantly, this

Table 1. Demographic Characteristics of Patients Seen During Phase I and Phase II

	Phase I, March 24–June 23, 2020 (n = 985)			Phase II, June 24–December 31, 2020 (n = 3923)		
Characteristic	**In-person (n = 347)**	**Virtual (n = 638)**	**p Value**	**In-person (n = 2922)**	**Virtual (n = 1001)**	**p Value**
Age, y, median (IQR)	56 (38-68)	52 (38-66)	0.025*	56 (41-68)	49 (36-62)	<0.001*
Sex, n (%)						
Male	173 (49.9)	226 (35.4)	<0.001*	1376 (47.1)	278 (27.8)	<0.001*
Female	174 (50.1)	412 (64.6)		1546 (52.9)	723 (72.2)	
Race/ethnicity, n (%)						
White	234 (67.4)	428 (67.1)	0.065	2079 (71.2)	616 (61.5)	<0.001*
Black	19 (5.5)	62 (9.7)		178 (6.1)	132 (13.2)	
Latinx	31 (8.9)	86 (13.5)		262 (9.0)	171 (17.1)	
Other	12 (3.5)	23 (3.6)		121 (4.1)	42 (4.2)	
Missing	51 (14.7)	39 (6.1)		282 (9.7)	40 (4.0)	
Insurance type, n (%)						
Commercial	212 (61.1)	412 (64.6)	0.018*	1871 (64.0)	639 (63.8)	<0.001*
Medicare	103 (29.7)	143 (22.4)		773 (26.5)	193 (19.3)	
Medicaid	31 (8.9)	81 (12.7)		257 (8.8)	163 (16.3)	
Other/uninsured	<10	<10		21 (0.7)	<10	
Education level, n (%)						
Bachelor's degree	170 (49.0)	298 (46.7)	0.098	1496 (51.2)	479 (47.9)	<0.001*
HS or less/GED	111 (32.0)	249 (39.0)		924 (31.6)	406 (40.6)	
Missing	66 (19.0)	91 (14.3)		502 (17.2)	116 (11.6)	
Primary language, n (%)						
English	319 (91.9)	584 (91.5)	0.356	2729 (93.4)	932 (93.1)	0.170
Non-English	18 (5.2)	43 (6.7)		144 (4.9)	61 (6.1)	
Missing	10 (2.9)	11 (1.7)		49 (1.7)	8 (0.8)	
Diagnosis, n (%)						
Hernia	42 (12.1)	106 (16.6)	<0.001*	597 (20.4)	91 (9.1)	<0.001*
Bariatric	33 (9.5)	137 (21.5)		226 (7.7)	368 (36.8)	
Hemorrhoids	38 (11.0)	37 (5.8)		288 (8.8)	<10	
Gallbladder	17 (4.9)	62 (9.7)		150 (5.1)	115 (11.5)	
Benign GI	98 (28.2)	154 (24.1)		827 (28.3)	199 (19.9)	
GI malignancy	41 (11.8)	32 (5.0)		217 (7.4)	65 (6.5)	
Other	77 (22.2)	109 (17.1)		616 (21.1)	155 (15.5)	
Missing	1 (0.3)	1 (0.2)		1 (0.1)	2 (0.2)	

p Values correspond to *t*-test and chi-square analyses.
*Statistically significant.
GED, General Educational Development; GI, gastrointestinal; HS, high school; IQR, interquartile range.

analysis is among the first investigations of telemedicine use in general surgery after the initial COVID-19 Public Health Emergency. During Phase I, Latinx patients were significantly less likely to have video telemedicine visits than phone visits compared with White patients. Notably, we found that during Phase II, when surgical visit volume largely normalized, Black patients were more likely than White patients to use virtual surgical consultation. In both phases, insurance type was not significantly associated with visit type, and women were more likely to use virtual visits than men. During Phase II, older patients, patients with lower education level, and patients with non-English primary language were less likely to use video streaming during virtual visits.

Previous surgical literature investigating telemedicine access during the pandemic has largely focused on operational and logistical factors affecting the adoption of telemedicine and has been limited to the early Public Health Emergency period.[11,15,16] In multi-center and national studies in orthopedic surgery, patients who are

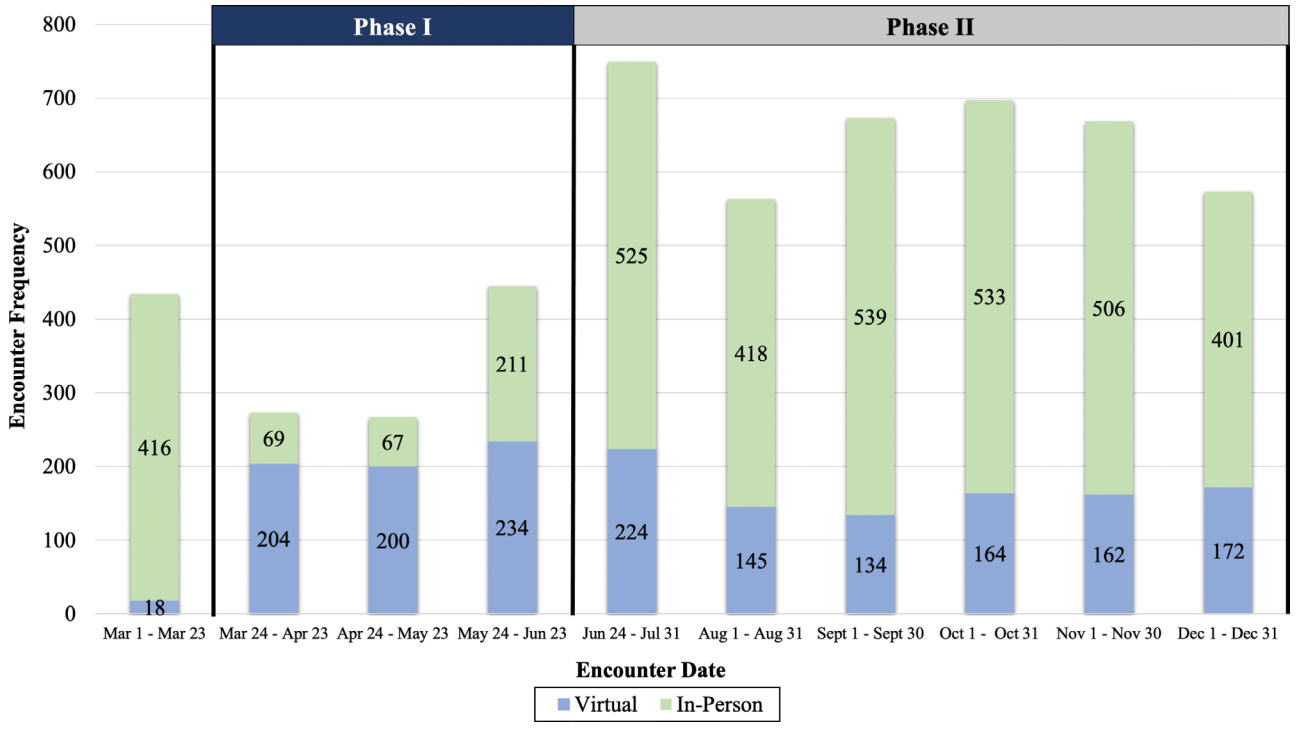

Figure 1. Visit modality distribution during the COVID-19 pandemic: Each column displays the number of virtual (blue) and in-person (green) visits that occurred during the indicated time period. Encounter dates corresponding to Phase I (March 24 through June 23, 2020) and Phase II (June 24 through December 31, 2020) are delineated by vertical black lines. Visit data from March 1 through March 23, 2020 are provided for reference.

Hispanic, low-income, have Medicaid insurance, and who speak languages other than English or Spanish were less likely to have telemedicine visits during the Public Health Emergency and were more likely to face barriers to navigating online platforms.[17,18] In a single-center study in otolaryngology, race/ethnicity was not significantly associated with visit modality during the Public Health Emergency, consistent with the present Phase I analysis.[10] Patients with lower median household income, Medicaid insurance, and older age had decreased odds of virtual visit and video streaming use.[10] In a single center analysis in general surgery, non-White patients were less likely to complete post-operative telehealth visits than White patients.[19] These disparities in telemedicine surgical consultation parallel inequities observed in general and subspecialty internal medicine, where racial/ethnic minorities, those with Medicare or Medicaid insurance, older patients, and patients with non-English primary language were less likely to have virtual visits and less likely to have video visits during the Public Health Emergency.[9,20-22] Although many of these previous findings were not apparent in the Phase I analysis, the Phase II analysis revealed that several of these disparities manifested in the general surgery population as the pandemic progressed.

As the healthcare system shifts to a new normal, the digital divide and structural discrimination against vulnerable groups may continue to impair access to surgical care and create inequities in telemedicine utilization.[21,23] Previous work has demonstrated that racial/ethnic minority and low-income patients are less likely to use the internet to obtain health information.[24] Furthermore, patients who lack broadband internet access and those with lower digital literacy tend to have fewer telemedicine visits and are less likely to use patient portals to communicate with providers.[25-27] Decreased use of video virtual visits by patients who are Latinx, older, have lower education level, and who have non-English primary language may reflect lower digital literacy and digital access in these populations.[2,21,24] The associations between Medicare insurance and visit modality on bivariate analysis were likely mediated by older age of the Medicare population, because these associations did not persist after adjustment for age. Women have been repeatedly found to have increased engagement with mobile health platforms.[9,10,28] This may reflect the relative convenience of attending virtual visits given a typically increased burden of domestic responsibilities in comparison with men.[28]

Table 2. Multivariable Analysis for Virtual Compared with In-Person New Visits

	Phase I, March 24–June 23, 2020		Phase II, June 24–December 31, 2020	
Characteristic	**Adjusted OR (95% CI)**	**p Value**	**Adjusted OR (95% CI)**	**p Value**
Age	1.00 (0.99-1.01)	0.892	1.00 (0.99-1.00)	0.487
Sex				
Male	Ref	—	Ref	—
Female	1.84 (1.32-2.55)	<0.001*	1.56 (1.29-1.90)	<0.001*
Race/ethnicity				
White	Ref	—	Ref	—
Black	1.21 (0.66-2.22)	0.537	1.52 (1.12-2.06)	0.007*
Latinx	1.03 (0.57-1.86)	0.911	1.33 (0.97-1.82)	0.074
Other	1.51 (0.63-3.59)	0.355	1.00 (0.65-1.53)	0.982
Insurance type				
Commercial	Ref	—	Ref	—
Medicare	0.72 (0.47-1.12)	0.143	0.90 (0.70-1.17)	0.437
Medicaid	0.99 (0.55-1.78)	0.969	0.96 (0.71-1.28)	0.772
Education level				
Bachelor's degree	Ref	—	Ref	—
HS or less/GED	1.22 (0.88-1.72)	0.228	1.06 (0.88-1.27)	0.568
Primary language				
English	Ref	—	Ref	—
Non-English	1.18 (0.52-2.65)	0.696	0.96 (0.62-1.48)	0.855
Diagnosis				
Hernia	Ref	—	Ref	—
Bariatric	1.03 (0.56-1.92)	0.922	7.34 (5.31-10.13)	<0.001*
Hemorrhoids	0.41 (0.20-0.84)	0.015*	0.10 (0.04-0.26)	<0.001*
Gallbladder	1.27 (0.57-2.82)	0.555	3.58 (2.46-5.21)	<0.001*
Benign GI	0.61 (0.36-1.03)	0.063	1.22 (0.90-1.65)	0.202
GI malignancy	0.33 (0.17-0.64)	0.001*	1.49 (0.99-2.23)	0.054
Other	0.62 (0.36-1.06)	0.083	1.22 (0.89-1.68)	0.216

Odds ratio (OR) > 1 indicates higher likelihood of virtual visit compared with in-person visit.
*Statistically significant.
GED, General Educational Development; GI, gastrointestinal; HS, high school.

The novel finding that Black patients were more likely to use virtual surgical consultation during the Phase II period may reflect institutional efforts to expand digital health access for communities of color in addition to disproportionate access barriers to in-person care in this population. The decreased logistical barriers to telemedicine participation make this visit modality more feasible for patients with significant time and resource constraints.[29] For example, telehealth platforms have been previously used to provide vascular surgery care to patients living in rural areas during initial consultation, perioperative visits, and long-term follow-up.[30,31] In response to state and national policies that dramatically affected surgical care delivery in March 2020, this academic hospital implemented initiatives to reduce disparities in telemedicine access, address structural racism, and promote equity in patient-facing digital health platforms. These institutional efforts, which were enacted in spring 2020, may have contributed to increased virtual visit use among Black patients during the Phase II months. Of note, demographics of the patient population in the Division of General and Gastrointestinal Surgery at this academic hospital in 2020 were similar to previous years, before the implementation of these digital equity initiatives **(Supplemental Digital Content 3 and 4** at http://links.lww.com/XCS/A19).

The present work suggests that telemedicine platforms may provide a critical mechanism for racial/ethnic minority patients to maintain healthcare access during the pandemic. Thus, policies to expand digital access and promote digital literacy in vulnerable communities are urgently needed to reduce disparities in telemedicine engagement and promote high-quality surgical care delivery during virtual visits, particularly for patients who are under-resourced.[23] For example, broadband subscribership and

Table 3. Demographic Characteristics of Patients Seen Virtually During Phase I and Phase II

Characteristic	Phase I, March 24–June 23, 2020 (n = 638)			Phase II, June 24–December 31, 2020 (n = 1001)		
	Audio-only (n = 410)	Video (n = 228)	p Value	Audio-only (n = 361)	Video (n = 640)	p Value
Age, y, median (IQR)	54 (38-66)	48 (37-63)	0.018*	55 (39-65)	46 (35-60)	<0.001*
Sex, n (%)						
Male	143 (34.9)	83 (36.4)	0.699	106 (29.4)	172 (26.9)	0.399
Female	267 (65.1)	145 (63.6)		255 (70.6)	468 (73.1)	
Race/ethnicity, n (%)						
White	258 (62.9)	170 (74.6)	0.011*	218 (60.4)	398 (62.2)	0.333
Black	42 (10.2)	20 (8.8)		40 (11.1)	92 (14.4)	
Latinx	66 (16.1)	20 (8.8)		69 (19.1)	102 (15.9)	
Other	11 (2.7)	12 (5.3)		14 (3.9)	28 (4.4)	
Missing	33 (8.1)	6 (2.6)		20 (5.5)	20 (3.1)	
Insurance type, n (%)						
Commercial	247 (60.2)	165 (72.4)	0.008*	202 (56.0)	437 (68.3)	<0.001*
Medicare	103 (25.1)	40 (17.5)		96 (26.6)	97 (15.2)	
Medicaid	59 (14.4)	22 (9.7)		61 (16.9)	102 (15.9)	
Other/uninsured	<10	<10		<10	<10	
Education level, n (%)						
Bachelor's degree	179 (43.7)	119 (52.2)	0.022*	153 (42.4)	326 (50.9)	0.006*
HS or less/GED	173 (42.2)	76 (33.3)		166 (46.0)	240 (37.5)	
Missing	58 (14.2)	33 (14.5)		42 (11.6)	74 (11.6)	
Primary language, n (%)						
English	369 (90.0)	215 (94.3)	0.074	318 (88.1)	614 (95.9)	<0.001*
Non-English	33 (8.1)	10 (4.4)		39 (10.8)	22 (3.4)	
Missing	8 (2.0)	3 (1.3)		4 (1.1)	4 (0.6)	
Diagnosis, n (%)						
Hernia	71 (17.3)	35 (15.4)	0.112	32 (8.9)	59 (9.2)	0.029*
Bariatric	94 (22.9)	43 (18.9)		124 (34.4)	244 (38.1)	
Hemorrhoids	27 (6.6)	10 (4.4)		<10	<10	
Gallbladder	46 (11.2)	16 (7.0)		54 (15.0)	61 (9.5)	
Benign GI	88 (21.5)	66 (29.0)		79 (21.9)	120 (18.8)	
GI malignancy	18 (4.4)	14 (6.1)		26 (7.2)	39 (6.1)	
Other	66 (16.1)	43 (18.9)		43 (11.9)	112 (17.5)	
Missing	0	1 (0.4)		2 (0.6)	0	

p Values correspond to *t*-test and chi-square analyses.
*Statistically significant.
GED, General Educational Development; GI, gastrointestinal; HS, high school; IQR, interquartile range.

data charge subsidies will help socioeconomically disadvantaged patients engage with mobile health platforms.[1] Health systems can also collaborate with local and national governments to support policies that expand access to broadband internet and technological devices, which will enable participation in virtual visits.[3,21,32] Health systems should also purposefully enroll under-resourced patients in telemedicine platforms. Digital literacy training as well as cultural and linguistic inclusivity in mobile health platform development will further help vulnerable patient populations engage with telemedicine.[23,32,33] Finally, expanding reimbursement incentives for virtual surgical consultation, including phone visits and patient portal communications, will promote equitable telemedicine access.[6,34,35]

Although digital health platforms may help expand access to under-resourced surgical populations, there may be clinical limitations to telemedicine. Virtual and

Table 4. Multivariable Analysis for Video Compared with Audio-Only New Virtual Visits

	Phase I, March 24–June 23, 2020		Phase II, June 24–December 31, 2020	
Characteristic	**Adjusted OR (95% CI)**	**p Value**	**Adjusted OR (95% CI)**	**p Value**
Age	0.99 (0.97-1.00)	0.094	0.97 (0.96-0.98)	<0.001*
Sex				
Male	Ref	—	Ref	—
Female	0.88 (0.58-1.32)	0.535	0.92 (0.64-1.31)	0.639
Race/ethnicity				
White	Ref	—	Ref	—
Black	0.62 (0.32-1.21)	0.162	0.85 (0.54-1.37)	0.512
Latinx	0.46 (0.22-0.96)	0.038*	0.95 (0.56-1.60)	0.833
Other	1.17 (0.46-3.02)	0.738	0.98 (0.45-2.14)	0.954
Insurance type				
Commercial	Ref	—	Ref	—
Medicare	0.68 (0.39-1.16)	0.156	0.72 (0.47-1.10)	0.132
Medicaid	0.72 (0.37-1.40)	0.335	0.80 (0.51-1.27)	0.350
Education level				
Bachelor's degree	Ref	—	Ref	—
HS or less/GED	0.72 (0.48-1.07)	0.103	0.66 (0.48-0.90)	0.009*
Primary language				
English	Ref	—	Ref	—
Non-English	0.69 (0.25-1.93)	0.486	0.27 (0.14-0.56)	<0.001*
Diagnosis				
Hernia	Ref	—	Ref	—
Bariatric	0.92 (0.47-1.80)	0.801	0.93 (0.52-1.65)	0.798
Hemorrhoids†	0.52 (0.19-1.43)	0.207	—	—
Gallbladder	0.88 (0.39-1.99)	0.760	0.51 (0.26-0.98)	0.044*
Benign GI	1.42 (0.78-2.60)	0.256	0.92 (0.51-1.65)	0.772
GI Malignancy	1.43 (0.58-3.52)	0.441	1.06 (0.49-2.29)	0.884
Other	1.29 (0.67-2.46)	0.448	1.36 (0.72-2.60)	0.346

Odds ratio (OR) >1 indicates higher likelihood of video visit compared with audio-only visit.
*Statistically significant.
†Hemorrhoids were included in the Benign GI category during Phase II owing to small cell sizes that would destabilize the multivariable model.
GED, General Educational Development; GI, gastrointestinal; HS, high school.

in-person visits may not provide a comparable level of quality, particularly for new consultations or visits that require a site-sensitive physical exam. These potential limitations are likely exacerbated in an audio-only encounter. Additionally, patients may have privacy or security concerns related to discussing health information over a virtual platform.[29] For follow-up surgical encounters, there is evidence that patient satisfaction and perceived visit quality are similar between virtual and in-person modalities.[36-38] However, certain patients have expressed that trust and comfort with surgical providers are better cultivated by an in-person visit, and patients may prefer in-person evaluation for more complex surgical diseases.[37,39] Notably, previous studies have also demonstrated similar post-discharge outcomes for patients who use virtual compared with in-person follow-up visits after low-risk surgical procedures.[40,41] Nevertheless, less is known regarding patient and provider perceptions of the quality of initial surgical consultation that is conducted through video or audio-only modalities. Institutional policies that promote digital access and literacy should focus on facilitating effective use of video-enabled technology.

Importantly, telemedicine use patterns continue to evolve during the pandemic. Virtual visit engagement is affected by patient and provider factors, which are influenced by the public health landscape as well as institutional, state, and national policies that govern healthcare delivery. For example, telemedicine use dramatically increased after the Centers for Medicare and Medicaid began reimbursing virtual visits commensurate with in-person visits in March 2020.[6] However, virtual visit use at this institution decreased during the Phase II months

as the Department of Public Health relaxed restrictions on in-person consultation. As the pandemic progressed in 2021, virtual visit use at this institution has remained closely associated with healthcare policy, and video visits continue to provide an important tool for care delivery. To promote equity, surgical providers can collaborate with their institutions and local policy makers to advocate for parity in reimbursement across visit modalities. Although providers and departments may become more selective in their use of digital health platforms as policies change, telemedicine will likely remain a valuable method of surgical care delivery.

Limitations of this study include missingness of the race/ethnicity and education level variables in the database, which reduced the sample size available for the multivariable models and thus decreased the power of the analysis. Notably, our institution implemented systematic efforts to collect more robust patient demographic data early in the pandemic, which resulted in decreased proportions of missing race/ethnicity and education level data during Phase II. These equity-focused initiatives may also limit the generalizability of the results to healthcare systems in which similar efforts are not being performed. Additionally, this study did not include qualitative analysis of the fundamental drivers of differences in visit modality usage. For example, increased engagement of Black patients with virtual consultation and increased use of phone visits by Latinx patients may reflect personal or cultural preference, concerns about potential COVID-19 exposure during a clinic visit, or privacy concerns regarding video visits.[29] Finally, the generalizability of these results is limited by the demographics of the patient population at this academic medical center. Similar to the overall Massachusetts population, this patient population is predominantly White, highly educated, and nearly universally insured, which limits the ability to analyze visit modality preferences among under-resourced groups.[42,43]

Future research should use qualitative methodology to analyze patient-, provider-, and system-level drivers of visit modality preferences among under-resourced general surgical patient populations, particularly racial/ethnic minority groups and patients with limited English proficiency. Additional quantitative studies are needed to assess potential disparities in use of virtual surgical consultation in other healthcare systems, particularly those serving a larger proportion of racial/ethnic minority, non–English-speaking, and uninsured patients. These studies should explore which initial visits can be effectively conducted virtually vs in-person from the clinical perspective. Future work should also examine the influence of community-level social factors, such as COVID-19 prevalence, on telemedicine use for surgical consultation across geographic regions.[44] Further analysis of the second phase months, when surgical consultation volume returned to near baseline levels and surgical providers likely grew more comfortable incorporating virtual visits into their clinical practice, will be particularly illuminating.

CONCLUSIONS

The present study investigated demographic disparities in the use of virtual compared with in-person consultation among general surgery patients at a tertiary academic medical center during the initial Public Health Emergency (March through June 2020) and second phase period (June through December 2020) of the COVID-19 pandemic. This analysis suggests that Black patients at this medical center may have relied on virtual visits as an essential healthcare access channel as the pandemic progressed; however, disparities persisted in the use of video streaming during virtual visits among certain vulnerable groups. This study provides preliminary evidence that virtual consultation may serve as a mechanism to increase access to surgical care among traditionally under-resourced populations during the COVID-19 pandemic and beyond. Health systems must implement policies to promote digital access and digital literacy in under-resourced communities.

Author Contributions

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