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HEALTH SERVICES RESEARCH

Sociodemographic Trends in Telemedicine Visit Completion in Spine Patients During the COVID-19 Pandemic

Edwin Owolo, BA,[a] Zoey Petitt, BS,[a] Dana Rowe, BA,[a] Emily Luo, BS,[a] Brandon Bishop, MS MBA,[b] Emily Poehlein, MB,[c] Cynthia L. Green, PhD,[c] Chad Cook, PT, PhD,[d] Melissa Erickson, MD MBA,[d] and C. Rory Goodwin, MD PhD[a]

Study Design: Retrospective cohort study

Objective: This study identifies potential disparities in telemedicine utilization in the wake of the COVID-19 pandemic and its aftermath in patients receiving spine surgery.

Summary of Background Data: COVID-19 led to the rapid uptake of telemedicine in the spine surgery patient population. While previous studies in other medical subspecialties have identified sociodemographic disparities in telemedicine uptake, this is the first study to identify disparities in patients undergoing spine surgery.

Materials and Methods: This study included patients who underwent spine surgery between June 12, 2018 and July 19, 2021. Patients were required to have at least one scheduled patient visit, either virtual (video or telephone visit) or in-person. Binary socioeconomic variables used for modeling included: urbanicity, age at the time of the procedure, sex, race, ethnicity, language, primary insurer, and patient portal utilization. Analyses were conducted for the entire cohort and separately for cohorts of patients who had visits scheduled within specific timeframes: Pre–COVID-19 surge, initial COVID-19 surge, and post–COVID-19 surge.

Results: After adjusting for all variables in our multivariable analysis, patients who utilized the patient portal had higher odds of completing a video visit compared with those who did not (OR: 5.21; 95% CI: 1.28, 21.23). Hispanic patients (OR: 0.44; 95% CI: 0.2, 0.98) or those living in rural areas (OR: 0.58; 95% CI: 0.36, 0.93) had lower odds of completing a telephone visit. Patients with no insurance or on public insurance had higher odds of completing a virtual visit of either type (OR: 1.88; 95% CI: 1.10, 3.23).

Conclusion: This study demonstrates the disparity in telemedicine utilization across different populations within the surgical spine patient population. Surgeons may use this information to guide interventions aimed at reducing existing disparities and work with certain patient populations to find a solution.

Key words: COVID-19, telemedicine, disparities, spine surgery, neurosurgery, orthopedic surgery

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From the [a]Department of Neurosurgery, Duke University Medical Center, Durham, NC; [b]Kansas City University College of Osteopathic Medicine, Kansas City, MO; [c]Department of Biostatistics and Bioinformatics, Duke University School of Medicine, Durham, NC; and [d]Department of Orthopaedic Surgery, Duke University School of Medicine, Durham, NC.

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Address correspondence and reprint requests to Melissa Erickson, MD, MBA, Department of Orthopedic Surgery, Duke University Medical Center, DUMC Box 3077, Durham, NC 27710; E-mail: Melissa.erickson@duke.edu

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Telemedicine is the delivery of health care and the exchange of information across distances.[1] During the COVID-19 pandemic, telemedicine has been widely utilized to traverse ever-evolving social distancing recommendations while still allowing for visits between patients and physicians.[2] The benefits of using telemedicine include additional access and lowered overall costs. However, before COVID-19, overall telemedicine usage was relatively low.[3] During the pandemic, there was a shift from the outpatient clinic to patient homes through the advent of telemedicine.[4] Driven by patient need, policy changes like the implementation of the 1135 Waiver by the Centers for Medicare and Medicaid Services on March 6, 2020, drastically expanded the role of telemedicine in health care delivery by extending coverage of telehealth visits outside the bounds of certain rural areas and provided more similar reimbursement rates for in-person and telemedicine visits.[5]

Despite the increased use of telemedicine during COVID-19, it has not been universally adopted across all medical and patient-level strata. Telemedicine appointments are dependent on a stable internet connection, access to technology, and electronic literacy to allow for the interactive communication between patient and physician.[6] Whereas ~80 percent of adults in the United States have access to a smartphone and 75 percent have an internet connection at home, these rates are decreased in populations of lower educational levels and income.[7] The discrepancy in telemedicine utilization may contribute to further exacerbating health care disparities that already exist among vulnerable members of our population. In a study of patients with head and neck surgeries, increased age and being in the lowest median household income quartile were associated with lower odds of completing a virtual visit during the early pandemic surge.[8]

Moreover, a number of studies across various specialties have demonstrated a decreased uptake of telephone and video visits among patients identifying as Black and/or Hispanic in light of the pandemic.[9–11]

At present, there is a lack of literature examining the role of social determinants of health on the completion of telemedicine visits for patients undergoing spine surgery. The goal of this study was to identify potential disparities in telemedicine utilization in the wake of the COVID-19 pandemic and its aftermath in patients receiving spine surgery.

MATERIALS AND METHODS

Study Design, Setting, and Participants

A retrospective study of patients with a spine-related condition who underwent surgery between the dates of June 12, 2018 and July 19, 2021 was performed at a large academic center serving an economically, racially, age, and gender-diverse population. Data was pulled utilizing CPT codes from the operating room log. The most common procedures were anterior cervical discectomy and fusion, lumbar laminectomy, posterior lumbar fusion, anterior lumbar fusion, and microdiscectomy (Supplemental Table #1, Supplemental Digital Content 1, http://links.lww.com/BRS/C113). Patients were required to have at least one scheduled follow-up visit, either virtual (video or telephone visit) or in-person, within that timeframe. Patients under the age of 18 were excluded. Data were collected from electronic health records, obtained through performance services, and were consecutive (IRB #: 90408).

Study Variables

The primary outcome of interest was virtual visit completion, defined as "Yes" if a video or telephone visit was completed and "No" if a video or telephone visit was scheduled but not completed. Visit completion of any type (virtual or in-person) was also assessed and defined as "Yes" if the visit was completed and "No" if the visit was scheduled but not completed. Binary socioeconomic variables used for modeling included: urbanicity (rural vs. urban, defined by zip code), age at the time of the procedure ($\geq$65 y *vs.* <65), sex (male vs. female), self-reported race (White *vs.* non-White), self-reported ethnicity (Hispanic *vs.* non-Hispanic), language (English-speaking *vs.* non–English-speaking), primary insurer (no insurance/Medicaid/Medicare and < 65 y of age *vs.* private insurance/Medicare and age $\geq$65 y), and patient portal utilization (activated and used at least once *vs.* not activated or activated but not used).

Analyses were conducted for the entire cohort and separately for cohorts of patients who had visits scheduled within specific time frames of interest: pre–COVID-19 surge (June 12, 2018–March 16, 2020), initial COVID-19 surge (March 17, 2020–April 24, 2020), and post–COVID-19 surge (April 25, 2020–July 19, 2021). March 17th was chosen as the first day of the initial COVID-19 surge as this was the day that the US Surgeon General urged hospitals to suspend all non-essential surgeries.[12]

Statistical Analysis

Demographic and clinical characteristics of the cohort on the patient and encounter level were summarized descriptively by visit type and stratified based on time period (pre–COVID-19 surge, initial COVID surge, and post–COVID-19 surge). Continuous variables are displayed as mean (SD), median (25th, 75th percentiles [Q1, Q3]) and range. Categorical variables are displayed as count (percentage) for non-missing data.

To assess the association between sociodemographic characteristics and completing a virtual visit, univariable and multivariable generalized linear mixed effects models with a binary distribution and logit link function were run using the binary social risk factor variables defined above for virtual visits and separately for video and telephone visits. A random intercept was included to account for repeat encounters among some patients. All candidate variables were included in the multivariable model due to the high event rate in this cohort. For this analysis, only patients with complete sociodemographic data were included. Sensitivity analyses were done, assuming first that missing values were "no" and then that missing values were "yes" to assess the effect of missingness on estimates.

To assess the association between visit completion of any type (virtual or in-person) and sociodemographic characteristics, models were built predicting visit completion using the same methods as above. To assess the association between visit completion of any type and sociodemographic characteristics during the different time periods, the multivariable models specified above were run separately in each of the three time periods. Odds ratios (OR) and 95% confidence intervals (CI) are reported separately for each time period (pre–COVID-19 surge, initial COVID surge, and post–COVID-19 surge). SAS version 9.4 (SAS Institute, Inc., Cary, NC, USA) was used for all analyses, and a p-value < 0.05 was considered statistically significant.

RESULTS

Initially, 9793 discharges associated with 61,971 appointments were identified. 6784 discharges took place outside of the hospital and were excluded along with their subsequent appointments. In addition, 606 appointments were scheduled after July 19, 2021 and were excluded. Thirty patients under the age of 18 were also excluded. The remaining 19,158 appointments from 2694 patients were included in the analysis (Fig. 1). The demographic and clinical characteristics of the patients whose visits were included in the analysis are summarized and stratified by visit type for each time period investigated (Table 1).

Visit Completion

Pre–COVID-19 pandemic (June 12, 2018–March 16, 2020), 9806 visits were scheduled. Of these scheduled visits, 6478 (68.8%) were completed. During the initial surge of the pandemic (March 17, 2020–April 24, 2020), 755 visits were scheduled and 39.6% were completed. After the COVID-19 initial surge (April 25, 2020–July 19, 2021), 8597 appointments were scheduled, and 63.5% were completed (Table 2). Figures 2 and 3 show the percentage of virtual and in-person visit completion rates, respectively, between February 4 and June 5, comparing the years 2020 and 2021.

Impact of Sociodemographic Characteristics on Visit Completion

Overall, 12,235 of the 19,158 visits assessed during the study were completed (63.9%). In the multivariable model, male sex, patient portal utilization, and having private insurance were positively associated with visit completion after adjusting for the other variables. Males had 1.09 times higher odds of visit completion than females (95% CI: 1.01–1.17; $P = 0.022$). Patients who utilized the patient portal had 1.39 times higher odds of visit completion than patients who did not utilize the patient portal (95% CI: 1.26–1.54; $P < 0.001$). Patients who had private insurance or Medicare and age > 65 had 1.32 times higher odds of visit completion compared with those who had no insurance or public insurance (Medicaid or Medicare and age < 65) (95% CI: 1.19–1.47; $P < 0.001$). The remaining sociodemographic factors were not associated with visit completion (Table 3).

When comparing visit completion rates between more granular insurance categories, patients who had Medicaid had 44% lower odds of completing a visit of any type compared with patients who had private insurance (OR: 0.56; 95% CI: 0.46–0.69; $P < 0.001$). Medicare patients who were under the age of 65 had 22% lower odds of completing a visit of any type compared with patients who had private insurance (OR: 0.78; 95% CI: 0.69–0.89; $P < 0.001$). There were no differences in visit completion for patients with Medicare who were greater than 65 years old or for self-pay patients compared with patients who had private insurance (Table 4).

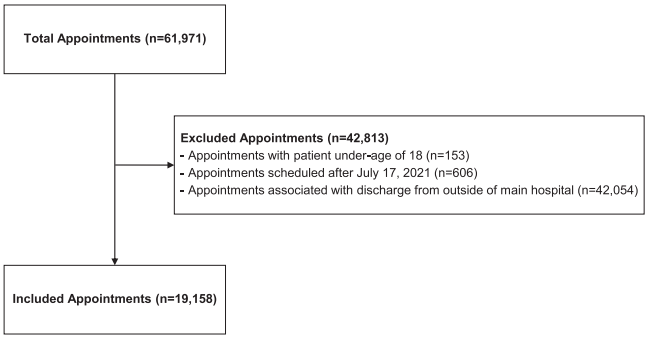

Figure 1. CONSORT Diagram displaying exclusion criteria.

Sociodemographic Characteristics Associated with Completing a Virtual Visit

Of all the scheduled virtual visits (n = 987 appointments), 762 (77.2%) were completed. In the multivariable model, having no insurance, Medicaid, or Medicare and age < 65 was associated with increased odds of virtual visit completion. After adjusting for other variables in the model, those who had no insurance or public insurance had 1.88 times the odds of completing a virtual visit compared with those who had private insurance or Medicare and age > 65 years (95% CI: 1.10–3.23; $P = 0.022$). No other variables investigated were associated with the completion of a virtual visit (Table 3).

Table 4 stratifies the analysis by more granular insurance categories. Patients on Medicaid or Medicare who were less than 65 years old, patients on Medicare who were greater than 65 years old, and patients with self-pay did not have significantly different odds of completing a virtual visit in comparison to patients on private insurance.

Sociodemographic Characteristics Associated With Completing a Video or Telephone Visit

In a multivariable analysis controlling for all other sociodemographic factors, patients who utilized the patient portal had 5.21 times higher odds of completing a video visit compared with patients who did not utilize the patient portal (95% CI: 1.28–21.23; $P = 0.022$). No other sociodemographic factors were associated with video visit completion (Table 3). Hispanic patients had 56% lower odds of completing a telephone visit compared with non-Hispanic patients (OR: 0.44; 95% CI: 0.20–0.98; $P = 0.044$). In addition, patients who lived in rural areas had 42% lower odds of completing a telephone visit compared with patients who lived in urban areas (OR: 0.58; 95% CI: 0.36–0.93; $P = 0.025$). No other sociodemographic factors were associated with the completion of a telephone visit (Table 3).

DISCUSSION

Within the surgical spine patient population at our institution, we observed the widespread adoption of

TABLE 1. Demographic and Clinical Characteristics Stratified by Visit Type

	Pre–COVID-19 surge			Initial COVID-19 surge					Post–COVID-19 surge				
	Completed in-person (N = 6478)	Not completed (N = 3328)	Total (N = 9806)	Completed in-person (N = 180)	Completed telephone (N = 98)	Completed virtual (N = 21)	Not completed (N = 456)	Total (N = 755)	Completed in-person (N = 4815)	Completed telephone (N = 399)	Completed virtual (N = 244)	Not completed (N = 3139)	Total (N = 8597)
Age													
Mean (SD)	60.7 (13.6)	59.6 (14.6)	60.3 (14.0)	58.0 (13.6)	60.3 (13.9)	58.7 (14.8)	61.1 (14.3)	60.2 (14.1)	59.4 (14.1)	60.5 (14.3)	58.8 (13.3)	59.0 (14.1)	59.3 (14.1)
Median (Q1, Q3)	64.0 (52.0, 71.0)	63.0 (50.0, 71.0)	63.0 (52.0, 71.0)	61.0 (48.0, 67.5)	62.0 (50.0, 71.0)	66.0 (45.0, 69.0)	64.0 (53.0, 71.0)	63.0 (51.0, 71.0)	62.0 (51.0, 70.0)	62.0 (52.0, 71.0)	63.0 (50.5, 69.0)	61.0 (50.0, 69.0)	62.0 (51.0, 70.0)
Min-Max	(18.0–91.0)	(18.0–91.0)	(18.0–91.0)	(23.0–83.0)	(32.0–84.0)	(27.0–74.0)	(19.0–89.0)	(19.0–89.0)	(18.0–91.0)	(18.0–88.0)	(19.0–81.0)	(18.0–88.0)	(18.0–91.0)
Female sex, n (%)	3,432 (53.0)	1,847 (55.5)	5,279 (53.8)	93 (51.7)	44 (44.9)	13 (61.9)	246 (53.9)	396 (52.5)	2,337 (48.5)	183 (45.9)	95 (38.9)	1,540 (49.1)	4,155 (48.3)
Race, n (%)													
2 or more races	50 (0.8)	23 (0.7)	73 (0.7)	1 (0.6)	1 (1.0)	0 (0.0)	1 (0.2)	3 (0.4)	22 (0.5)	5 (1.3)	2 (0.8)	19 (0.6)	48 (0.6)
American Indian or Alaskan Native	23 (0.4)	14 (0.4)	37 (0.4)	3 (1.7)	1 (1.0)	1 (4.8)	5 (1.1)	10 (1.3)	28 (0.6)	2 (0.5)	3 (1.2)	13 (0.4)	46 (0.5)
Asian	49 (0.8)	39 (1.2)	88 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.4)	2 (0.3)	77 (1.6)	6 (1.5)	5 (2.0)	56 (1.8)	144 (1.7)
Black or African American	1,245 (19.2)	632 (19.0)	1,877 (19.1)	35 (19.4)	14 (14.3)	2 (9.5)	73 (16.0)	124 (16.4)	972 (20.2)	59 (14.8)	18 (7.4)	639 (20.4)	1,688 (19.6)
Caucasian/White	4,932 (76.1)	2,503 (75.2)	7,435 (75.8)	134 (74.4)	81 (82.7)	18 (85.7)	361 (79.2)	594 (78.7)	3,561 (74.0)	322 (80.7)	212 (86.9)	2,330 (74.2)	6,425 (74.7)
Native Hawaiian or Other Pacific Islander	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (0.1)	0 (0.0)	0 (0.0)	2 (0.1)	7 (0.1)
Not Reported/Declined	108 (1.7)	78 (2.3)	186 (1.9)	2 (1.1)	1 (1.0)	0 (0.0)	6 (1.3)	9 (1.2)	49 (1.0)	1 (0.3)	1 (0.4)	26 (0.8)	77 (0.9)
Other	71 (1.1)	39 (1.2)	110 (1.1)	5 (2.8)	0 (0.0)	0 (0.0)	8 (1.8)	13 (1.7)	101 (2.1)	4 (1.0)	3 (1.2)	54 (1.7)	162 (1.9)
Ethnicity, n (%)													
Missing	194	103	297	7	3	0	10	20	99	17	3	58	177
Not Hispanic or Latino	6,146 (97.8)	3,157 (97.9)	9,303 (97.8)	169 (97.7)	91 (95.8)	21 (100.0)	430 (96.4)	711 (96.7)	4,560 (96.7)	362 (94.8)	228 (94.6)	2,980 (96.7)	8,130 (96.6)
Hispanic or Latino	138 (2.2)	68 (2.1)	206 (2.2)	4 (2.3)	4 (4.2)	0 (0.0)	16 (3.6)	24 (3.3)	156 (3.3)	20 (5.2)	13 (5.4)	101 (3.3)	290 (3.4)
Insurance type, n (%)													
Medicaid	137 (2.1)	103 (3.1)	240 (2.4)	5 (2.8)	4 (4.1)	2 (9.5)	26 (5.7)	37 (4.9)	200 (4.2)	26 (6.5)	5 (2.0)	209 (6.7)	440 (5.1)
Medicare	3,387 (52.3)	1,717 (51.6)	5,104 (52.0)	88 (48.9)	53 (54.1)	14 (66.7)	255 (55.9)	410 (54.3)	2,284 (47.4)	207 (51.9)	115 (47.1)	1,523 (48.5)	4,129 (48.0)
Other	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.0)
Other Government	87 (1.3)	62 (1.9)	149 (1.5)	4 (2.2)	4 (4.1)	0 (0.0)	2 (0.4)	10 (1.3)	86 (1.8)	3 (0.8)	9 (3.7)	48 (1.5)	146 (1.7)
Private	2,616 (40.4)	1,318 (39.6)	3,934 (40.1)	71 (39.4)	34 (34.7)	3 (14.3)	151 (33.1)	259 (34.3)	1,954 (40.6)	133 (33.3)	103 (42.2)	1,132 (36.1)	3,322 (38.6)
Self-Pay	98 (1.5)	56 (1.7)	154 (1.6)	5 (2.8)	1 (1.0)	2 (9.5)	8 (1.8)	16 (2.1)	123 (2.6)	9 (2.3)	2 (0.8)	83 (2.6)	217 (2.5)
Special Programs	153 (2.4)	72 (2.2)	225 (2.3)	7 (3.9)	2 (2.0)	0 (0.0)	14 (3.1)	23 (3.0)	166 (3.4)	21 (5.3)	10 (4.1)	144 (4.6)	341 (4.0)
Urbanicity, n (%)													
Missing	22	15	37	0	0	0	0	0	3	0	2	5	10
Urban	4,700 (72.8)	2,413 (72.8)	7,113 (72.8)	125 (69.4)	64 (65.3)	13 (61.9)	311 (68.2)	513 (67.9)	3,464 (72.0)	288 (72.2)	187 (77.3)	2,167 (69.1)	6,106 (71.1)
Rural	1,756 (27.2)	900 (27.2)	2,656 (27.2)	55 (30.6)	34 (34.7)	8 (38.1)	145 (31.8)	242 (32.1)	1,348 (28.0)	111 (27.8)	55 (22.7)	967 (30.9)	2,481 (28.9)
Language, n (%)													
Arabic	2 (0.0)	0 (0.0)	2 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
English	6,417 (99.1)	3,300 (99.2)	9,717 (99.1)	180 (100.0)	96 (98.0)	21 (100.0)	453 (99.3)	750 (99.3)	4,769 (99.0)	394 (98.7)	244 (100.0)	3,118 (99.3)	8,525 (99.2)
Hindi	9 (0.1)	8 (0.2)	17 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Korean	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.0)
Mandarin	1 (0.0)	3 (0.1)	4 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Nonpatient (Spec)	3 (0.0)	1 (0.0)	4 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Spanish	42 (0.6)	15 (0.5)	57 (0.6)	0 (0.0)	2 (2.0)	0 (0.0)	3 (0.7)	5 (0.7)	43 (0.9)	5 (1.3)	0 (0.0)	21 (0.7)	69 (0.8)
Vietnamese	4 (0.1)	1 (0.0)	5 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Patient portal utilization	5,538 (85.5)	2,766 (83.1)	8,304 (84.7)	152 (84.4)	77 (78.6)	19 (90.5)	365 (80.0)	613 (81.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Missing	0	0	0	0	0	0	0	0	0	0	0	9	9
Not used	940 (14.5)	562 (16.9)	1,502 (15.3)	28 (15.6)	21 (21.4)	2 (9.5)	91 (20.0)	142 (18.8)	549 (11.4)	63 (15.8)	8 (3.3)	519 (16.6)	1,139 (13.3)
Used	5,538 (85.5)	2,766 (83.1)	8,304 (84.7)	152 (84.4)	77 (78.6)	19 (90.5)	365 (80.0)	613 (81.2)	4,266 (88.6)	336 (84.2)	236 (96.7)	2,611 (83.4)	7,449 (86.7)

TABLE 2. Visit Completion Rates by Time Period

	Pre-COVID-19 Surge (6/12/18–3/16/20)	Initial COVID-19 Surge (3/17/20–34/24/20)	Post–COVID-19 Surge (4/25/20–37/19/21)
Overall visit completion (%)	6478/9806 (68.8)	299/755 (39.6)	5458/8597 (63.5)
In-person visit completion (%)	6478/9806 (68.8)	180/604 (29.8)	4815/7761 (62.0)
Telephone visit completion (%)	No telephone visits scheduled	98/122 (80.3)	399/501 (79.6)
Video visit completion (%)	No video visits scheduled	21/29 (72.4)	244/335 (72.8)
Scheduled appointments per week			
No. weeks	92	6	64
Mean (SD)	106.6 (63.6)	125.8 (13.5)	134.3 (40.2)
Median (Q1-Q3)	122.5 (42–157)	126 (119–133)	143.5 (104.5–167.5)
Min-Max	1–206	105–145	54–204
Completed appointments per week			
No. weeks	92	6	64
Mean (SD)	71.2 (42.6)	49.8 (12.1)	85.3 (26.4)
Median (Q1-Q3)	79 (28–106)	47.5 (41–63)	90.5 (65–108)
Min-Max	0–145	35–65	34–134

telemedicine visits during the initial surge of the COVID-19 pandemic. Within the initial surge of the pandemic from March 17th to April 24th, 2020, ~40 percent of completed visits were telemedicine encounters. Before this period, telemedicine visits were not utilized in the population observed. Of these telemedicine encounters, the majority were conducted over the telephone. However, we observed an increase in video visits in the post-initial surge period. While telephone visits were still used at higher rates than video visits, the increased utilization of video visits potentially reflects a better-organized infrastructure for performing this type of visit. At the onset of the pandemic, different options for video visits were available through multiple platforms like Zoom and Doximity. Eventually, our institution established a secured video visit function that integrated into the electronic medical record. Further, physicians were required to take training on how to use this function.

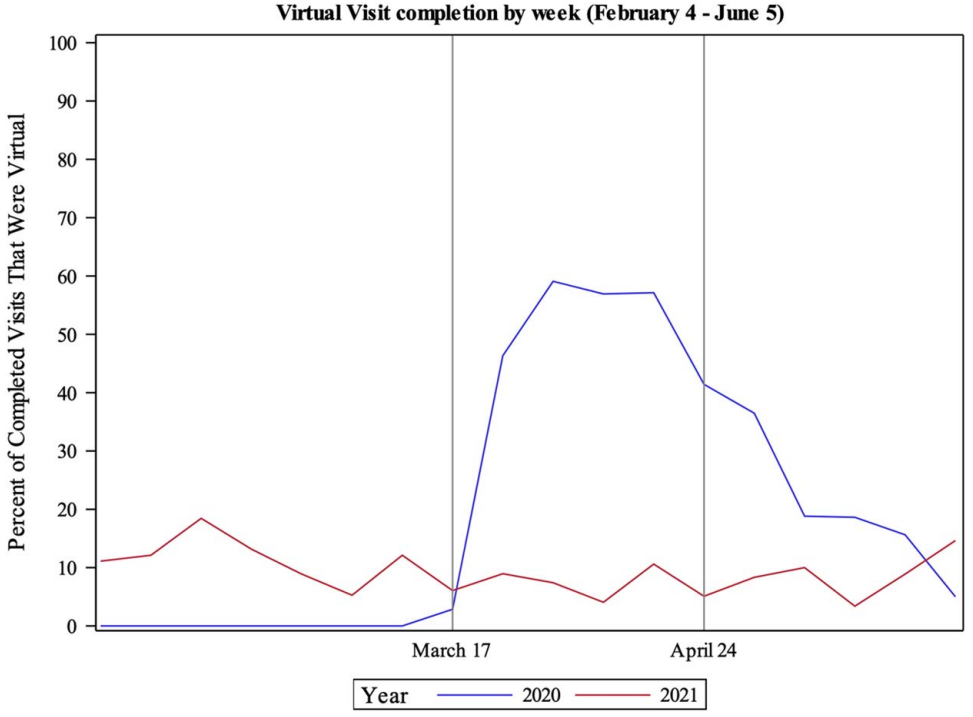

Figure 2. Graph showing the percent of completed visits that were virtual (video and telephone) between February 4 to June 5 in 2020 and 2021. The vertical lines correspond to the initial COVID-19 surge period from March 17, 2020 to April 24, 2020. full color online

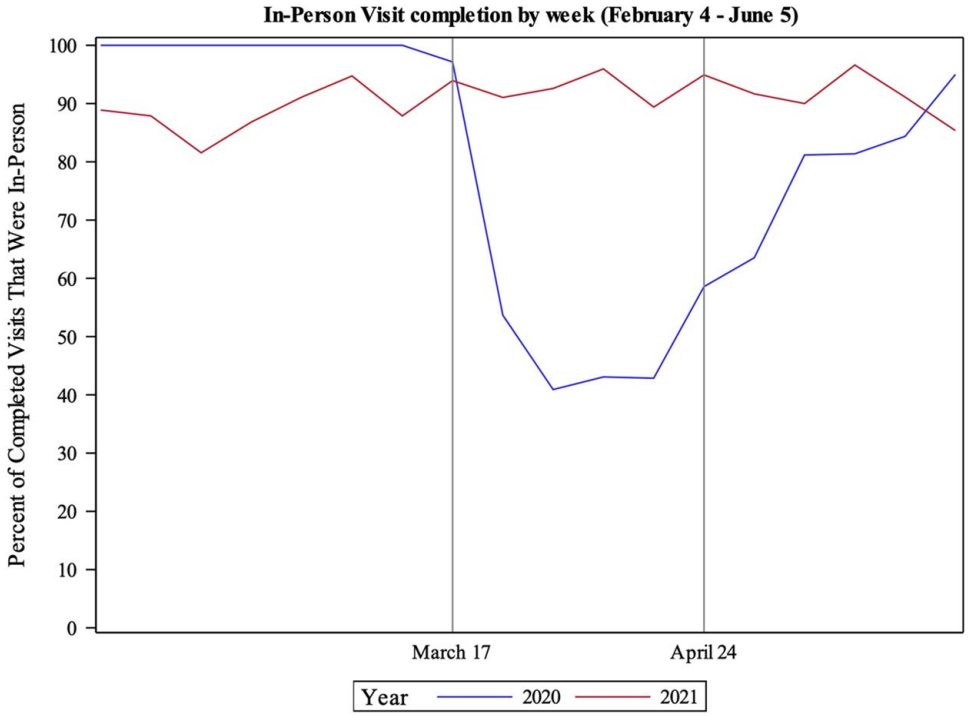

Figure 3. Graph showing the percent of completed visits that were in-person between February 4 to June 5 in 2020 and 2021. The vertical lines correspond to the initial COVID-19 surge period from March 17, 2020 to April 24, 2020. full color online

Patient portal utilization was associated with higher odds of video visit completion during the initial and post-initial surge periods. Patient portals like MyChartâ, which is utilized at our institution, provide patients with the ability to take a more engaged role in their care by allowing them to perform a multitude of tasks like viewing medications, test results, upcoming and past appointments, and messaging providers.[13] Before the pandemic, video visits were not linked to portal use. However, telemedicine innovation during the pandemic created an integrated way for patients to launch video visits within their patient portal, which helps to explain why its utilization was associated with higher rates of video visit completion. The portal also provided a streamlined way for providers to get trained on how to use the video visit function. The association between patient portal utilization and video visit completion also highlights the importance of coordinating with patients to ensure that they have the necessary resources like internet access, a device with a camera, and the associated visit platform downloaded onto their device to successfully perform a video visit.

Patients who identified as Hispanic and patients living in rural areas had lower odds of completing telephone visits during the initial and post-initial surge periods. These findings corroborate prior studies that show decreased telemedicine adoption and visit completion rates in Hispanic and rural patients.[14,15] For patients living in rural areas, this raises questions about the potential benefits and drawbacks of telephone visits. Rural patients face unique barriers to care, including greater travel times and increased financial burden.[16,17] In theory, telephone visits would alleviate these barriers by allowing patients to conduct visits remotely and forego travel. However, given that rural patients are less likely to complete this type of visit, this would suggest that providers should lean more heavily on video or in-person visits. The decision-making process for this dichotomy would be multifactorial, accounting for the distance traveled, type of encounter (new patient *vs.* returning patient, pre-operative *vs.* postoperative), comfort the physician has with not seeing the patient in-person, access the patient has to reliable internet connection, and the patient's technological literacy.

Interestingly, we observed that patients who were uninsured or on public insurance (Medicaid or Medicare and age < 65) had higher odds of virtual visit completion than those who were privately insured (or Medicare and age ≥ 65) in the post-pandemic surge period. In a subanalysis, we saw that patients insured by Medicare who were under the age of 65 and those insured by Medicaid had lower odds of completing a visit of any type in comparison to privately insured patients. However, when we ran the same analysis for the completion of virtual visits, this trend disappeared. A possible explanation for this is that patients who are uninsured or on public insurance are less likely to complete an in-person visit. Members of this population have shown to be less likely to complete outpatient visits.[18] The option of having a virtual visit may remedy some of the barriers, like transportation, that preclude members of this population from completing in-person visits.

TABLE 3. Multivariable Logistic Regression Results for Visit Completion by Type

Variable	Virtual (telephone and video)		Telephone		Video		Any Type (in-person and virtual)	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Age ≥65 y	1.08 (0.71–1.63)	0.74	0.82 (0.48–1.40)	0.46	1.99 (0.82–4.80)	0.13	0.98 (0.90–1.06)	0.61
Hispanic	0.65 (0.24–1.75)	0.40	0.44 (0.20–0.98)	0.044	1.28 (0.09–17.68)	0.85	0.95 (0.74–1.22)	0.71
Male	1.28 (0.87–1.89)	0.22	1.35 (0.81–2.25)	0.25	1.35 (0.62–2.94)	0.45	1.09 (1.01–1.17)	0.022
Patient portal utilization	1.22 (0.70–2.10)	0.48	1.08 (0.59–1.98)	0.79	5.21 (1.28–21.23)	0.022	1.39 (1.26–1.54)	<0.001
No insurance/Medicaid/ Medicare and age <65	1.88 (1.10–3.23)	0.022	1.69 (0.82–3.47)	0.15	2.36 (0.77–7.22)	0.13	1.32 (1.19–1.47)	<0.001
Non–English-Speaking	1.19 (0.28–5.05)	0.83	1.06 (0.25–4.43)	0.93	Non–estimable	1.28 (0.84–1.96)	0.25	
Non-White	0.98 (0.59–1.64)	0.94	1.03 (0.48–2.21)	0.94	0.67 (0.24–1.86)	0.44	1.03 (0.94–1.12)	0.53
Rural	0.73 (0.49–1.09)	0.12	0.58 (0.36–0.93)	0.025	0.83 (0.32–2.17)	0.70	0.95 (0.88–1.03)	0.22

The longevity of telemedicine for spine surgeons is unclear. Before the pandemic, spine surgeons underutilized telemedicine as it had a number of challenges, including implementation costs of required technology, difficulty performing physical examinations, lack of perceived benefit, and negative financial implications.[3] While a fifth of visits were conducted virtually at our institution during the early days of the pandemic, more than 33 percent of clinical practice worldwide was shifted toward telemedicine.[19] In a survey sent out to members of AO Spine International, 81.9 percent of physicians that responded agreed that telemedicine was easy to use, with a preference for imaging review, initial appointments, and postoperative care.[20] From a patient perspective, telemedicine has been met with generally high satisfaction rates and, in some cases, is preferred over in-person visits.[21,22] Altogether, this suggests that telemedicine is a feasible and reliable platform to conduct certain types of visits for certain patient populations. Although there appears to be some benefit in conducting virtual visits, as the pandemic has progressed into later stages, we have observed a decline in the percentage of completed visits that are performed virtually. The future of telemedicine may hinge on a variety of factors like insurance coverage for virtual visits as well as the preferences of patients and providers.

Limitations

This study is limited by its retrospective design, which may not account for potential confounders that could affect our analysis. Moreover, low sample sizes impact our ability to truly understand how certain sociodemographic groups utilized telemedicine during the initial surge of the pandemic. In addition, our study only includes patients who underwent a surgical procedure. Therefore, the sociodemographic trends in telemedicine utilization that we observed cannot be generalized to nonoperative patients seen by spine surgeons. Lastly, this study does not address what sociodemographic groups are more or less likely to have a certain type of visit (in-person or virtual)

TABLE 4. Visit Completion by Insurance Type

Comparison	Virtual		Any Type	
	Odds ratio (95% CI)*	P	Odds ratio (95% CI)[a]	P
Reference = Private	1.00	—	1.00	—
Medicaid	2.16 (0.86, 5.39)	0.10	0.56 (0.46–0.69)	<0.001
Medicare and age <65 y	1.68 (0.87, 3.24)	0.12	0.78 (0.69–0.89)	<0.001
Medicare and age ≥65 y	1.10 (0.42, 2.86)	0.85	1.13 (0.91–1.40)	0.27
Self-Pay	1.81 (0.57, 5.79)	0.32	0.87 (0.65–1.17)	0.36

** Odds ratios are adjusted for all binary risk factors.*

scheduled since we only accounted for visit completion rates. Follow-up studies could investigate potential disparities in the scheduling of visits across different modalities.

CONCLUSION

Across the health care system, the COVID-19 pandemic ushered in a new period of heavy reliance on telemedicine to provide care to patients. This study identifies sociodemographic disparities in the utilization of telemedicine during the initial surge of the pandemic and its aftermath. Knowledge of these disparities will provide spine surgeons with a better understanding of the type of telemedicine visit they should consider offering to patients belonging to certain sociodemographic groups.

➢ Key Points

- ❑ Although a powerful tool for traversing the social distance ushered in by the COVID-19 pandemic, telemedicine visits were completed at varying rates among patients belonging to different sociodemographic groups.
- ❑ Hispanic patients or those living in rural areas had lower odds of completing a telephone visit.
- ❑ Patients that were enrolled in the patient portal had higher odds of completing a video visit than those who were not.
- ❑ Patients with no insurance or on public insurance had higher odds of completing either a video or telephone visit than patients with private insurance.

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