Multicenter Evaluation of Telehealth Utilization in Hip and Knee Arthroplasty Before and for One Year During the COVID-19 Pandemic

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A R T I C L E   I N F O

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A B S T R A C T

Background: The Coronavirus Disease 2019 (COVID-19) pandemic has led to an increase in telehealth utilization across the health-care sector. It is unknown if telehealth use among hip and knee arthroplasty clinics has remained an important health-care delivery platform. The purpose of the present study was to analyze telehealth utilization before and for 1 year during the pandemic among four varied hip and knee arthroplasty clinics.

Methods: Retrospective data were available from four regionally diverse hip and knee arthroplasty centers. Data on volume of patient visits, demographics, visit types (new visit, follow-up, postoperative visit, other), and visit modality (in-person, telehealth, telephone) were available from January 2020 through April 2021. Data from the centers were analyzed as a total and separately, using chi-squared and Fisher exact tests.

Results: Among the four centers, there were 296,540 hip and knee arthroplasty outpatient clinic visits occurring in March 2020 (>55%) and April 2020 (>25%). From August 2020 until April 2021, telehealth visits accounted for 2%-3% of total visits. Younger patients (<50 years old) were most likely to use telehealth. Follow-up and postoperative were the most likely telehealth visits.

Conclusion: Telehealth utilization peaked during March and April of 2020 and has since reverted to near prepandemic levels. Younger patients and lower complexity visits such as postoperative or follow-up visits are more likely to use telehealth.

Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic has impacted the World in innumerable ways. In response to the early COVID-19 pandemic, orthopedic surgery departments across the United States (US) used telehealth services to deliver patient care [1]. The implementation of telehealth was further supported by the Centers for Medicare and Medicaid Services. As of March 2020, the Centers for Medicare and Medicaid Services provided payment parity for telehealth services and allowed for a wide variety of communication platforms to deliver telemedicine, whether they were compliant with the Health Insurance Portability and Accountability Act (HIPAA) or not [2].

Telemedicine and telehealth are often interchangeable terms, both referring to the provision of health-care services from provider to patient in differing locations [3,4]. Before COVID-19 being declared a pandemic by the World Health Organization (WHO) on March 11, 2020 [3], telehealth accounted for less than 1% of all patient visits in the US [4]. After the COVID-19 pandemic, however, 83% of academic orthopedic surgery departments implemented telehealth services [1].

Within orthopedic surgery, total joint arthroplasty providers were early adopters of telehealth [5-7]. Although increased utilization of telehealth was evident in the first several months of the COVID-19 pandemic, it is not known if this represents a lasting or transient care delivery model in arthroplasty [7]. The purpose of this study is to analyze the trends of utilization of telehealth among four varied arthroplasty practices across the US from January 2020 to April 2021. Second, we sought to determine if telehealth is more used among certain patient demographics or specific appointment types.
Material and methods

Data were retrospectively collected from the electronic medical records of four medical centers located in representative areas of the US. Institution review board approval was obtained at each center.

Patients and centers

The patients included in the study were limited to those evaluated in hip and knee arthroplasty clinics among the four included centers. Demographic data were available. The included centers were anonymized and labeled A, B, C, and D. Center A is an academic, specialized orthopedic hospital in the Eastern region of the US. Center B is an academic medical center in the Western region of the US. Center C is a large community-based private clinic in the Midwestern region of the US. Center D is an academic, specialized orthopedic hospital in the Eastern region of the US.

Visit types

Visit types encompassed all outpatient visits to an adult hip and knee reconstruction clinic at one of the four centers. Visits were classified as “new patient visits,” “follow-up visits,” “postoperative visits,” and “other visits.” Visits were also characterized by whether they occurred in-person, over telehealth platforms, or over telephone. These data were reported monthly by each site.

Data compilation and reporting

To provide anonymity to each of the four centers, the total volume of visits in the four centers were reported in absolute values. The data for each center are otherwise reported in percentages rather than absolute values.

Data analysis

Patient visits to each center, subclassified by sex, appointment types, and age groups, were presented as frequencies and percentages and compared using the chi-squared test or the Fisher exact test, as appropriate. The comparisons for utilization difference in the trends over time between centers were conducted using a Cochran-Armitage test for trend. All tests were 2-sided. Significance was defined as \( P < .05 \). Statistical analyses and data visualizations were performed using SAS 9.4 (SAS Institute Inc., Cary, NC) and Rstudio 1.2.5042 (RStudio, Inc., Boston, MA).

Results

Overall study period results

A total of 296,540 hip and knee arthroplasty outpatient clinic visits occurred between January 2020 and April 2021 among the four centers included in this study. Of these, a total of 15,240 (5%) were telehealth visits. Centers had a difference in overall telehealth utilization during the study period (Table 1). Fifty-seven percent of all visits and 57% of all telehealth visits were by females. Furthermore, during this time period, the highest utilization category for telehealth was among follow-up visits and in patients younger than 50 years (Table 2; Fig. 1).

Telehealth utilization over time

Before March 2020, nearly no telehealth visits occurred at any of the centers. The greatest utilization of telehealth visits occurred in April 2020 (center A 82%, center B 79%, center C 82%, center D 55%)
Appointment type and telehealth utilization

Across the cohort, from April 2020 to April 2021, telehealth utilization was greatest for follow-up and postoperative visits (Fig. 5). However, centers A, B, C, and D had statistical differences in telehealth utilization by appointment type, with greater utilization among follow-up and postoperative visits in all centers but one (Table 3; \( P < .0001 \)).

**Figure 1.** Overall and center-specific breakdown of telehealth usage by age over time.
Discussion

This multicenter study, which included four regionally diverse centers, analyzed hip and knee arthroplasty clinic telehealth utilization patterns starting from 2 months before the COVID-19 pandemic through 1 year after the start of the pandemic. There were several key findings in this study. First, despite an initial surge in telehealth utilization during the early pandemic, telehealth usage returned to minimal utilization among patients undergoing arthroplasty. Second, our data suggest that demographics may not influence telehealth utilization, except perhaps in younger patients. Finally, new patient evaluations are least likely to use telehealth, whereas postoperative and follow-up visits are most likely to occur over telehealth although practice variability exists in our cohort.
Although payment parity exists between telehealth and in-person visits, arthroplasty care has reverted to existing practice patterns of predominantly delivering care in-person. Our data indicate that, except for 2 months in the early pandemic, most patient clinic visits across centers have been in-person. This is a pattern that has emerged across orthopedic subspecialties. Through a statewide cohort study, Chao et al. [8] analyzed telehealth utilization across surgical subspecialties during the pandemic through September 2020. Their results found neurosurgery and urology to be the highest and orthopedic surgery to be either the lowest or second lowest in converting clinic appointments to telehealth. While the present study did not focus on identifying explanations for the return to low

Figure 3. Month-over-month change in telehealth utilization for overall cohort and by center.
utilization of telehealth, this finding does not seem to be driven by low patient or surgeon satisfaction, as the orthopedic literature has identified high patient and surgeon satisfaction with telehealth [9-11]. Moreover, other fields in medicine, such as neurology [12], have incorporated telehealth into a significant portion of their practice, with certain clinics delivering over 25% of their care through telehealth. Despite low current usage of telehealth in orthopedic surgery, a systematic review by Jenkins et al [13] forecasts growth in utilization of telehealth as technological platforms and indications for telehealth usage mature.

Figure 4. Overall and center-specific breakdown of telehealth usage by sex over time.
Among arthroplasty patients, younger patients (<50 years of age) were more likely to use telehealth, while sex does not have an impact on telehealth utilization. The results of the present study are similar to those of Xiong et al. [14], who found that across two urban academic medical centers, telehealth users tended to be younger, whereas sex did not affect telehealth utilization. Their study was from March through May 2020; the present study adds to the literature by demonstrating these patterns persist through April 2021.

Of all arthroplasty clinic visits, new patient visits were least likely to take place over telehealth. In the present study, postoperative and
follow-up visits were most likely to be performed over telehealth. It is possible that patients and surgeons feel these generally lower complexity visits are more appropriate to happen via telehealth, particularly during an ongoing pandemic. It is also possible that surgeons and/or patients feel an evaluation for surgical vs nonoperative care requires an in-person physical examination. However, surgeons and/or patients feel an evaluation for surgical vs nonoperative care requires an in-person physical examination.

Table 3 Center-specific breakdown of telehealth usage by appointment type over time (four time periods: 04/2020, 08/2020, 12/2020, 04/2021).

| Center A | 2020-04 | 2020-08 | 2020-12 | 2021-04 | P value |
|----------|---------|---------|---------|---------|---------|
| Appt     |         |         |         |         |         |
| FollowUp | 37      | 67      | 60      | 77      | <.0001  |
| NewPatient | 20   | 15      | 11      | 13      |         |
| Other    | 0       | 0       | 0       | 0       |         |
| PostOp   | 43      | 18      | 29      | 10      |         |

| Center B | 2020-04 | 2020-08 | 2020-12 | 2021-04 | P value |
|----------|---------|---------|---------|---------|---------|
| Appt     |         |         |         |         | <.0001  |
| FollowUp | 83      | 72      | 67      | 70      |         |
| NewPatient | 16   | 11      | 7       | 19      |         |
| Other    | 0       | 0       | 0       | 0       |         |
| PostOp   | 1       | 18      | 25      | 11      |         |

| Center C | 2020-04 | 2020-08 | 2020-12 | 2021-04 | P value |
|----------|---------|---------|---------|---------|---------|
| Appt     |         |         |         |         | <.0001  |
| FollowUp | 7       | 0       | 10      | 0       |         |
| NewPatient | 0   | 0       | 0       | 0       |         |
| Other    | 93      | 100     | 70      | 100     |         |
| PostOp   | 1       | 0       | 20      | 0       |         |

| Center D | 2020-04 | 2020-08 | 2020-12 | 2021-04 | P value |
|----------|---------|---------|---------|---------|---------|
| Appt     |         |         |         |         | <.0001  |
| FollowUp | 65      | 36      | 32      | 47      |         |
| NewPatient | 7   | 2       | 1       | 1       |         |
| Other    | 14      | 6       | 7       | 8       |         |
| PostOp   | 15      | 56      | 60      | 44      |         |

Appt: Appointment type.

Conflicts of interest

M. Ast is in the editorial or governing board of Journal of Arthroplasty and is a committee member of AAKHS, AAOS, and EOA. J. D. Marat is in the speakers’ bureau of or gave paid presentations for and is a paid consultant for Medacta; and is a board member of AAKHS Digital Health. C. A. Krueger is a paid consultant for Smit and Nephew and is a board member of AAOS and AAKHS. S. Bini received royalties from Stryker, has stock or stock options in InSilicoTrials.com, CaptureProof.com, Cloudmedix.com, and SiraMedical.com; received research support from Google.com, received financial or material support from Elsevier, is in the editorial or governing board of Journal of Arthroplasty and Arthroplasty Today; and is a board or committee member of American Association of Hip and Knee Surgeons and Personalized Arthroplasty Society.

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