

Original Research

Age and Racial Disparities in Telemedicine Utilization in an Academic Orthopedic Surgery Department

Akshaya V. Annapragada, BA, MS,¹
Prashant Meshram, MBBS, MS, DNB,² Sabrina G. Jenkins, BS,²
Amit Jain, MD,² Kellie K. Middleton, MD, MPH,³
Savya C. Thakkar, MD,² Adam S. Levin, MD,²
and Uma Srikumaran, MD, MPH, MBA²

¹The Johns Hopkins University School of Medicine, Baltimore, Maryland, USA.

²Department of Orthopedic Surgery, Johns Hopkins University, Baltimore, Maryland, USA.

³Northside Hospital, Cumming, Georgia, USA.

Abstract

Introduction: The COVID-19 pandemic has highlighted significant racial and age-related health disparities. In response to pandemic-related restrictions, orthopedic surgery departments have expanded telemedicine use. We analyzed data from a tertiary care institute during the pandemic to understand potential racial and age-based disparities in access to care and telemedicine utilization.

Materials and Methods: Data on patient race and age, and numbers of telemedicine visits, in-person office visits, and types of telemedicine were extracted for time periods during and preceding the pandemic. We calculated odds ratios for visit occurrence and type across race and age groups.

Results: Patients ages 27–54 were 1.3 (95% confidence interval [CI] 1.1–1.4, $p < 0.01$) and 1.2 (95% CI 1.0–1.3, $p < 0.05$) times more likely to be seen than patients <27 during the pandemic, versus the 2019 and 2020 controls. Patients 54–82 were 1.3 (95% CI 1.1–1.5, $p < 0.001$) times more likely to be seen than patients <27 during the pandemic versus the 2019 control. Patients 27–54, 54–82, and 82+, respectively, were 3.3 (95% CI 2.6–4.2, $p < 1e-20$), 3.5 (95% CI 2.8–4.4, $p < 1e-24$), and 1.9 (95% CI 1.1–3.4, $p < 0.05$) times more likely to be seen by telemedicine than patients <27. Among pandemic telemedicine appointments, Black patients were 1.5 (95% CI 1.2–1.9, $p < 1e-3$) times more likely to be seen by audio-only telemedicine than White patients, as compared with video telemedicine.

Conclusions: Telemedicine access barriers must be reduced to ensure that disparities during the pandemic do not persist.

Keywords: COVID-19, orthopedics, racial disparities, age disparities, telemedicine, telehealth

Introduction

The COVID-19 pandemic has highlighted significant health care inequities and disparities; in particular, race and age-related disparities exist.^{1,2} Black, Hispanic, and Asian patients are more likely to be hospitalized with COVID-19 and have higher death rates from the disease than White patients.¹ Older patients also have higher COVID-19 mortality rates than younger patients, with patients older than 60 years experiencing the highest mortality risk.²

In addition to disparities in outcomes, evidence suggests that COVID-19 pandemic-related restrictions may have exacerbated inequities in access to care.^{3,4} During the most severe periods of lockdown, many hospitals employed telemedicine as a medium by which to continue seeing patients.⁵ Specifically, orthopedic surgery departments adapted to offering virtual postoperative follow-ups, physical examinations, and even teleconsultations for new patients.^{6,7} While these types of appointments were an important adaptation to ensure availability and continuity of care, evidence suggests that not all patients were able to access telemedicine equally.^{8,9} In the United States, a study of orthopedic patients at two large academic centers found that racial minority patients, non-English speakers, and patients insured through Medicaid were less likely to be seen through telemedicine throughout the pandemic.⁸ However, another study noted that older orthopedic patients were more likely to be seen by telemedicine during the pandemic.⁹ Even for in-person appointments, differences in employment status, perceived risk, and economic status may have contributed to differential willingness and ability to access medical care across all specialties during the pandemic.^{3,4}

While the broad availability of COVID-19 vaccines is enabling the drastic loosening of pandemic-related restrictions, it is likely that telemedicine will remain a larger portion of surgical practice than it previously was due to high satisfaction from both the patient and provider sides.¹⁰ Moreover, understanding the ways in which the pandemic differentially affected access to care among certain groups is important to

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addressing health disparities moving forward. For these reasons, we retrospectively reviewed the patients seen within our academic orthopedic surgery department of a tertiary care academic center before and during the COVID-19 pandemic and aimed to identify racial and age-related differences in access to care that could become targets of future interventions to help eliminate health care disparities.

Methods

This study was approved by the Johns Hopkins Institutional Review Board, study number IRB00250908.

We used SlicerDicer through Epic Electronic Health Records on May 13, 2021 to extract data on all patients seen within the orthopedic surgery department during three time periods: (1) The peak of COVID-19 pandemic-related restrictions in the hospital: March 16, 2020 to May 30, 2020; (2) A pre-pandemic control from 2019: March 16, 2019 to May 30, 2019; (3) A pre-pandemic control from the time period immediately preceding COVID-19 pandemic-related restrictions: January 1, 2020 to March 15, 2020. We chose March 16, 2020 as the start of the pandemic as this was the first Monday after the WHO characterized COVID-19 as a pandemic, and aligns with the beginning of COVID-19 restrictions at our hospital.

For all three periods, the data extracted included total numbers of patients seen in orthopedic department of our institution through either office visit (in-person) or telemedicine, and their race and age distribution (*Table 1*). Additionally, for the pandemic time period, we extracted data on the distribution of patients seen by telemedicine visits and in-person office visits, distributed by race and age (*Table 2*). For race, we considered only White and Black patients, as patients from other available racial groups (Asian, Other, Unknown, or None of the Above) was very limited (less than 125 patients seen during the pandemic vs. greater than 500 for White and Black patients). Hispanic or Latino ethnicity was not available through SlicerDicer. For age, we stratified patients into four groups: (1) patients under the age of 27, (2) patients with age greater than or equal to 27 and less than 54 (27–54), (3) pa-

tients with age greater than or equal to 54 and less than 82 (54–82), and (4) patients with age greater than or equal to 82 (82+). The first three groups were chosen to span an equivalent number of years, while the last group captures the rest of the patients.

We then calculated odds ratios for patients of different ages and races being seen during the pandemic versus before the pandemic, and by telemedicine versus in-person. When calculating odds ratios, we used patients under age 27 and White patients as the reference groups. We then calculated the odds ratios for patients in each other age group or race being seen during the pandemic, as compared with the two pre-pandemic control periods. We also calculated odds ratios for patients in each other age group or race being seen during the pandemic by telemedicine, as compared with office visits.

To further study differences in telemedicine use by race during the pandemic, we extracted data from the Johns Hopkins Telemedicine Dashboard on all telemedicine visits conducted in the department of orthopedic surgery between March 16, 2020 and May 30, 2020. This included the race of the patient and whether the telemedicine visit was conducted by synchronous audio/video remote visit or audio only. We then calculated the odds ratios for patients in each race being seen by audio only as compared with audio/video remote visit.

Results

We found that patient race (Black vs. White) did not significantly impact the odds of being seen during the pandemic, nor the odds of being seen through telemedicine (*Tables 3 and 4*). However, patient race did affect the odds of being seen by audio only as opposed to audio/video remote visit (*Table 4*). In contrast, we found that age significantly impacted the odds of being seen during the pandemic and the odds of being seen by telemedicine visit (*Tables 3 and 4*).

Specifically, older patients were more likely to be seen during the pandemic than the youngest patients, when considering both telemedicine and in-person visits. Patients, ages 27–54, were 1.3 (95% confidence interval [CI] 1.1–1.4,

Table 1. Number of Patients Seen During Each Studied Time Period, by Race and Age

	RACE AND AGE						TOTAL
	WHITE PATIENTS	BLACK PATIENTS	LESS THAN 27	27–54	54–82	82+	
Pandemic (March 16, 2020 to May 30, 2020)	1,288	515	453	637	872	53	2,017
2019 Control (March 16, 2019 to May 30, 2019)	3,649	1,586	1,590	1,783	2,391	227	5,991
2020 Control (January 1, 2020 to March 15, 2020)	3,638	1,547	1,447	1,762	2,590	172	5,971

Table 2. Number of Patients Seen by Telemedicine or Office Visit During the Pandemic (March 16, 2020 to May 30, 2020), by Race and Age

RACE	WHITE OR CAUCASIAN	BLACK OR AFRICAN AMERICAN		
	Telemedicine Visit	877	338	
Office Visit	428	174		
AGE	<27	27–54	54–82	82+
Telemedicine Visit	201	464	648	33
Office Visit	254	178	234	22

$p < 0.01$) and 1.2 (95% CI 1.0–1.3, $p = < 0.05$) times more likely to be seen than patients under age 27 during the pandemic, versus the 2019 and 2020 controls, respectively (Table 3). Patients, ages 54–82, were 1.3 (95% CI 1.1–1.5, $p < 0.001$) times more likely to be seen than patients under age 27 during the pandemic versus the 2019 control (Table 3). Patients ages 27–54, 54–82, and 82+, respectively, were 3.3 (95% CI 2.6–4.2, $p < 1e-19$), 3.5 (95% CI 2.8–4.4, $p < 1e-24$), and 1.9 (95% CI 1.1–3.4, $p < 0.05$) times more likely to be seen by telemedicine than patients under age 27 (Table 4). Among telemedicine visits during the pandemic, Black patients were 1.5 (95% CI 1.2–1.9, $p < 1e-3$) times more likely to be seen by audio only than White patients, as compared with audio/video remote visits.

Discussion

These results demonstrate significant patterns of association between age and utilization of orthopedic surgery care during the pandemic, with older patients being both more likely to be seen overall during the pandemic and more likely to be seen through telemedicine. In contrast, there were no significant patterns of association between race and utilization of orthopedic surgery care during the pandemic, although among telemedicine appointments, Black patients were more likely to be seen by audio-only telemedicine than White patients. Of note, we studied only the peak of the pandemic, between March 16 and May 30, 2020—a period chosen to correspond to the strictest COVID-19-related restrictions on in-person patient appointments.

In general, older patients were between 1.2 and 1.3 times more likely to be seen during the pandemic than patients under the age of 27, depending on the age group considered and control time period. Older patients were also between 1.9 and 3.5 times more likely to be seen by telemedicine visit than

Table 3. Odds Ratios for Patients Seen During the Pandemic Versus 2019 and 2020 Control Periods

	BLACK PATIENTS VERSUS WHITE PATIENTS SEEN DURING THE PANDEMIC	
	VERSUS 2019 CONTROL	VERSUS 2020 CONTROL
Odds ratio	0.9199	0.9403
Lower bound 95% CI	0.8176	0.8354
Upper bound 95% CI	1.0351	1.0583
p	0.1657	0.3075
	PATIENTS 27–54 VERSUS PATIENTS UNDER 27 SEEN DURING THE PANDEMIC	
	VERSUS 2019 CONTROL	VERSUS 2020 CONTROL
Odds ratio	1.254	1.1548
Lower bound 95% CI	1.0922	1.0048
Upper bound 95% CI	1.4397	1.3271
p	0.0013	0.0426
	PATIENTS 54–82 VERSUS PATIENTS UNDER 27 SEEN DURING THE PANDEMIC	
	VERSUS 2019 CONTROL	VERSUS 2020 CONTROL
Odds ratio	1.2801	1.0754
Lower bound 95% CI	1.124	0.9439
Upper bound 95% CI	1.4578	1.2253
p	0.0002	0.2746
	PATIENTS OVER 82 VERSUS PATIENTS UNDER 27 SEEN DURING THE PANDEMIC	
	VERSUS 2019 CONTROL	VERSUS 2020 CONTROL
Odds ratio	0.8195	0.9843
Lower bound 95% CI	0.597	0.7108
Upper bound 95% CI	1.1248	1.363
p	0.218	0.924

Gray shading indicates a significant odds ratio, at $p < 0.05$.

patients under the age of 27 during the pandemic, depending on the age group considered and control time period. These results could in part be explained by the finding that young adults were more likely to avoid or delay medical care due to COVID-19 concerns during the pandemic than older adults,¹¹

Table 4. Odds Ratios for Patients Seen by Telemedicine Versus Office Visit, and Audio-Only Telemedicine Versus Video Telemedicine During the Pandemic

	BLACK PATIENTS VERSUS WHITE PATIENTS SEEN BY VIDEO DURING THE PANDEMIC	PATIENTS 27–54 VERSUS PATIENTS UNDER 27 SEEN BY VIDEO DURING THE PANDEMIC	PATIENTS 54–82 VERSUS PATIENTS UNDER 27 SEEN BY VIDEO DURING THE PANDEMIC	PATIENTS 82+ VERSUS PATIENTS UNDER 27 SEEN BY VIDEO DURING THE PANDEMIC	AMONG TELEMEDICINE VISITS DURING THE PANDEMIC, BLACK PATIENTS VERSUS WHITE PATIENTS SEEN BY AUDIO-ONLY
Odds ratio	0.948	3.2941	3.4994	1.8955	1.4809
Lower bound 95% CI	0.7636	2.5573	2.7586	1.0716	1.1798
Upper bound 95% CI	1.177	4.2431	4.4392	3.3528	1.8587
<i>p</i>	0.6286	2.7304E-20	5.6548E-25	0.028	0.000709

Gray shading indicates a significant odds ratio, at $p < 0.05$.

and that older adults were more likely to be seen by telemedicine in orthopedic surgery.⁵ More likely, these patterns also reflect referral patterns, which were impacted by COVID-19-related restrictions. During lockdown, a large orthopedic surgery department in the United Kingdom reported decreases in trauma injuries associated with younger populations, likely due to social distancing and reduced road traffic.¹² Another study in the United Kingdom found that during the pandemic the average age of patients seen in orthopedics was older than before the pandemic, potentially explained by a decrease in orthopedic trauma due to lockdown restrictions curtailing mobility while levels of fragility injuries remained constant.¹³

Another important consideration is that previous studies have shown that older patients faced significant barriers in accessing telemedicine during the pandemic,¹⁴ and that close to 40% of older adults in the United States may be unready or unable to use telemedicine.¹⁵ As the pandemic has progressed and synchronous audio/video technology has become an increasingly ubiquitous part of life, it is likely that some patients would have adapted to using telemedicine despite early challenges. However, the reasons that older adults may struggle with telemedicine use include disability such as poor vision or hearing, inexperience and difficulties with using technology, and lack of suitable connectivity and necessary devices.¹⁴ Given these trends, it will be important to ensure that barriers to accessing telemedicine are reduced among older adults if telemedicine use is to continue successfully. This can be done through efforts such as providing devices for telemedicine access as medical necessities, and providing accessibility accommodations for patients with disabilities.¹⁴ Additionally, younger patients who may have

delayed care during the pandemic should be targeted for postpandemic outreach, to ensure that inequities in care utilization between older and younger adults do not extend into the future.

We did not observe significant patterns of association between race and overall utilization of orthopedic surgery care in our academic orthopedic surgery department, although among telemedicine appointments, we found that Black patients were 1.5 times more likely to be seen by audio-only remote visit than White patients. One study of primary care and ambulatory subspecialties at an academic medical center found that Asian, Black, and Latin patients were less likely to be seen by telemedicine than White patients during the pandemic, although another study focused on orthopedic surgery did not find significant differences for Black patients as compared with White patients.^{8,14} However, studies have consistently found that when using telemedicine, Black patients are more likely to use audio-only visits as opposed to video visits, perhaps reflecting lower access to telemedicine technology.^{14,16} This is an important inequity to address, as video visits may enable more comprehensive physical examination and more personal interaction among health care providers and patients. Specifically in orthopedic surgery, some common exam maneuvers such as manual motor and sensory testing are difficult to perform over any type of telemedicine,¹⁷ and even more limited if video is not employed to see the patient’s movements.

To this point, a limitation of our study is that we focused only on Black and White patients, due to low numbers of patients from other racial groups when studying only the initial period of the pandemic with most severe restrictions. Moreover, our findings may be partly due to the lower

numbers of Black patients seen in this department at baseline—during all three periods studied, and the percentage of Black patients seen was less than 30% of all patients. It is possible that racial disparities in utilization of orthopedic surgery care merely persisted throughout the pandemic, and were unchanged by pandemic-related restrictions and telemedicine utilization. Another reason for the lack of association may be due to the early, widespread, and consistent adoption of telemedicine during the pandemic by our orthopedic surgery department, hence, ensuring broad availability of telemedicine services to all patients regardless of clinic site or provider.¹⁸ That said, other studies have shown that telemedicine adoption by providers varies between surgical specialties and within subspecialties; therefore, provider availability is an important factor to prioritize in ensuring equitable access to telemedicine.¹⁹

Regardless, this cohort represents a large, diverse patient population drawn from an orthopedic surgery department at a large academic medical center. Data on patient volumes, patient characteristics, and visit types was available in detail for prepandemic and during-pandemic times, allowing for a controlled statistical analysis. The findings of associations between age and orthopedic care utilization and telemedicine use during the pandemic can offer insights into inequities exacerbated during the pandemic. In future, it would be beneficial to expand this analysis to a larger time period to understand how these inequities changed over time in response to evolving adoption levels for telemedicine and changing COVID-19-related restrictions on in-person patient visits.

Conclusion

We found that older adults were more likely than younger adults to be seen overall in our orthopedic surgery department during the height of the COVID-19 pandemic, and more likely to use telemedicine. We further found that among telemedicine appointments, Black patients were more likely to be seen by audio-only remote visit than White patients. Given the existing evidence that older adults and Black patients may face barriers to accessing telemedicine and that younger adults may have been more likely to delay needed medical care during the pandemic, it is important to continue reducing barriers to telemedicine access for all patients and prioritizing outreach to younger patients.

Authors' Contributions

All authors contributed to the conception of the work or the acquisition and interpretation of the data, drafting the piece or critically revising it, and the final version of the article.

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REFERENCES

- Lopez L, Hart LH, Katz MH. Racial and ethnic health disparities related to COVID-19. *JAMA* **2021**;325:719–720.
- Bonadad C, Garcia-Blas S, Tarazona-Santabalbina F, et al. The effect of age on mortality in patients with COVID-19: A meta-analysis with 611,583 subjects. *J Am Med Dir Assoc* **2020**;21:915–918.
- Yıldırım M, Geçer E, Akgül O. The impacts of vulnerability, perceived risk, and fear on preventive behaviours against COVID-19. *Psychol Health Med* **2019**;26:35–43.
- Zelner J, Trangucci R, Narahariseti R, et al. Racial disparities in coronavirus disease 2019 (COVID-19) mortality are driven by unequal infection risks. *Clin Infect Dis* **2021**;72:e88–e95.
- Patel S, Mehrotra A, Huskamp H, et al. Variation in telemedicine use and outpatient care during the COVID-19 pandemic in the United States. *Health Aff* **2021**;40:349–358.
- Foni NO, Costa LAV, Velloso LMR, Pedrotti CHS. Telemedicine: Is it a tool for orthopedics? *Curr Rev Musculoskelet Med* **2020**;13:797–801.
- Meshram P. CORR Insights®: How Did the number and type of injuries in patients presenting to a Regional Level I Trauma Center change during the COVID-19 pandemic with a stay-at-home order? *Clin Orthop Relat Res* **2021**;479:276–279.
- Xiong G, Greene NE, Lightsey HM, et al. Telemedicine use in orthopaedic surgery varies by race, ethnicity, primary language, and insurance status. *Clin Orthop Relat Res* **2021**;479:1417–1425.
- Smith AJ, Pfister BF, Woo EWY et al. Safe and rapid implementation of telemedicine fracture clinics: The impact of the COVID-19 pandemic. *ANZ J Surg* **2020**;90:2237–2241.
- Rizzi AM, Polachek WS, Dulas M, Strelzow JA, Hynes KK. The new 'normal': Rapid adoption of telemedicine in orthopaedics during the COVID-19 pandemic. *Injury* **2020**;51:2816–2821.
- Czeisler MÉ, Marynak K, Clarke KE, et al. Delay or avoidance of medical care because of COVID-19-related concerns—United States, June 2020. *MMWR Morb Mortal Wkly Rep* **2020**;69:1250–1257.
- Murphy T, Akehurst H, Mutimer J. Impact of the 2020 COVID-19 pandemic on the workload of the orthopaedic service in a busy UK district general hospital. *Injury* **2020**;51:2142–2147.
- Scott CEH, Holland G, Powell-Bowens MFR, Brennan CM, Gillespie M, Mackenzie SP, Clement ND, Amin AK, White TO, Duckworth AD. Population mobility and adult orthopaedic trauma services during the COVID-19 pandemic: Fragility fracture provision remains a priority. *Bone Jt Open* **2020**;1:182–189.
- Eberly LA, Kallan MJ, Julien HM, et al. Patient characteristics associated with telemedicine access for primary and specialty ambulatory care during the COVID-19 pandemic. *JAMA Netw Open* **2020**;3:e2031640.

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15. Lam K, Lu AD, Shi Y, Covinsky KE. Assessing telemedicine unreadiness among older adults in the United States during the COVID-19 pandemic. *JAMA Intern Med* 2020;180:1389–1391.
16. Rodriguez JA, Betancourt JR, Sequist TD, Ganguli I. Differences in the use of telephone and video telemedicine visits during the COVID-19 pandemic. *Am J Manag Care* 2021;27:21–26.
17. Makhni M, Riew GJ, Sumathipala M. Telemedicine in orthopaedic surgery. *J Bone Jt Surg* 2020;102:1109–1115.
18. Annapragada AV, Jenkins SG, Chang AL, Jain A, Srikumaran D, Srikumaran U. Factors driving rapid adoption of telemedicine in an Academic Orthopedic Surgery Department. *Telemed J E Health* 2021;28:415–421.
19. Aguwa UT, Aguwa CJ, Repka M, Srikumaran U, Woreta F, Singman EL, Jenkins SG, Srikumaran D. Teleophthalmology in the era of COVID-19: characteristics of early adopters at a Large Academic Institution. *Telemed J E Health* 2021;27:739–746.

Address correspondence to:
Uma Srikumaran, MD, MPH, MBA
Department of Orthopedic Surgery
Johns Hopkins University
601 North Caroline Street
Baltimore, MD 21287
USA

E-mail: us@jhmi.edu

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