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Original Research

Age, Sex, and Education Level Predict Telehealth Engagement in Total Joint Arthroplasty Patients

Michael Lotito, BA [a, *], Matthew Jamison, MD [b], Cole Howell, PT, DPT [c], Adriana Liimakka, BS [d], Jeffrey Lange, MD [b], Antonia F. Chen, MD, MBA [b]

[a] Rutgers Robert Wood Johnson Medical School, Piscataway, NJ, USA
[b] Department of Orthopedics, Brigham & Women's Hospital, Boston, MA, USA
[c] Albany Medical College, Albany, NY, USA
[d] Harvard Medical School, Boston, MA, USA

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ABSTRACT

Background: Racial and other demographic predictors of total joint arthroplasty (TJA) telehealth engagement since the onset of the COVID-19 pandemic remain unclear. The purpose of the current study was to elucidate this relationship.

Methods: A retrospective, cross-sectional study on 732 primary TJA patients was conducted within a single hospital system from March 2020-December 2021 (during the pandemic). Patients were excluded if their race or education level could not be determined. Patient demographics (age, sex, body mass index, language) and TJA information were obtained. The number of telehealth visits and telehealth engagement were assessed. Engagement (yes/no) and engagement frequency across all demographics and each measure of telehealth (telemedicine, patient-reported outcome measurements [PROMs], and electronic patient portal [EPP] messaging) were analyzed using multivariate logistic and linear regression, respectively.

Results: Our results demonstrated that non-White race was not a significant predictor of binomial engagement or engagement frequency across all telehealth measures. Older age was a negative predictor of binomial engagement and engagement frequency with telemedicine and EPPs. Male sex was shown to be a negative predictor of binomial engagement with EPPs as well as PROM engagement frequency. Educational attainment of less than a college degree was a negative predictor of binomial engagement and engagement frequency with PROMs and EPPs.

Conclusions: This study demonstrates that older age, male sex, and lower education level were negative predictors of various measures of telehealth engagement. Non-White race was not a significant predictor. This data informs providers on how to improve access to virtual orthopaedic care.

Introduction

The COVID-19 global pandemic accelerated the digital transformation in health care [1]. This shift is promising, as the use of telemedicine may provide an opportunity for a greater number of patients to receive musculoskeletal care. However, there may be multiple barriers to engaging in telemedicine, including access to technology and comfort with using technology. Several recent studies have studied socioeconomic barriers to telehealth utilization, including access to telemedicine for minority (non-White) patients. In a recent study, patient data pre- and post-March 2020 was analyzed. Black patients were 1.5 times more likely to be seen by audio-only telemedicine than White patients compared to video telemedicine [1]. In another study, Hispanic or Asian patients were less likely to be seen through telemedicine than White patients when evaluating nontelemedicine patients (March-May 2019) to telemedicine patients (March-May 2020) [2]. Nonetheless, other studies present conflicting findings. Among patients seen in-person/telephone/virtual at an orthopaedic trauma center during March-May 2020, Hispanic and Black/African American patients

* Corresponding author. Rutgers Robert Wood Johnson Medical School, Piscataway, NJ, USA.
E-mail address: ml1640@rwjms.rutgers.edu

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were able to access virtual care at similar rates to White patients [3]. Furthermore, recent work showed no association between the ability to use telemedicine and patient race [4]. Due to these mixed results of relatively few available studies, the question of engagement with orthopaedic telemedicine across races requires further study.

The lack of access to telemedicine may also affect utilization of electronic patient portals (EPPs) to communicate with medical providers and completion of patient-reported outcome measures (PROMs) [5,6]. Recent work demonstrated that PROMs can be used in virtual orthopaedic visits to more accurately gauge patients' functional capacity and symptom severity, as well as to assist with determining the necessity of subsequent in-person visits/surgical interventions, postoperative monitoring, and triage [7,8]. No studies to date have examined if remote PROMs and EPP messaging utilization differs across race or other demographic variables among total joint arthroplasty (TJA) patients.

Overall, no study to date has been conducted examining racial and other demographic differences in TJA patients with regards to telemedicine utilization, PROMs, and EPP messaging. We hypothesize that telehealth engagement and telehealth engagement frequency among TJA patients will be significantly higher for White patients than for each subgroup of non-White patients (Asian, Black, other, and two or more) across all 3 telehealth measures: telemedicine visits, PROMs, and EPP messaging. Analysis of other demographic variables is secondary.

Material and methods

Given that the World Health Organization declared the COVID-19 outbreak to be a global pandemic on March 11, 2020, a retrospective, cross-sectional study was conducted on primary total hip arthroplasty or total knee arthroplasty patients between March 1, 2020 and December 31, 2021 in a single hospital system. Institutional review board approval was obtained. This start date was chosen to correspond to the onset of the COVID-19 pandemic. Seven hundred thirty-two patients underwent TJA during this time frame, and patients were excluded if race or education level was not recorded, leaving 622 patients (Fig. 1). In addition, age, sex, body mass index, language, and procedure date were collected via electronic chart review.

With regards to telemedicine visits, if a patient had one or more orthopaedic telemedicine encounters within the specified timeframe, they were marked as "yes" under binomial engagement with telemedicine visits. If they had 0 telemedicine encounters within the specified timeframe, they were marked as "no." Telemedicine encounters (video and audio-only) were then counted to obtain frequency data. The same procedure was followed for PROMs and EPP messaging; of note, EPP engagement was defined as sending a message in the portal (as opposed to simply logging into the portal).

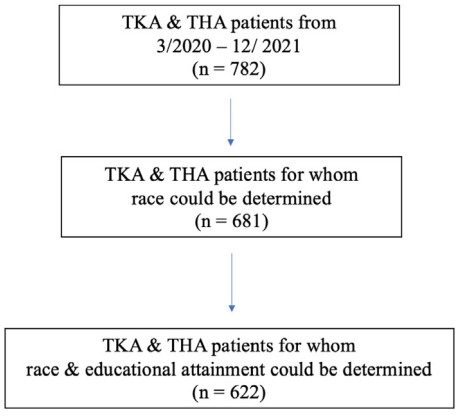

Figure 1. Inclusion criteria.

Statistical analysis

Categorical and continuous data were reported. Multivariate logistic and linear regressions were conducted to analyze demographic predictors of binomial (yes/no) engagement and engagement frequency, respectively. Racial data was calculated in reference to White race, and educational data was calculated in reference to attainment of a college degree, as these were the two most frequent demographics in our population. All statistical analyses were conducted using RStudio (2022.07.2), and statistical significance was set at $P < .05$.

Results

Of the 622 patients in the study, baseline demographics (Table 1) demonstrated that the majority of patients were White (585/622, 94.0%), female (369/622, 59.4%), and English-speaking (590/622, 94.9%).

Multivariate logistic regression (Table 2) demonstrated that older age was a significant negative predictor of binomial (yes/no) engagement with telemedicine visits ($P = .019$) and EPPs ($P = .007$*10-5). Male sex was a significant negative predictor of binomial engagement with EPPs ($P = .009$). "High school" education level was a significant negative predictor of binomial engagement with PROMs ($P = .005$*10-3) and EPPs ($P = .002 \times$ 10-3). "Some college" education level was a significant negative predictor of binomial engagement with PROMs (*P*-.029) and EPPs ($P = .004 \times$ 10-1). "Some high school" education level was a significant negative predictor of binomial engagement with PROMs ($P = .002 \times$ 10-2) and EPPs ($P = .003$).

Additionally, multivariate linear regression (Table 3) demonstrated that older age was a significant negative predictor of telemedicine ($P = .037$) and EPP ($P = .001 \times$ 10-1) engagement frequency. Male sex was a negative predictor of PROM ($P = .013$) engagement frequency. Greek ($P = .03$) and Italian ($P = .014$)

Table 1
Baseline demographics.

Race (n, %)	
American Indian and Alaska Native	1 (0.1%)
Asian	6 (0.9%)
Black	56 (9%)
Other	24 (3.9%)
Two or more	4 (0.6%)
White	585 (94%)
Sex (n, %)	
Male	253 (40.6%)
Female	369 (59.4%)
Language (n, %)	
English	590 (94.9%)
Non-English	32 (5.1%)
Education level (n, %)	
Did not attend school	1 (0.2%)
8th Grade or less	6 (1%)
Some high school	24 (3.9%)
Graduated high school or GED	144 (23.2%)
Some college	80 (12.9%)
Some vocational program	2 (0.3%)
Associate's, vocational, or technical degree	4 (0.6%)
Graduated - college	269 (43.2%)
Graduated - grad school/post graduate	92 (14.8%)
Mean age (years, std. dev.)	66.8 (11.7)
Mean body mass index (kg/m^2, std. dev.)	30.3 (6.7)

Table 2
Demographic predictors of binomial telehealth engagement.

	Telemedicine visits *P*-value	PROMs *P*-value	EPPs *P*-value
American Indian or Alaska Native race	.997	.997	.994
Asian race	.992	.992	.772
Black race	.78	.186	.218
Other race	.76	.583	.071
Two or more races	.992	.996	.946
Age	.019[a]	.053	.007 × 10-5[b]
Male sex	.165	.84	.009[c]
Albanian language	.997	.996	.995
Farsi language	.34	.364	.993
Greek language	.994	.994	.991
Italian language	.404	.995	.944
Korean language	.999	.999	.995
Polish language	.997	.997	.995
Portuguese language	.997	.996	.994
Portuguese - European language	.996	.994	.995
Romanian language	.997	.996	.994
Spanish language	.816	.895	.726
Unknown language	.997	.997	.995
BMI	.125	.132	.294
8th Grade or less	.272	.991	.098
Associate's, vocational, or technical degree	.876	.429	.57
Did not attend school	.996	.996	.994
Graduated - grad school	.357	.828	.358
Graduated - high school	.78	.005 × 10-3[b]	.002 × 10-3[b]
Graduated - post graduate	.147	.878	.289
Obtained GED	.992	.545	.613
Some college	.937	.029[a]	.004 × 10-1[b]
Some high school	.227	.002 × 10-2[b]	.003[b]
Some vocational program	.995	.996	.993

BMI, body mass index; GED, general educational development.
[a] $P < .05$.
[b] $P < .001$.
[c] $P < .005$.

Table 3
Demographic predictors of telehealth engagement frequency.

	Telemedicine visits *P*-value	PROMs *P*-value	EPPs *P*-value
American Indian or Alaska Native race	0.371	0.47	0.372
Asian race	0.122	0.075	0.282
Black race	0.619	0.06	0.175
Other race	0.979	0.288	0.09
Two or more races	0.952	0.07	0.882
Age	0.037[a]	0.467	0.001 × 10-1[b]
Male sex	0.077	0.013[a]	0.275
Albanian language	0.427	0.437	0.897
Farsi language	0.631	0.407	0.626
Greek language	0.03[a]	0.37	0.509
Italian language	0.416	0.014[a]	0.667
Korean language	0.313	0.186	0.446
Polish language	0.711	0.856	0.545
Portuguese language	0.667	0.423	0.578
Portuguese - European language	0.458	0.871	0.844
Romanian language	0.698	0.349	0.973
Spanish language	0.282	0.318	0.829
Unknown language	0.451	0.756	0.625
BMI	0.018[a]	0.02[a]	0.285
8th Grade or less	0.774	0.29	0.554
Associate's, vocational, or technical degree	0.544	0.119	0.522
Did not attend school	0.277	0.459	0.522
Graduated - grad school	0.621	0.232	0.053
Graduated - high school	0.255	0.029[a]	0.018[a]
Graduated - post graduate	0.752	0.21	0.161
Obtained GED	0.804	0.63	0.871
Some college	0.642	0.019[a]	0.001[b]
Some high school	0.257	0.004[c]	0.023[a]
Some vocational program	0.869	0.898	0.273

BMI, body mass index; GED, general educational development.
[a] $P < .05$.
[b] $P < .001$.
[c] $P < .005$.

language were significant negative predictors of telemedicine and PROM engagement frequency, respectively. Body mass index was a significant negative predictor of telemedicine ($P = .018$) and PROM ($P = .02$) engagement frequency. "High school" education level was a significant negative predictor of engagement frequency with PROMs ($P = .029$) and EPPs ($P = .018$). "Some college" education level was a significant negative predictor of engagement with PROMs ($P = .019$) and EPPs ($P = .001$). "Some high school" was a significant negative predictor of engagement with PROMs ($P = .004$) and EPPs ($P = .023$).

Discussion

The results of our study contribute to a mixed body of literature regarding the relationship between telemedicine utilization and race among TJA patients since the start of COVID-19 by demonstrating that non-White race was not a significant predictor of binomial engagement or engagement frequency with telemedicine, PROMs, or EPPs.

However, our findings showed that education level negatively predicted PROM and EPP engagement but did not affect telemedicine engagement. This suggests that these patients may have inadequate health literacy as opposed to inadequate internet connectivity. For example, patients with decreased health literacy may not be aware of the importance of PROMs or EPPs. This is encouraging because it suggests that this health disparity is modifiable; future studies would do well to examine causal mechanisms underlying this relationship. In the meantime, providers are encouraged to help empower these patients to improve their health outcomes by educating them on the utility of PROMs and EPPs.

Our study also contributes to the literature by demonstrating the effect of age on telehealth engagement in TJA patients. Older age was a negative predictor of both engagement (yes/no) and engagement frequency with telemedicine and EPPs. A recent cross-sectional survey of patients awaiting TJA demonstrated that retired patients had less confidence using technology compared with employed patients, likely due to the older age of the retired group [5]. Given that TJA patients are generally older and are at greater risk for contracting severe COVID-19 infection during an in-person visit, arthroplasty providers might minimize risk by investing resources into educating older patients on how to access telehealth confidently.

Male sex was also shown to be a negative predictor of engagement (yes/no) with EPPs as well as PROM engagement frequency. A seminal review of the literature cited large studies, national data, and meta-analyses to show that men are less likely to engage with medical care, including cancer screenings and medication adherence [9]. Our study corroborates this notion in the unique context of telehealth engagement among TJA patients. Contemporary health psychology research has shown that decreased health care seeking among men is likely driven by traditional views of masculinity [10]. Given the importance of EPPs and PROMs in tracking outcomes and recovery following TJA, arthroplasty care teams may benefit from addressing traditional masculine views with their male patients and emphasizing the use of these technologies in their care.

The current study has several limitations. First, the data was analyzed during the COVID-19 pandemic, during which telemedicine utilization may not reflect that of a normal time period. This represents a potential confounding variable. Nonetheless, this time

period provided the highest number of telemedicine patients for study, and the possibility remains that a return to “normal” time period for telemedicine usage in orthopaedics may never arrive; nearly all orthopaedic clinics have integrated a telemedicine option, and this is unlikely to change. Second, the data was collected from a single health-care system in a Northeastern city, thereby limiting the generalizability of the conclusions. Third, this was a retrospective, correlational study with inherent limitations.

Conclusions

The present study demonstrates that older age, male sex, and lower educational level were negative predictors of various measures of telehealth engagement in TJA patients. Race was not a significant predictor. This information adds to a mixed body of literature on the impact of race on telemedicine engagement within orthopaedics. Additionally, this study is the first to examine demographic predictors of PROM and EPP utilization in TJA patients. Together, this data informs virtual orthopaedic care by elucidating modifiable risk factors for access disparity in a postpandemic setting.

Conflicts of interest

A. Chen receives royalties from Stryker, is a paid consultant for Adaptive Phage Therapeutics, Avanos, BICMD, Convatec, Ethicon, GLG, Guidepoint, Heraeus, IrriMax, Pfizer, and Stryker, receives stock/stock options from Hyalex, Irrimax, Joint Purification Systems, Sonoran, and IlluminOss, and receives royalties and financial support from SLACK Incorporated and UpToDate. He also serves as an editorial board member for the Journal of Arthroplasty, Clinical Orthopaedics and Related Research, Journal of Bone and Joint Infection, Journal of Bone and Joint Surgery, and Arthroplasty Today and as a board member of the American Academy of Orthopaedic Surgeons, American Joint Replacement Registry, and the American Association of Hip and Knee Surgeons. All other authors declare no potential conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2023.101191.

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