



Original research

Patient Perception Regarding the Safety of Elective Joint Arthroplasty Surgery During the COVID-19 Pandemic

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ABSTRACT

Background: Total joint arthroplasty (TJA) practices have been dramatically impacted by the COVID-19 pandemic. To date, no study has assessed trends in patient perceptions regarding the safety of elective TJA. **Methods:** A single-institution, prospective cohort study was conducted between May 11th and August 10th, 2020. All patients who underwent elective hip and knee arthroplasty were contacted via telephone or emailed surveys. Two-hundred and thirty-five consecutive patients were screened, and 158 agreed to participate. The average age was 65.9 ± 11.5 years, with 51.0% of patients being female. The percentage of participants who underwent total knee, total hip, and unicompartmental knee arthroplasty was 41.4%, 37.6%, and 21.0%, respectively. Survey components assessed demographic data, level of concern and specific concerns about the pandemic, and factors increasing patient comfort in proceeding with surgery. **Results:** Older age ($P = .029$) and female sex ($P = .004$) independently predicted higher concern on multivariate analysis. Race ($P = .343$), surgical site (knee vs hip, $P = .58$), and procedure type (primary vs revision, $P = .26$) were not significantly related to degree of concern. Most participants (71.5%) disagreed that the pandemic would negatively affect the outcome of their surgery. Patient concern mirrored statewide COVID-19 cases and deaths, rather than local municipal trends. The most cited reassuring factors were preoperative COVID-19 testing, personal protective equipment usage by hospital staff, and surgeon support. **Conclusions:** Patient concern regarding the safety of elective TJA may follow broader policy-level events rather than local trends. Surgeons should note that universal preoperative COVID-19 testing, adequate personal protective equipment, and surgeon support were reassuring to patients. **Level of Evidence:** Level IV Therapeutic.

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Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), known to cause coronavirus disease 2019 (COVID-19), is a highly contagious coronavirus that originated in Wuhan, China, in December 2019 and spread rapidly throughout the world over the subsequent months. The COVID-19 outbreak escalated in the United States (U.S.) in early March 2020, threatening to overwhelm regional health-care systems. Subsequently, many hospitals across the U.S. postponed elective surgeries across all specialties in an effort to preserve health-care resources and to care for patients

with COVID-19. In April 2020, the American Academy of Orthopedic Surgeons released guidelines for elective surgery during the COVID-19 epidemic, encouraging providers to consider delaying nonurgent procedures to reserve limited health-care resources for a potential surge of COVID-19 cases [1]. Simultaneously, many patients have been hesitant to seek health care during the COVID-19 epidemic because of fears of being exposed to the virus in the inpatient setting, a paucity of information regarding risk-mitigation efforts by hospital systems, and concerns of resource scarcity as depicted in the national news [2]. Therefore, as orthopedic surgeons practice in the midst of the pandemic, both patients and providers must address psychosocial barriers related to prolonged social distancing measures and manage persistent concerns regarding COVID-19 transmission.

Several studies have described the impact of COVID-19 on elective surgery practices [3–6]. However, to our knowledge, no

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study has investigated the impact of COVID-19 on trends in patient perception for those undergoing elective joint arthroplasty. The persistence of the pandemic has led to a decrease in patient volume for many orthopedic surgery practices, which may continue until an efficacious vaccine is available. Furthermore, the total joint arthroplasty population tends to be older, as increasing age is associated with greater morbidity and mortality rates in those affected by COVID-19 [7,8]. However, there continues to be a paucity of data regarding the changing patient perceptions over time in those undergoing elective hip or knee arthroplasty.

The purpose of this study is to evaluate the impact of the COVID-19 pandemic on patient perceptions regarding the safety of undergoing elective joint arthroplasty surgery. We hypothesized that (1) patient perceptions regarding the safety of undergoing elective total joint arthroplasty would mirror COVID-19 case trends and deaths within the state, and (2) patient concerns regarding the safety of surgery during the COVID-19 pandemic would be assuaged by mandatory personal protective equipment (PPE) usage by hospital staff and surgeon reassurance. These data will help arthroplasty surgeons better understand and address the psychological factors impacting their patients. These findings will provide valuable insight into the specific concerns that elective arthroplasty patients have related to COVID-19. Knowledge of specific concerns and how they change over time will provide critical information that can be used to enhance the care of these patients.

Material and methods

Study design

A prospective cohort survey study was conducted on a consecutive series of patients undergoing planned or previously-postponed, elective, primary or revision arthroplasty procedures of the hip or knee performed by 6 orthopedic surgeons at an academic institution between May 11th, 2020, and August 10th, 2020. This date range was chosen as it coincided with the first 3 months after which elective arthroplasty was resumed following the pause in elective surgery during the initial phase of the COVID-19 pandemic in the U.S. Patients with a nonelective operative indication such as hip fracture or trauma and patients undergoing arthroplasty procedures in the urgent or emergent setting were excluded from this study. Patient demographics and surgical procedures were collected via chart review. The present study was conducted as approved by the institutional review board.

All patients were initially contacted via email before their scheduled surgeries and invited to complete an electronic questionnaire. Patients without email access were given the option of completing the survey over the phone with a member of the research team. Patients were contacted up to 3 times via email at intervals of 2 days after surgery. If unresponsive after the third email, they were contacted via telephone daily up to 4 times. After 4 unsuccessful attempts to reach the patient by phone, patients were considered to have declined participation in the study. Patients were instructed to complete their questionnaires within 1 week of their surgery date.

Patients were asked to identify their operating surgeon, the procedure performed, the original date of their scheduled surgery, and to state whether or not they had an elective arthroplasty procedure postponed as a result of the COVID-19 pandemic (Fig. S1). Surgical procedures and dates were manually confirmed by chart review. Then, the questionnaire used a five-point Likert scale (“strongly agree” = 1, “agree” = 2, “neutral” = 3, “disagree” = 4, “strongly disagree” = 5) to evaluate patient concerns regarding the COVID-19 pandemic. In addition, patients were asked to identify specific concerns about the COVID-19 pandemic, whether or

not anyone in their social network (self, family member, friend, or coworker) had been diagnosed with COVID-19, and whether or not various factors would increase their comfort in proceeding with surgery (Fig. S2). Finally, the percentage of patients undergoing joint arthroplasty who marked “strongly agree” or “agree” regarding their concern about the COVID-19 pandemic was tracked over a 3-month period (May 11th–August 10th) at 1-week intervals.

Statistical analysis

Statistical analyses were performed using SPSS version 26 (IBM, Armonk, NY). Patient demographics and questionnaire response data were presented as means or percentages with accompanying standard deviations and ranges. The relationship between patient concerns regarding undergoing elective arthroplasty during the COVID-19 pandemic and direct patient experiences with COVID-19 were assessed using a two-sample t-test. Chi-squared and Fisher's exact tests were used to analyze categorical variables while unequal variance t-tests were used to compare continuous variables. A multiple linear regression model was conducted to determine if age, gender, race, and type of surgery (primary vs revision procedure) predicted levels of patient concern toward the COVID-19 pandemic. The level of concern was set as the dependent variable, and age, sex, race, and surgery type were set as independent variables. The threshold for significance for all statistical analyses was set at $P < .05$.

Results

General demographics

A total of one-hundred and fifty-three out of two-hundred and thirty-five (67.2%) eligible patients participated in this study while 77 patients declined to participate or were excluded. There were no differences in age ($P = .72$) or sex ($P = .74$) between respondents and nonrespondents, although nonresponders were significantly more likely to be Hispanic (26.0% vs 13.4%, $P = .002$). The average age of the study participants was 65.9 ± 11.5 (range: 26 to 97), with

Table 1
Patient demographics and procedures.

Demographic characteristic	Value, N (%)
Age (y)	
<50	14 (8.9)
50–59	25 (15.9)
60–69	56 (35.7)
70–79	50 (31.9)
>80	12 (7.6)
Gender	
Male	77 (49.0)
Female	80 (51.0)
Race	
White	111 (70.3)
Black or African American	9 (5.7)
Asian	13 (8.2)
Hispanic or Latino	21 (13.3)
Other ^a	4 (2.5)
Surgery delayed due to pandemic	
Yes	66 (41.8)
No	92 (58.2)
Procedure ^b	
Primary knee	59 (37.6)
Primary hip	46 (29.3)
Partial knee	33 (21.0)
Revision hip	13 (8.3)
Revision knee	6 (3.8)

^a American Indian, Alaska Native, >1 race, unknown.

^b One patient with restricted chart access, procedure unknown.

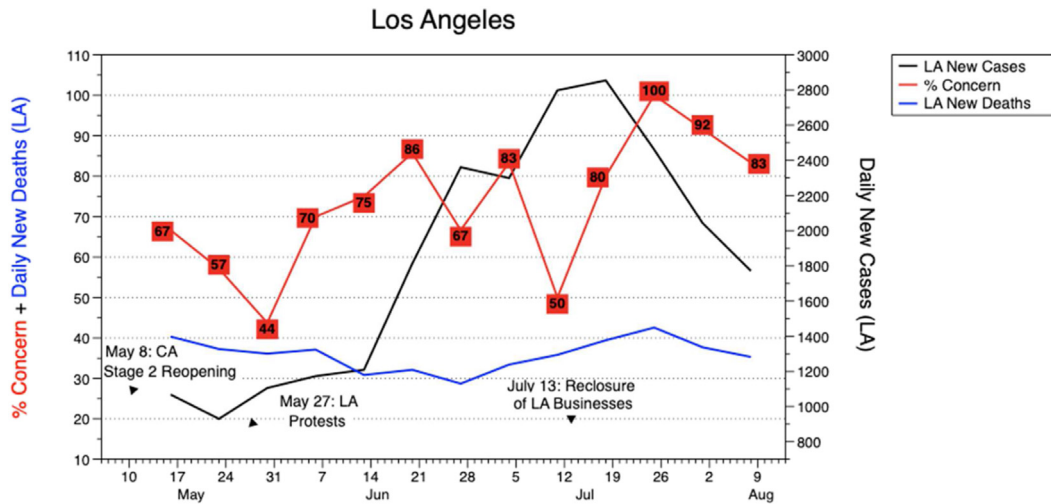


Figure 1. Patient concern over time juxtaposed with daily new cases and daily deaths in Los Angeles County.

51.0% being female (Table 1). A total of 64 participants (40.5%) reported having a delay in their surgery due to COVID-19, and 45 (28.5%) knew a family member, friend, or coworker who contracted COVID-19. No participants had a history of active COVID-19 infection at the time of survey completion. The percentage of participants who underwent total knee arthroplasty, total hip arthroplasty, and unicompartmental knee arthroplasty was 41.4%, 37.6%, and 21.0%, respectively. Of these surgeries, 87.9% were primary cases (58.6% knee, 29.3% hip) while 12.1% were revisions (8.3% hip, 3.8% knee).

Patient concern over time

The composite average weekly concern of all participants was plotted alongside the daily incidence and number of deaths in both Los Angeles County and California as a whole (Figs. 1 and 2). The proportion of concerned patients was weakly correlated with the daily COVID-19 incidence in Los Angeles County but more strongly correlated with both new daily cases and deaths in the state of California.

Concern by age, sex, and race

Age separated by decade (<50, 50-59, 60-69, 70-79, and 80+) showed a significant association between increasing age and average level of concern ($P = .029$) (Fig. 3). Females were also found to be significantly more concerned about the COVID-19 pandemic than males (83.8% vs 60.3%, $P = .004$), while race was not significantly associated with level of concern ($P = .343$) (Fig. 4 and S3). The surgical site (knee vs hip, $P = .58$) and type of procedure (primary vs revision, $P = .26$) were not significantly related to degree of concern (Fig. 5a and b).

Overall patient perceptions of safety, areas of concern, and reassuring factors

Overall, 20.3% (32 patients) of respondents strongly agreed or agreed that the COVID-19 pandemic would negatively affect the safety of their surgery while 51.9% (82 patients) strongly disagreed or disagreed (Fig. S4). The vast majority of participants (113 patients, 71.5%) strongly disagreed or disagreed that the COVID-19 pandemic would negatively affect the outcome of their surgery

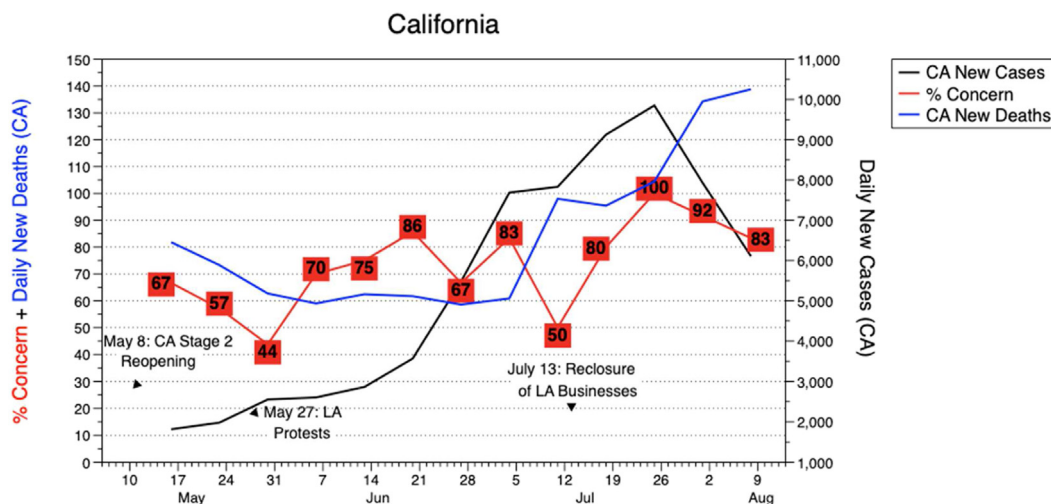


Figure 2. Patient concern over time juxtaposed with daily new cases and daily deaths in California.

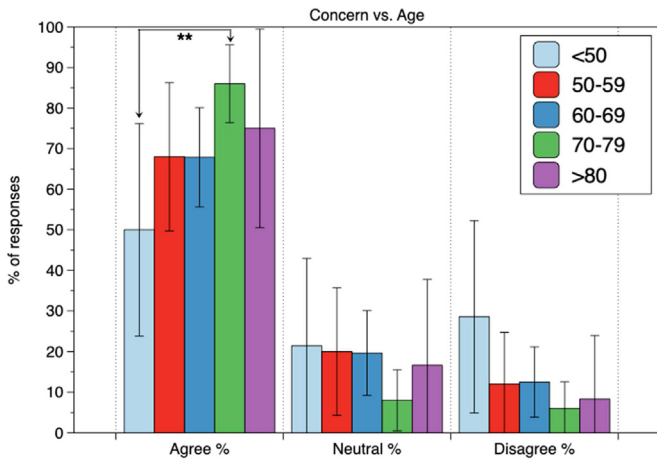


Figure 3. Average level of concern by age group. ** represents statistically significant differences between groups, with the threshold for statistical significance set at $P < .05$.

while 10.8% (17 patients) agreed or strongly agreed (Fig. S5). Most patients were either neutral (34 patients, 21.5%) or not hesitant (80 patients, 50.6%) to proceed with surgery because of the COVID-19 pandemic (Fig. S6).

The most commonly cited concerns about the COVID-19 pandemic were health of family or friends (71.5%), personal physical health (58.9%), and social isolation (49.4%) while mental health (26.6%) and job security (17.1%) were of least concern (Fig. 6a). When surveyed about which hospital policy measures would make patients more comfortable proceeding with surgery, the most cited alleviating factors were preoperative COVID-19 testing (72.2%), mandatory use of masks and other PPE by all hospital staff (67.7%), and reassurance by their surgeon (51.3%) (Fig. 6b). The least impactful alleviating factor was relaxation of statewide “stay-at-home” orders (18.4%). Concern was also compared between study participants who knew a family member, friend, or coworker infected by COVID-19 and those who did not, but no significance was found ($P = .94$).

Multivariate analysis

The multivariate linear regression model demonstrated a statistically significant amount of variance in patient concern about

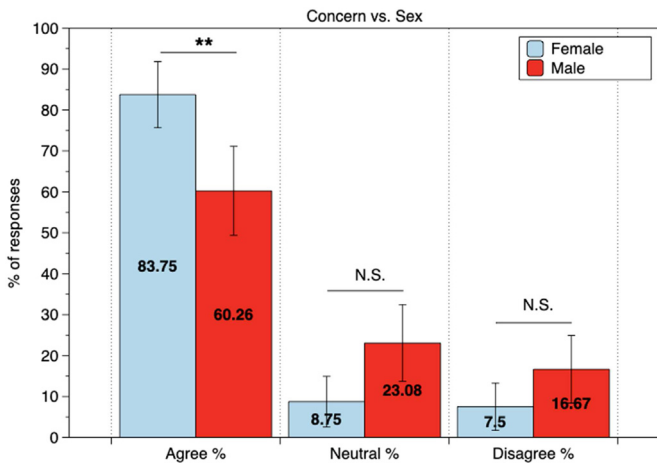


Figure 4. Average level of concern by sex. ** represents statistically significant differences between groups, with the threshold for statistical significance set at $P < .05$.

the COVID-19 pandemic ($R^2 = 0.154, P = .001$). Specifically, increasing age ($\beta = -0.20, P = .01$), female sex ($\beta = -0.18, P = .02$), and Asian race ($\beta = -0.19, P = .01$) were statistically significant predictors of patient agreement with the statement, “I am concerned about the COVID-19 pandemic” on a 5-point Likert scale. When controlling for age, sex, and race, having a revision procedure was not a significant predictor of patient concern about the COVID-19 pandemic ($\beta = 0.075, P = .327$).

Discussion

Over 3 months, the level of concern in arthroplasty patients regarding the COVID-19 pandemic closely mirrored daily COVID-19 incidence and deaths within the state. No decrease in patient concern was identified during the study period, a troubling finding that persisted 3 months after the resumption of elective surgery. However, most patients undergoing joint arthroplasty did not believe that the COVID-19 pandemic would negatively affect the safety or outcome of their surgery. Despite this, approximately one-third of patients were hesitant to proceed with surgery because of the COVID-19 pandemic. The most cited safety practices that relieved concern were preoperative COVID-19 testing, mandatory PPE usage by hospital staff, and surgeon reassurance. Our analysis found that female sex, greater age, and Asian race were independently associated with greater concern regarding the COVID-19 pandemic.

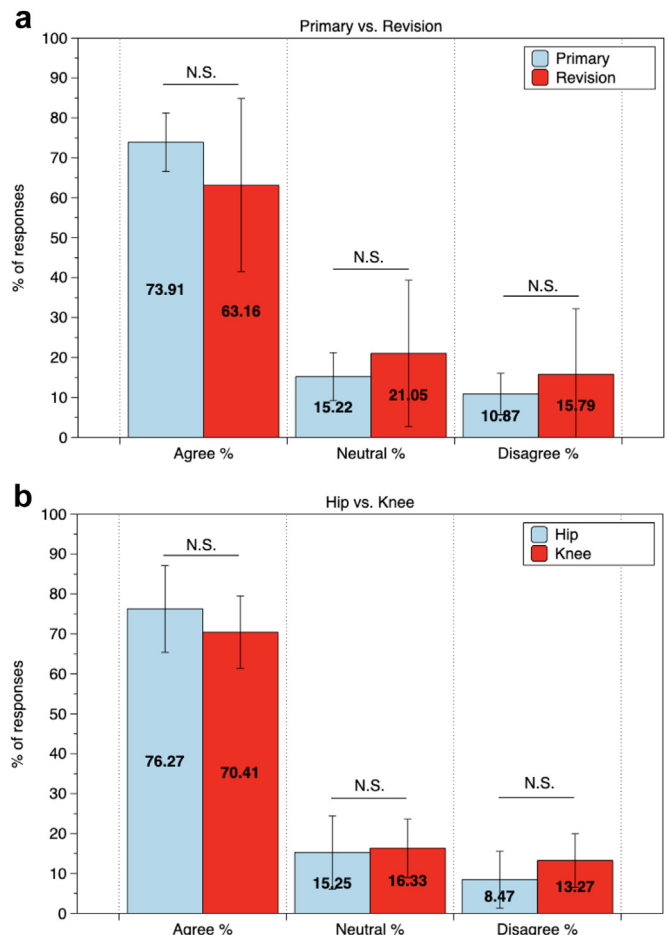


Figure 5. (a) Average level of concern as a function of primary vs revision arthroplasty. (b) Average level of concern as a function of surgical site.

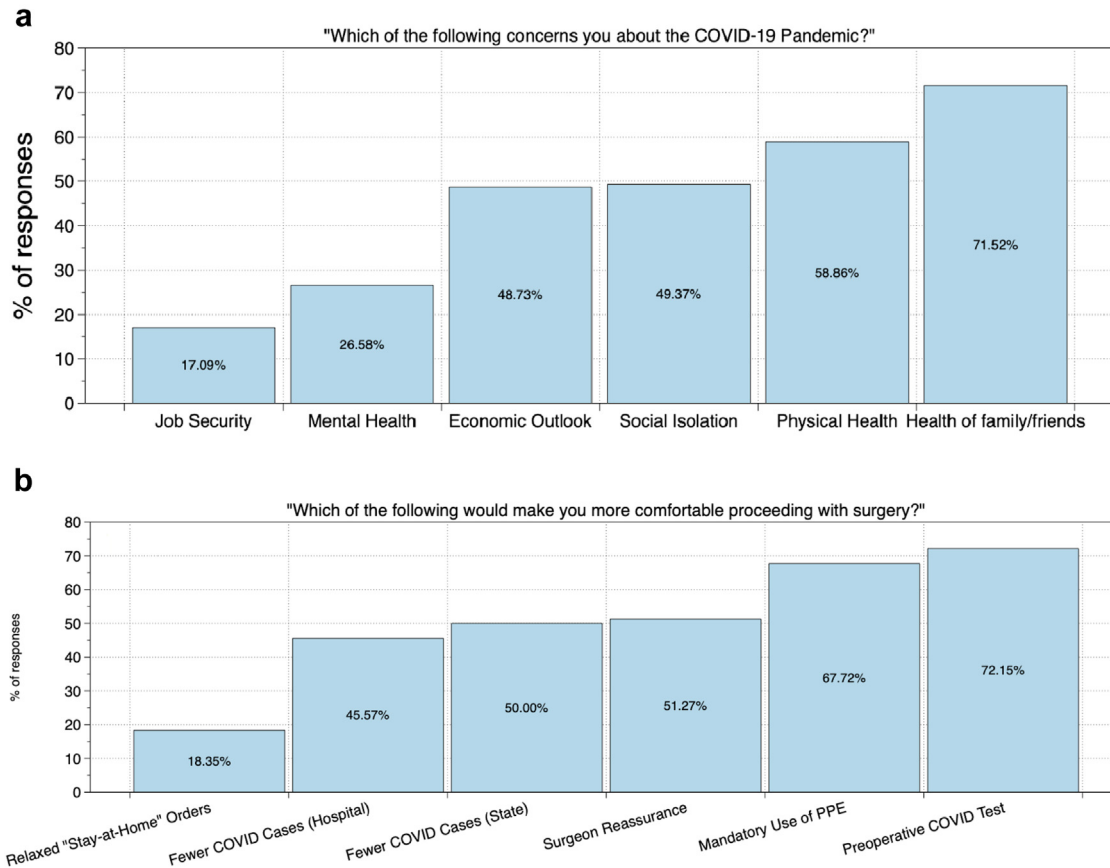


Figure 6. (a) Specific patient concerns regarding the COVID-19 pandemic. (b) Specific measures that make patients more comfortable proceeding with elective joint arthroplasty surgery.

Some of the trends observed in the present study paralleled the timing of California state policy announcements. The levels of concern expressed by patients in early May trended downward, which coincided with the May 8th staged reopening of California due to slowing COVID-19 incidence [9]. However, patient concerns increased in the last week of May, associated with the May 27th social justice protests and mandatory evening curfews across the state [10]. These events may have increased fears of a second wave of COVID-19 cases. Average concern varied over the next few weeks but reached a peak between the weeks of July 13–July 19. This timeframe coincided with rapidly increasing statewide COVID-19 incidence and the July 13th reclosure of many businesses within California [11]. While it is impossible to attribute concern levels to statewide events and public closure mandates, the close relationship between levels of patient concern and state data suggests that patient concern is more likely related to statewide policy changes and COVID-19 cases rather than local county-wide numerical trends.

Another interesting finding of this study is the nonsignificant difference in concern between participants with and without personal knowledge of COVID-19-infected contacts, as these patients could be expected to have greater concern of the pandemic. However, given the overall low COVID-19 case-fatality rate [7] and commonly asymptomatic or mildly symptomatic presentation of infected individuals, having a personal connection to a COVID-19-infected individual may have reduced concerns in our participant population. Finally, job security was the least chosen concern regarding the COVID-19 pandemic, but this is likely confounded by the fact that most participants were Medicare beneficiaries who

were likely retired. Occupation was not explicitly surveyed, so no analysis was conducted between employed and unemployed or retired respondents.

The results of this study are important for understanding the psyche of a particularly vulnerable population of surgical candidates. The average age of patients undergoing hip and knee arthroplasty within the U.S. is 67.4 and 66.7 years, respectively [12]. This population is at the highest risk for COVID-related hospitalizations, which are 412.9 per 100,000 in those older than 65 years [13]. Greater age is also a strong predictor of COVID-related mortality, with 80% of deaths due to COVID-19 in the U.S. coming from patients in the >65 years age group [14] and death rates due to COVID-19 approximately tripling with each decade after the age of 30 years [15].

The identification of factors that reassure patients enables surgeons to understand and address patient safety concerns regarding surgical management. Our finding that preoperative COVID-19 testing was the most cited factor to reassure patients regarding the safety of the procedure supports the importance of testing and delaying elective surgery in COVID-positive individuals, as numerous studies have associated active COVID-19 infection with both poor postoperative outcomes and higher mortality rates [16–18]. Preoperative COVID-19 testing and mandatory PPE usage were the most commonly selected reassuring factors; these measures are currently being widely recommended across hospital systems in the U.S. [19]. Our study also highlights the importance of implementing policies in the clinic to alleviate patient concerns and provide reassurance of the safety of elective joint arthroplasty. The findings of this study provide arthroplasty surgeons with data to

understand how the COVID-19 pandemic has impacted patient perceptions regarding the safety of undergoing elective joint replacement surgery. The findings of this study provide arthroplasty surgeons with data to better address patient fears, understand common concerns, and address specific factors that maximize psychological comfort.

This study has several limitations. Inherent within any survey study, the correlations found do not suggest causation. In addition, there may have been selection bias as patients with lower concern may have preferentially scheduled earlier surgery dates, potentially resulting in an underestimation of the true concern in this patient population. The survey response rate was approximately 67%, leaving one-third of patients that could have altered our results unaccounted for. This inherent limitation was unavoidable at our institution as research personnel were not allowed to administer the survey on the premises (ie, in the preoperative holding unit or PACU) because of institution-wide COVID-19 safety mandates. As such, patients could only be contacted by phone or email. In an attempt to identify any potential participation bias, we compared attributes between responders and nonresponders but were unable to find any differences between age and sex. There was also only one survey collected for each patient, so weekly trends in level of concern are essentially cross-sectional and do not represent trends in individual perceptions over time. Moreover, the reliability of the survey instruments used in the present study has not been previously validated. Finally, this study was conducted at a single, private academic center, which limits generalizability to other hospital types and locations. However, many of the safety policies we assessed have been implemented nationwide in various types of practice settings, and this study highlights broadly applicable practices that alleviate patient concern over the safety of their hip and knee arthroplasties.

Conclusions

The COVID-19 pandemic has posed challenges for medical professionals across the globe. Within the U.S., elective surgery has been impacted by a combination of mandatory shutdowns due to unavailability of intensive care unit beds and continued patient hesitance to pursue elective surgical procedures during this time of uncertainty. The strength of this study is that it directly surveyed patients undergoing nearly every type of knee or hip replacement and is likely representative of the total arthroplasty population immediately after the surgery moratorium was lifted. Our findings suggest preoperative COVID-19 testing, mandatory mask and PPE usage by all hospital staff, and surgeon reassurance may be the most effective strategies to assuage patient anxiety regarding elective arthroplasty. Furthermore, increased age and female sex were significantly associated with increased concern, identifying patient cohorts that arthroplasty surgeons may need to spend more time and effort reassuring and educating in the clinic. Finally, we found that patients' concern more closely follows statewide rather than citywide trends in daily COVID-19 incidence and COVID-related deaths, suggesting that normalization in patient concerns over the safety of surgery may not occur until COVID-19 is controlled at the state or national level. Longer term follow-up data

will be needed to identify trends in patient perceptions toward undergoing elective joint surgery and better specify factors that will aid in the return to normalcy.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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Appendix

Demographics

Page 1

Name _____

Race

- American Indian/Alaska Native
- Asian
- Native Hawaiian or Other Pacific Islander
- Black or African American
- White
- Hispanic or Latino
- More Than One Race
- Unknown / Not Reported

Gender

- Female
- Male
- Non-binary/other

Have you had a surgery postponed as a result of the COVID-19 Pandemic?

- Yes
- No

When is your surgery scheduled?
(if unsure, please guess) _____

When was your surgery scheduled?
(if unsure, please guess) _____

What surgery were/are you scheduled for?

- Knee replacement
- Hip replacement
- Partial knee replacement
- Revision hip surgery
- Revision knee surgery
- Other

Who is your surgeon?

- _____
- _____
- _____
- _____
- _____
- _____

Figure S1. Patient survey demographics.

Covid Questions

How would you rate your agreement with the following statements?					
	1 - Strongly agree	2	3 Neutral	4	5 - Strongly disagree
I am concerned about the COVID-19 pandemic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The COVID-19 pandemic is currently affecting my day-to-day life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have been hesitant to proceed with surgery because of the COVID-19 pandemic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The COVID-19 pandemic will affect the safety of my surgery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The COVID-19 pandemic will affect the outcome of my surgery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which of the following concerns you about the COVID-19 Pandemic? Select all that apply.

- Job security
- Social isolation
- Mental health
- Personal physical health
- Health of family or friends
- Economic outlook

Have you or someone you know had COVID-19? Select all that apply.

- Self
- Family member
- Friend
- Co-worker

Which of the following would make you more comfortable proceeding with surgery? (select all that apply)

- Having a COVID-19 test before surgery
- Fewer new cases of COVID-19 in California
- Fewer COVID-19 positive patients at the hospital
- Relaxation of statewide "stay-at-home" orders
- Mandatory use of masks and other personal protective equipment by all hospital staff
- Surgeon reassurance

Figure S2. Main survey questionnaire.

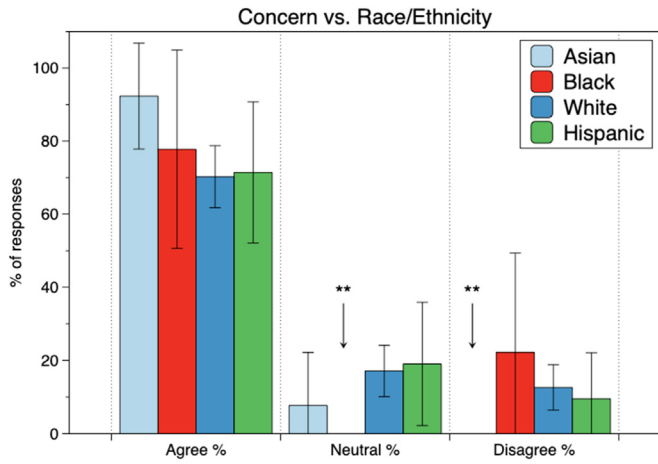


Figure S3. Average level of concern as a function of race. ** represents statistically significant differences between groups, with the threshold for statistical significance set at $P < .05$.

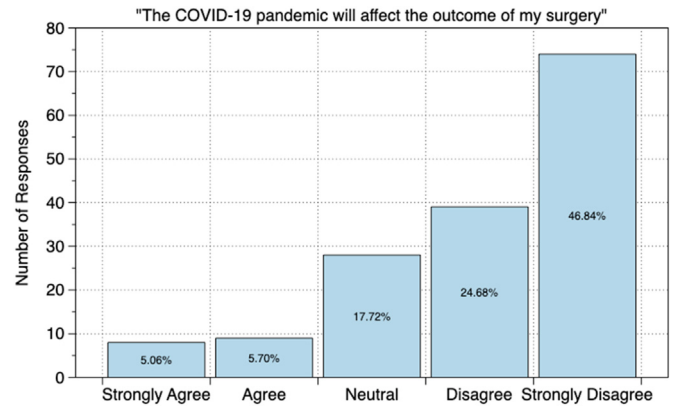


Figure S5. Patient perception of the impact of COVID-19 on the outcome of surgery.

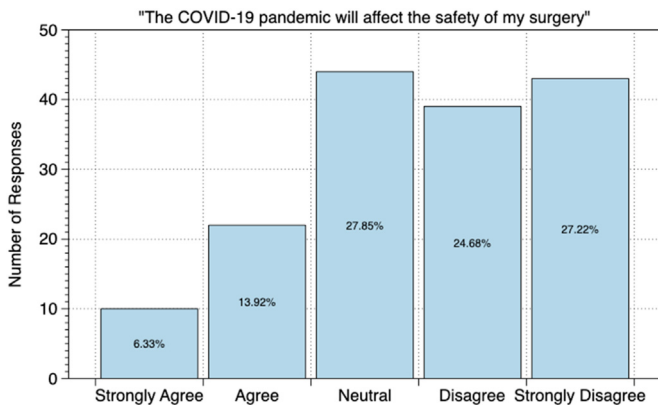


Figure S4. Patient perception of the impact of COVID-19 on the safety of surgery.

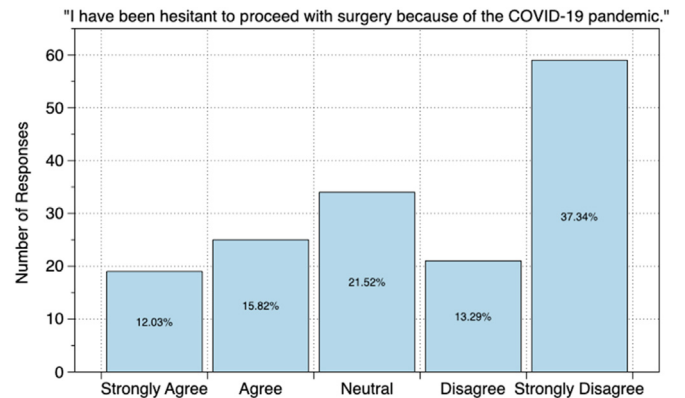


Figure S6. Patient hesitancy to proceed to surgery due to the COVID-19 pandemic.