

# COVID-Delayed Elective Surgery Has a Negative Effect on Young Sports Medicine Patients



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**Purpose:** The purpose of this study was to evaluate the physical and psychological effects of COVID-related elective surgery delays on young sports medicine patients. **Methods:** We conducted a cross-sectional study of patients (10-25 years old) who had elective sports medicine surgery delayed due to the COVID crisis. Electronic surveys were sent to patients and included the 12-item Short Form Health Survey (SF-12), which yields a physical component score (SF12-PCS) and a mental component score (SF12-MCS), the PROMIS Psychological Stress Experience survey (PROMIS-PSE), and self-designed questions about patient concerns regarding the COVID crisis and delayed surgery. **Results:** Of the 194 eligible patients with delayed elective sports surgeries, 107 patients (55%) elected to participate (mean age  $17.6 \pm 3.09$  years, 30% male). The mean surgical delay was 76 days (CI 57-98). Delayed surgery patients scored significantly lower than population norms on the SF12-PCS (mean 39.3, CI 37.0-41.7;  $P < .001$ ). Males scored significantly higher than females on the SF12-MCS (52.8 vs 45.7;  $P = .002$ ), but the overall SF12-MCS mean was not significantly different from the general population (47.4;  $P = .07$ ). The mean PSE score was significantly higher than population norms (57.7, CI 56.1-59.3;  $P < .001$ ), but they did not differ by age or gender. Patients who reported higher levels of concern about their surgical delay endorsed significantly lower scores on the SF-MCS ( $P = .006$ ) and higher scores on the PROMIS-PSE ( $P < .001$ ), indicating greater emotional symptoms. The biggest concern with COVID-related surgical delays was a concern about not being back in time for a sports season. **Conclusions:** Young sports medicine patients reported significant physical and emotional symptoms associated with COVID-related surgical delays. Patients were most concerned about delays resulting in missed sport seasons. Those who reported greater levels of concern with surgical delays reported more emotional symptoms and higher levels of psychological stress. **Clinical Relevance:** It is important to understand the impact of delayed elective surgical treatment on young patients due to COVID. This study will allow us to make more informed choices for patients during the pandemic.

## Introduction

The COVID-19 pandemic has introduced tremendous levels of stress into the medical system of the United States.<sup>1</sup> As a response to the spread of the virus, elective surgeries throughout the country were canceled early on in the pandemic, in an effort to

minimize further transmission of disease, ensure available inpatient beds to care for COVID-19 patients, and conserve resources, such as personal protective equipment (PPE), for healthcare providers. Reports indicate that elective surgeries account for up to 91% of all surgeries in the United States,<sup>2,3</sup> which suggests the

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cancellation of these procedures is a substantial measure to take for resource preservation. State governments initially ordered a halt to all scheduling and performing of nonessential elective invasive procedures as early as March 15, 2020, in Massachusetts and March 23, 2020, in New York.<sup>4,5</sup> While surgeries were canceled in an effort to prevent COVID-19 transmission, this may have had unanticipated consequences for individuals who were directly affected by surgical delays.<sup>6</sup> As the pandemic has continued to surge over a year later, health systems have continued to place temporary restrictions on elective surgeries in certain areas,<sup>7,8</sup> and the strain of the pandemic on the health care system is likely to continue for some time.

Adolescents and young adults with sports injuries often have strong athletic identities and a desire to resume sport activities as soon as possible.<sup>9,10</sup> Injuries negatively affect these individuals with respect to self-esteem and motivation, and ceasing sports participation can be difficult for these athletes to cope with emotionally.<sup>11-13</sup> Furthermore, postinjury, athletes have reported feelings of depression, loss, frustration, anger, and decreased self-esteem.<sup>14,15</sup> These emotions postinjury may change over time, and athletes may not be open to discussing their psychological distress initially.<sup>14</sup> Mandated surgical delays during the COVID-19 pandemic may exacerbate the physical and psychological struggles of athletes with injuries requiring surgery, as ultimate recovery is prolonged.

The purpose of this study was to evaluate the physical and psychological effects of COVID-related elective surgery delays on young sports medicine patients. We hypothesized that young sports medicine patients will experience significant physical and emotional symptoms compared to the general population due to COVID-related elective surgery delays.

## Methods

### Data Statement

The dataset generated during and analyzed during the current study is not publicly available, but it is available from the corresponding author upon reasonable request. The data presented in this study were aggregated, deidentified, and derived from Boston Children's Hospital, Department of Orthopedic Surgery & Sports Medicine. The data were stored on a secure department-managed server.

### Patients

After Institutional Review Board approval (IRB-P00035351) from Boston Children's Hospital, we obtained a report of all sports medicine surgical patients with delayed surgeries due to the COVID-19 pandemic. Delayed surgeries, for the purpose of this article, were defined as procedures that were previously scheduled

and postponed due to the pandemic or new procedures that could not be booked due to the temporary halt in scheduling elective procedures at our institution. All patients (ages 10-25 years) with COVID-related surgical delays for sports medicine procedures were included. Sports medicine procedures were defined as arthroscopic or open procedures performed by the seven sports medicine surgeons at our institution. Patients were excluded if they were non-English speaking, had surgery before survey completion, were not interested in participating, did not complete the survey within the 1-month recruiting period, surgery was canceled or completed at an outside hospital, or other reasons.

### Recruitment Timeline

Elective surgeries were suspended at our institution starting in mid-March 2020. On May 14<sup>th</sup>, 2020, all patients with elective surgical delays due to the pandemic were sent electronic surveys to complete. New patients evaluated between May and June 2020, who were indicated for surgery but still affected by delays and operating room backlog, were also sent electronic surveys on June 15<sup>th</sup>, 2020. Enrollment closed after this date due to elective sports medicine surgeries resuming on a limited, but more regular, basis starting in July 2020. To encourage survey completion, patients were contacted up to seven times over a one month period, including three phone calls and four emails. An initial plan for longitudinal data collection was discontinued due to the restart of surgeries and significant patient drop out on subsequent surveys.

### Patient-Reported Outcomes

Electronic surveys included a demographic form, 12-item Short Form Health Survey (SF-12),<sup>16</sup> Patient-Reported Outcome Measurement Information System (PROMIS) Psychological Stress Experience (PSE) Short Form,<sup>17</sup> self-designed attribution questionnaire, and a self-designed concern questionnaire (see [Appendix Fig 1](#)). The demographic form included questions about age, gender, date of survey, original date of scheduled surgery, body part awaiting surgery, and level of athlete starting in fall 2020. Age was categorized into three different distributions (pre-adolescent, adolescent, and young adult), while level of athlete was categorized by youth, middle school, high school, college, professional, or did not play competitive sports ([Table 1](#)). The SF-12 and PROMIS PSE Short Form have been developed and validated to assess our measures of interest.<sup>16-18</sup> The SF-12 yields a physical component score (SF12-PCS), as well as a mental component score (SF12-MCS). The SF12-PCS and SF12-MCS are scaled to a mean score of 50 and standard deviation of 10, as these represent population norms. The self-designed attribution questionnaire included 3 questions assessed whether patients' attributed their reported physical and

**Table 1.** Patient Characteristics for all Subjects (*N* = 107) and by Timing of Initial Survey

Characteristic	Frequency	(%)
Age at survey (years; mean ± SD)	17.6	± 3.09
Pre-adolescent (10 to ≤14)	22	(21%)
Adolescent (>14-18)	44	(41%)
Young adult (>18-25)	41	(38%)
Sex (% male)	32	(30%)
Body part awaiting surgery		
Upper extremity	19	(18%)
Shoulder	17	(16%)
Elbow	2	(2%)
Lower extremity	84	(79%)
Hip	15	(14%)
Knee	58	(54%)
Ankle	11	(10%)
Missing	4	(4%)
Level of athlete		
Youth	1	(1%)
Middle school	12	(11%)
High school	45	(42%)
College	18	(17%)
Professional	2	(2%)
Do not play competitive sports	29	(27%)

emotional symptoms to their 1) body part awaiting surgery, 2) general feelings about COVID-19, and 3) other reasons. Patients responded on a linear scale, indicating their level of attribution from 0 to 100%, and scores for the 3 questions added up to 100%. The concern questionnaire included a primary question on how concerned the patient was that their elective sports surgery had to be delayed because of the COVID-19 crisis. In addition, there were 13 questions, self-designed by author collaboration, which rated the importance of specific potential concerns with regard to delayed surgery. All responses were ranked on a 5-point Likert scale. Furthermore, the questionnaire asked which specific concern listed was of highest importance, whether the patient was seeing a therapist or mental health counselor, and if the patient had a history of any mental health conditions.

**Statistical Methods**

Patient demographics and injury characteristics were summarized for all subjects. Continuous outcomes were summarized by mean and standard deviation (SD) or 95% confidence interval (CI), or median and interquartile range (IQR, 25th-75th percentile), as appropriate. Patient reported outcomes including SF-12 PCS, SF-12 MCS, and PROMIS PSE were compared to the expected population mean of 50 using a Student’s *t*-test. Variation in patient reported outcomes across patient demographic groups and location of procedure (upper extremity vs lower extremity surgery) were conducted using analysis of variance or a Kruskal-Wallis test, as appropriate. All tests were two-sided and *P* values less than .05 were considered significant.

**Results**

One hundred ninety-four patients had delayed elective sports surgeries during the acute COVID elective surgery shutdown among 7 surgeons. Fifty-five percent of these patients (107/194) elected to participate in this study. Eighty-nine patients (83.2%) were part of the first delayed group that was surveyed, and 18 patients (16.8%) were surveyed in the second group as delays continued. Importantly, there were no significant differences among the first and second groups in terms of demographic factors, length of surgical delays, or reported physical or mental health outcome measures (*P* > .4 in all cases).

**Demographics and Surgical Delays**

The average age of all participants was 17.6 ± 3.1 years. 30% were male and 70% were female. Additional demographic factors can be seen in Table 1, demonstrating varied distribution among age groups and level of sports participation. Seventy-eight subjects (78/107, 73%) indicated participation in competitive sports. The majority of patients (84/107, 79%) were awaiting surgery on the lower extremity, with knee surgery being the most common. For those with an originally defined surgical date (*n* = 68), the median time from this date to survey completion was 44 days (IQR: 28-54 days).

Of the participants, 91 of 107 (85%) ultimately underwent surgery by the end of September 2020. Four additional patients rescheduled surgery well after more normal scheduling operations had resumed by the end of 2020. Of these 91 subjects, 68 (79%) had a defined, originally scheduled surgical date. Only 6 of 68 (9%) had surgery on or before the date they were originally scheduled for. For the remaining 62 patients with a defined initial surgical date that was delayed, the median delay to surgery was 76 days (IQR: 57-98 days).

**SF-12**

Eighty-eight subjects (82%) completed the SF-12 patient questionnaire. Patients scored significantly below population norms on the SF12-PCS with a mean score of 39.3 (95% CI = 37.0-41.7; *P* < .001) (Table 2). No significant associations were detected in SF12-PCS score across genders (*P* = .24), age groups (*P* = .91), or location of procedure (*P* = .74) (Table 3). Mean SF-12 MCS was slightly below population norm, 47.4 (95% CI = 44.6-50.2), but not significantly different (*P* = .07). It was found, however, that males scored significantly higher on SF12-MCS compared to females (52.8 vs 45.7; *P* = .002) (Table 3). No significant associations were detected in SF12-MCS age groups (*P* = .64) or location of procedure (*P* = .47).

**PROMIS PSE**

One hundred (93.4%) completed the PROMIS PSE questionnaire. Mean PROMIS PSE was found to be

**Table 2.** Outcome Measures and Questionnaire Results for all Subjects ( $N = 107$ ) and by Timing of Initial Survey

Characteristic	N	Median	(IQR)
Delay to time of surgery (days)	62	76	(57-98)
Delay to time of survey completion (days)	68	44	(28-54)
SF12 PCS (means $\pm$ SD)	88	39.3	$\pm$ 11.18
SF12 MCS (means $\pm$ SD)	88	47.4	$\pm$ 12.92
PROMIS PSE (means $\pm$ SD)	100	57.7	$\pm$ 7.96
Percentage of emotional symptoms attributed to			
Injury awaiting surgery	84	50	(33-76)
COVID-19	83	25	(10-42)
Other reasons	84	10	(0-25)
Surgical Delay Concerns			
Questionnaire (Likert scale, 1-5)			
General concern for delay of surgery	86	4	(3-5)
Specific concerns			
Timing			
Wanting to get surgery done as soon as possible	82	5	(4-5)
Delays leading to prolonged recovery	83	4	(4-5)
Sports			
Returning to sport in time for sports season	82	4	(1-5)
Playing at a highly competitive level	82	2	(1-5)
Symptoms			
Further damage to injured limb over time	83	3	(2-4)
Pain in injured limb awaiting surgery	83	4	(3-5)
Feeling of instability in injured limb	83	4	(2-5)
Unable to do day-to-day tasks	82	4	(3-5)
COVID			
Afraid of getting COVID-19	82	2	(1-3)
Too anxious regarding COVID to have surgery	83	1	(1-1)
General emotions			
Generally anxious about not being able to have surgery	83	4	(2-5)
Feeling generally down or sad about not being able to have surgery	82	3	(2-4)
Mental health			
Currently seeing a therapist	82	12	(15%)
History of mental health condition(s)	82	20	(24%)

IQR, interquartile range; MCS, mental component score; PCS, physical component score; PSE, psychological stress and emotions.

significantly higher than population norms, suggesting more psychological stress in these patients, with a mean score of 57.7 (95% CI, 56.1-59.3;  $P < .001$ ). No significant associations were detected in PROMIS PSE

score across genders ( $P = .33$ ), age groups ( $P = .32$ ), or location of procedure ( $P = .13$ ) (Table 3).

### Emotion Attribution and Mental Health Comorbidities

The majority of patients indicated that their emotional stress was attributed mostly to their injury awaiting surgery, with patients reporting a median 50% attribution (IQR: 33-76%). Median attributions of emotional stress to COVID and other concerns were 25% (IQR: 10-42%) and 10% (IQR: 0-25%) respectively. Fifteen percent (12/82) reported that they were currently seeing a mental health counselor and 24% (20/82) reported a history of a mental health condition (Table 2). Those with a history of mental health conditions reported lower SF12-MCS scores (41 vs 49.7;  $P = .02$ ) and higher PROMIS-PSE scores (62 vs 56.2;  $P = .01$ ) compared to those without (Table 3).

### Surgical Delay Concerns

Eighty-six patients (80.4%) responded to questions regarding specific concerns of surgical delays. On average, patients reported being "very concerned" (median 4, IQR: 3-5) about surgical delays. Patients who reported higher levels of concern about their surgical delay had significantly lower scores on the SF-MCS ( $P = .006$ ) and higher scores on the PROMIS-PSE ( $P < .001$ ), suggesting more significant emotional symptoms (Table 3). They also reported lower scores on the SF-PCS ( $P = .05$ ) compared to those less concerned about their delay.

Medians for specific concerns regarding surgical timing, returning to sport, symptoms, COVID, and general emotions can be seen in Table 2. The most highly rated concerns by the cohort were timing-related concerns with a median response of 5 ("extremely important") for desire to get surgery as soon as possible and a median score of 4 ("very important") for concerns about delays prolonging recovery, returning to sports in time for a season, symptoms related to their knee, and feeling generally anxious about surgery. When patients were asked to choose their biggest concern with COVID-related surgical delays, concerns about potentially not being back in time for a sports season was most commonly reported, followed by desire to have surgery as soon as possible (Table 4). There were no significant differences in biggest concerns among age groups or reported gender.

### Discussion

This study showed that young patients did demonstrate significant physical and emotional symptoms related to elective surgery delays, and that those with higher levels of concern regarding surgical delays reported worse symptoms. The US health care system has been significantly strained as a result of the pandemic,<sup>1</sup>



**Table 3.** Stratified Outcomes

Characteristic	SF12-PCS (N = 88)		SF12-MCS (N = 88)		PROMIS PSE (N = 100)	
	Means ± SD	P	Means ± SD	P	Means ± SD	P
Sex		.24		.002		.33
Male	41.6 ± 9.80		52.8 ± 6.96		55.3 ± 8.31	
Female	38.6 ± 11.58		45.7 ± 13.96		57.8 ± 8.11	
Age group		.91		.64		.32
Preadolescent (≤14)	40.3 ± 9.22		52.7 ± 12.84		52.1 ± 8.70	
Adolescent (14-18)	39.1 ± 11.29		46.2 ± 13.09		57.5 ± 8.61	
Young adult (>18)	39.3 ± 11.65		47.5 ± 12.83		58 ± 7.53	
Location of procedure		.74		.47		.13
Upper extremity	39.9 ± 11.46		45.0 ± 13.40		59.9 ± 5.63	
Lower extremity	38.7 ± 11.11		47.9 ± 13.06		56.9 ± 8.62	
Level of concern with surgical delay due to COVID-19 crisis		.05		.006		<.001
Not concerned at all	46.6 ± 7.47		51.1 ± 7.95		43.5 ± 6.46	
A little concerned	37.5 ± 11.30		52.0 ± 9.31		54 ± 5.60	
Moderately concerned	41.2 ± 11.57		53.2 ± 11.07		55.3 ± 5.04	
Very concerned	39.7 ± 11.70		45.4 ± 14.67		59.3 ± 8.06	
Extremely concerned	35.4 ± 10.58		41.9 ± 13.49		62.4 ± 7.11	
Mental health counselor (MHC)		.30		.67		.07
Seeing an MHC	35.6 ± 11.65		46 ± 14.75		60.3 ± 5.51	
Not seeing an MHC	39.7 ± 11.28		48 ± 12.92		57 ± 8.31	
Mental health history		.88		.02		.01
History of mental health condition	38.7 ± 10.82		41 ± 13.80		62 ± 8.02	
No history of mental health condition	39.2 ± 11.58		49.7 ± 12.32		56.2 ± 7.60	

SD, standard deviation.

and conservation of resources was a necessary step to preserve access to life-saving treatments for those affected by COVID-19. Even today, almost 2 years after the pandemic began, some institutions continue to restrict elective surgeries as capacity issues continue to evolve. As with any decision that prioritizes care of some over others, there are collateral consequences that should be recognized and considered.

Significant physical and emotional symptoms were reported in this study and were consistent among different age groups (pre-adolescent, adolescent, and young adult). Lower SF12-PCS scores and higher PROMIS-PSE were found in our study cohort, suggestive of worse reported physical symptoms and higher levels of psychological distress compared to the general population. The SF12-MCS scores did not significantly differ from the general population; however, males scored significantly higher on this dimension than females. Additionally, participants with a history of mental health conditions reported greater emotional symptoms compared to the rest of the cohort. These data suggest that young people may have varied experiences associated with delayed surgery, and considering the individual impact on patients is important. As such, specific attention to mental health and psychological coping should be attended to in the perioperative period for young athletes with surgical delays. The health care team’s understanding of the patient’s experience and frustration can potentially help mitigate compounding negative effects. It is not surprising that patients, on average, were “very concerned” about

surgical delays and that those with more concern reported worse reported physical and mental symptoms. A cross-sectional population study in a general adolescent population found an association between reported psychological concerns and somatic symptoms.<sup>19</sup> It is reasonable that a mind-body connection can play a role in a patient’s experience, and it is important to recognize and acknowledge all aspects of their injury experience in order to provide optimal care.

The majority of the patients in this study identified themselves as athletes, and the biggest reported concern about surgical delays was being unable to return to sports for the next season. For young athletes, sports can be a central aspect of their identity. Because identifying as an athlete can be a critical component of how they see themselves, when the ability to participate in sports is taken away by injury this can have devastating emotional effects and consequences for self-worth.<sup>9,11,12</sup> Studies have shown that young athletes experience significant emotional distress after diagnosis with surgical injuries, such as anterior cruciate ligament tears.<sup>20</sup> Participation in sports has also been shown to have significant psychosocial benefits.<sup>21</sup> Even in the COVID era, physical activity among adolescents during the pandemic has been found to be somewhat protective of mental health and well-being during this time.<sup>22</sup> For our athletes awaiting elective sports surgery during the pandemic, it is logical to suspect that their time away from sport, the uncertainty as to when their surgery would be, as well as the prolonged nature of their treatment and ultimate recovery might be significant stressors. A study in 2007 of adults awaiting

**Table 4.** Biggest Concern with Respect to Delayed Surgery for all Subjects and by Patient Age Group

Concern	All Subjects (N = 75)		Preadolescent (N = 9)		Adolescent (N = 32)		Young Adult (N = 34)	
	Frequency	(%)	Frequency	(%)	Frequency	(%)	Frequency	(%)
Wanting to get the surgery done as soon as possible	10	(13%)	1	(11%)	5	(16%)	4	(12%)
Concerns about delays leading to prolonged recovery	7	(9%)	0	(0%)	3	(9%)	4	(12%)
Concerns about further damage to injured extremity over time	4	(5%)	1	(11%)	2	(6%)	1	(3%)
Concerns about potentially not being back in time for a sports season	<b>20</b>	<b>(27%)</b>	<b>3</b>	<b>(33%)</b>	<b>11</b>	<b>(34%)</b>	<b>6</b>	<b>(18%)</b>
Concerns about being able to play high-level competitive sports such as in college, or professionally	3	(4%)	0	(0%)	1	(3%)	2	(6%)
Having pain in the injured body part awaiting surgery	10	(13%)	0	(0%)	4	(13%)	6	(18%)
Feeling like the injured body part is unstable, loose, or giving out	9	(12%)	2	(22%)	3	(9%)	4	(12%)
Being unable to do day-to-day activities how I would like to	7	(9%)	1	(11%)	2	(6%)	4	(12%)
Afraid of getting COVID-19 during this time if I were to have surgery	1	(1%)	0	(0%)	0	(0%)	1	(3%)
Feeling too anxious or sad during this time about the COVID-19 crisis to want to have surgery anyway	0	(0%)	0	(0%)	0	(0%)	0	(0%)
Feeling generally anxious or worried about not being able to have my surgery right now	3	(4%)	0	(0%)	1	(3%)	2	(6%)
Feeling generally down or sad about not being able to have my surgery right now	1	(1%)	1	(11%)	0	(0%)	0	(0%)

NOTE. Bolded values indicated the most common concern cited by different age groups.

general surgery procedures showed having to wait longer for surgery was associated with worse quality of life outcomes.<sup>23</sup> During this pandemic, adult cardiac and vascular patients described challenges with their mental and physical health associated with surgical delays, and also expressed desires to “return to normal” and improve their symptoms through surgery.<sup>24</sup>

An additional consideration in this young patient population is that many of these athletes are at critical times in their sports careers, with looming opportunities for advancement, such as college scholarships or recruitment for more elite teams. Being sidelined for surgery, in addition to general sport cessation during the pandemic, could place these future opportunities in jeopardy as well. At the time of the surgical delays, there was also uncertainty as to when and whether sport participation would resume as most sport activity was also canceled due to safety concerns during the pandemic. It follows that the biggest concern in this study regarding surgical delays was a concern about potentially not being back in time for an upcoming sports season, especially among the younger patients in

the study. This highlights the high activity level of these young patients, as well as the importance placed on sports in this age demographic.

Patients in this study did report significant concerns related to delayed elective surgeries during the COVID pandemic. It is important to continue investigating how mandated rationing of care affects patients on an individual level, as the uncertainty of whether these health care trends will continue in the postpandemic era. Further studies should be directed toward understanding downstream patient effects of these utilitarian decisions on the national, state, and local levels.

### Limitations

There are limitations to this cross-sectional survey study, and results should be interpreted with these in mind. First, not all patients with delayed surgery elected to participate in the study, possibly introducing responder bias. It is possible that only patients with major symptoms elected to participate, and there may be patients not included in this study who did not experience significant disruption with elective surgery delays.

Surveys were also self-reported and could be subject to recall and self-report bias, and analyzed results were from a single time point during patients' surgical delays. An attempt was made to collect monthly longitudinal data while delays persisted; however, there was significant dropout, limiting ability to meaningfully analyze these results. We also do not have any comparison data about what emotional/physical symptoms athletes experience while waiting for surgery in nonpandemic times. This could potentially put the results of this study in better context as to whether patients were particularly affected by mandated delays or affected, in general, by their injury. In this study, patient attributions of symptoms were an important part in attempting to answer this question, asking to what degree symptoms were specifically related to the patient's injured body part versus COVID-19 general concerns versus other concerns. Furthermore, this study included a wide age range, and thus, preadolescents may answer the surveys differently than young adults. Finally, while surgeries that were postponed were considered "elective," not all elective procedures have the same urgency. This likely affected priority for scheduling once more normal operations resumed, and there was likely variability in delay time, even among this cohort.

## Conclusions

Young sports medicine patients reported significant physical and emotional symptoms associated with COVID-related surgical delays. Patients were most concerned about delays resulting in missed sport seasons. Those who reported greater levels of concern with surgical delays reported more emotional symptoms and higher levels of psychological stress.

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