

Female and Younger Orthopaedic Sport Medicine Patients Are More Negatively Affected by COVID-19–Related Health Care Closures



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Purpose: To determine whether sex or age influence whether coronavirus disease 2019 (COVID-19) health care closures affect the health, recovery, and access to resources of preoperative and postoperative orthopaedic sports medicine patients. **Methods:** Electronic questionnaires assessing physical and emotional health, the value of virtual care, and access to resources were distributed to patients with postponed (PP) orthopaedic restorative surgeries and those within 3 months' postoperative (PO), at the time of the COVID-19 health care closures. The EQ-5D-3L was included as a standardized measure of general health. Chi-square tests compared responses between sexes and age groups. Unpaired *t*-tests compared the EQ visual analog scale (VAS) by sex, and a one-way analysis of variance (ANOVA) compared the EQ VAS by age. **Results:** Females in the PO group were more likely to report that their recovery was delayed (49.5% vs 36%) and that closures had negatively affected their recovery ($P = .013$). Females in the PP group reported more symptoms of pain/discomfort on the EQ-5D-3L ($P = .023$). In the PP group, patients aged 25 to 44 years were most likely to identify pain as a concern ($P = .54$). In the PO group, patients younger than 45 years reported a significantly lower mean EQ VAS health state ($P = .017$). For the final analysis, there were 115 subjects in the PP group and 198 in the PO group. **Conclusion:** This study demonstrated significant sex- and age-specific differences in health and recovery among orthopaedic sports medicine patients as a result of the COVID-19 health care closures. Females reported significantly more pain, anxiety, and delay in their rehabilitation, while younger patients reported greater negative impacts and worse overall health state.

Introduction

Since it was first declared a pandemic in March 2020, coronavirus disease 2019 (COVID-19) has had a significant impact on medical systems and the health of populations around the world. The climbing death toll and stressed hospital units clearly indicate the burden of the SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) virus. Unfortunately, there may be other health consequences to consider that are not as readily apparent. The interruption of routine

patient care due to the closure of physician's offices, operating rooms, and allied care services has created gaps in health care delivery that will be challenging to close. As health systems begin to tackle the fallout of these disruptions, the expansive toll of the COVID-19 pandemic is just beginning to be fully appreciated.

A survey study evaluating patient physical and emotional health, the effectiveness of virtual care, and access to resources as a result of COVID-19-related health care closures was previously conducted among orthopaedic sports medicine patients.¹ The results revealed that the majority of patients (71.3%) experienced an overall negative impact on their physical and emotional health. Many patients were concerned that their postoperative recovery was delayed (69.7%), and those awaiting surgery were worried about their ability to return to work (62.9%). Less than half (41.4%) were able to access virtual physiotherapy, and only 61.3% felt that virtual orthopaedic follow-up was useful. The authors concluded that restorative procedures play an important role in maintaining overall well-being and that virtual medicine does not adequately replace in-person care.

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Differences in the incidence and clinical outcomes of orthopaedic conditions have been described in the literature for both sex and age. Studies have shown that females not only experience a different burden of musculoskeletal disease than males, but also report differences in outcomes.²⁻⁵ For example, women are more likely than men to suffer from osteoarthritis of the knee and experience greater severity of disease.³ In the preoperative and early postoperative period following rotator cuff repair surgery, females tend to report increased pain and functional limitations compared to males.^{4,5} Age has also been shown to correlate with outcomes following orthopaedic surgery. Although older individuals are at increased risk of degenerative conditions, such as arthritis and rotator cuff disease, younger patients report increased pain following rotator cuff repair surgery.⁶ Younger age is also a significant risk factor for graft failure following anterior cruciate ligament (ACL) reconstruction.⁷ Although further research is needed to better explain the reason for these differences, it is clear that sex and age are important determinants of the burden of musculoskeletal (MSK) disease, as well as the response to treatment.

There is currently limited data on the impact of the COVID-19 health care closures across different sex and age categories in the orthopaedic population. The purpose of this study was to determine whether sex or age influence whether COVID-19-related health care closures affect the health, recovery, and access to resources of preoperative and postoperative orthopaedic sport medicine patients. We hypothesized that there would be no significant difference between the sexes, but that younger patients would have increased access and familiarity with virtual resources and, thereby, be less negatively affected in their postoperative recovery.

Methods

This study was conducted in a community practice of four subspecialty orthopaedic sport medicine surgeons. Questionnaires assessing physical health, emotional health, virtual care, and access to resources were electronically distributed to patients whose orthopaedic

restorative surgeries were postponed (PP), as well as to patients within 3 months' postoperative (PO) at the time of the COVID-19 health care closures. The surveys were designed as a quality assurance assessment and were not previously validated. All responses were anonymous and patient records were not accessed to supplement the survey results. Demographic information collected was limited to age, sex (male/female), and surgical procedure performed or postponed. Patient responses were assessed using a 7-point Likert scale. The European Quality of Life, Five Dimension, Three Level (EQ-5D-3L) was included as a quantitative and standardized measure of general health status.⁸ It comprises the following five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension has three levels: no problems, some problems, extreme problems (labeled 1–3). Patients were asked to indicate their health state by checking the box against the most appropriate statement. The EQ visual analog scale (VAS) records the self-rated health on a VAS from 0 to 100, where 100 is labelled "The best health you can imagine" and 0 is labeled "The worst health you can imagine". Patients were asked to select a point on the VAS that corresponded to their overall health on that day. The EQ-5D-3L has been previously assessed in orthopaedic patients, and normative data were available for comparison purposes. All questionnaire responses were anonymous, and participation was voluntary. Patients who responded to the questionnaires indicated their consent to provide information at the beginning of the survey. Formal Research and Ethics Board approval was not required.

Statistical Analysis

Data were stratified by sex and divided into three age groups: 24 years and younger, 25 to 44 years, and 45 years and older). The data were descriptively analyzed using means, standard deviations, and percentages. Chi-square tests were performed to compare survey responses for females and males, as well as between age groups and between the five dimensions of the EQ-5D-3L ($P < .05$). Unpaired t -tests were used to compare the EQ VAS health

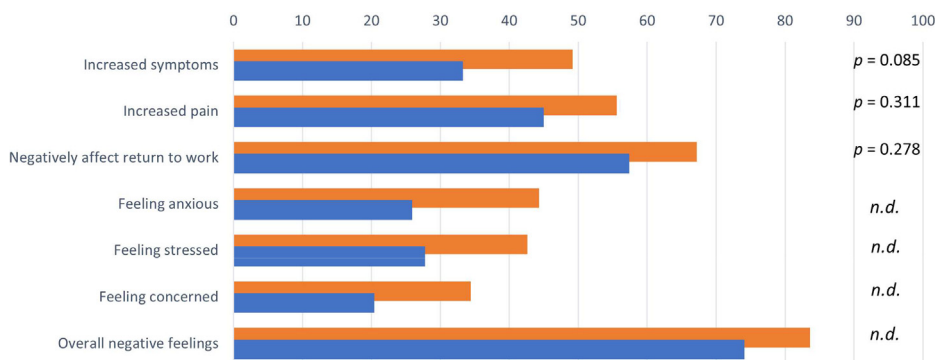


Fig 1. Patient-reported health impacts in males and females in the postponed surgery group. $n.d.$, not determined based on χ^2 analysis.

Table 1. EQ-5D-3L Frequencies Reported by Problem, Level, and Sex, and Mean VAS Health State Reported by Sex for Patients in the Postponed Surgery Group

	Mobility <i>n</i> (%)		Self-care <i>n</i> (%)		Usual Activities <i>n</i> (%)		Pain/Discomfort <i>n</i> (%)		Anxiety/Depression <i>n</i> (%)		VAS Health State
	No Problems	Any Problems	No Problems	Any Problems	No Problems	Any Problems	No Problems	Any Problems	No Problems	Any Problems	\bar{X} (SD)
Females	28 (45.9)	33 (54.1)	56 (91.8)	8 (8.2)	16 (26.2)	45 (73.8)	6 (9.8)**	55 (90.2)**	28 (45.9)	33 (54.1)	67.9 (19.2)
Males	30 (55.6)	24 (44.4)	50 (92.6)	4 (7.4)	23 (42.6)	31 (57.4)	14 (25.9)**	40 (74.1)**	34 (63)	20 (37)	72.1 (18.0)

**Statistically significant difference between females and males (χ^2 (1, *N* = 115) = 5.16, *P* = .023). SD, standard deviation; VAS, visual analog scale; \bar{X} , mean.

state between females and males, and a one-way analysis of variance (ANOVA) was used to compare EQ VAS health state by age groups.

Results

Patient Population

The questionnaire was completed by 115 of the 269 (42.8%) PP patients. There were 61 females (53%) and 54 males (47%) in this group. The majority (64.4%) of patients were between 18 and 44 years old. Seventy two percent of females were between 18 and 44 years of age, and only 19.7% were >44 years old. Meanwhile, 55.5% of males were between 18 and 44 years of age and 42.7% were >44 years old. Of 479 PO patients, 198 (41.3%) completed the survey, including 109 females (55.1%) and 89 males (44.9%). The majority (67.7%) of patients were between 18 and 44 years old. Seventy three percent of females were between 18 and 44 years of age and only 22% were >44 years old. Over half (60.7%) of males were between 18 and 44 years of age and 34.8% were >44 years old.

Sex-Specific Data

Postponement of surgery had a greater effect on female patients compared with male patients. In the PP group, females were more likely than males to report increased symptoms (49.2% vs 33.3%; *P* = .085) and were also more likely to experience an overall increase in pain (55.6% vs 45%; *P* = .31). Further, 67.2% of female patients compared to 57.4% of male patients reported that the postponement of their surgery would negatively affect their ability to return to work (*P* = .278). Female patients more frequently described feelings of anxiety, stress, concern, and general negativity (Fig 1).

A comparison of the five EQ-5D-3L dimensions showed a statistically significant difference between females and males when reporting on symptoms of pain or discomfort (χ^2 [1, *n* = 115] = 5.16; *P* = .023). A comparison of EQ VAS health state, however, revealed no statistically significant differences between female and male patients (*P* = .23) (Table 1).

In the PO group, the majority of patients (69.7%) indicated that COVID-19-related health care closures had an overall negative effect on their recovery, with more females reporting that their recovery was delayed than males (49.5% vs 36%; *P* = .055). Females accessed virtual physiotherapy more often than males (46.8% vs 34.8%; *P* = .089), but they were also more likely to report that the lack of in-person physiotherapy negatively impacted their recovery 82.6% versus 61.8% (χ^2 [2, *N* = 198] = 10.78; *P* = .001) (Fig 2). Female patients more frequently reported feelings of anxiety, concern, and frustration due to COVID-related health care closures than male patients. Female patients

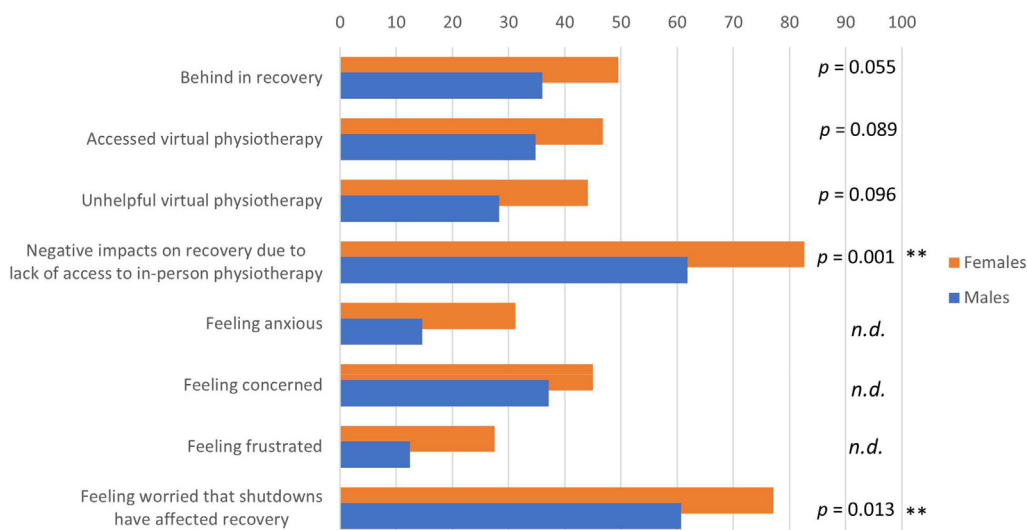


Fig 2. Patient-reported health impacts in males and females in the postoperative group. *n.d.*, not determined based on χ^2 analysis.

were also more likely to express feelings of concern that the closures had negatively affected their recovery ($X^2 [1, N = 198] = 6.232; P = .013$) (Fig 2).

Comparison of the five EQ-5D-3L dimensions showed that postoperatively, females were less likely to maintain their “Usual Activities” than males, and this difference was statistically significant ($X^2 [1, N = 198] = 3.938, P = .047$) (Table 2). A comparison of the EQ VAS health state, however, revealed no statistically significant differences between female and male patients ($P = .59$) (Table 2).

In both the PP and PO groups, more females than males responded to the survey. The odds ratio for a response in the PP group was 1.11 for females and 0.90 for males. In the PO group, the odds ratio for a response was 1.19 for females and 0.84 for males. There was no difference in response rates based on PP and PO groups (45% vs 46%).

Age-Specific Data

In the PP group, the majority of patients whose surgeries were postponed were 25-44 years of age (49%, $n = 56$), with 21% of patients aged 24 years and younger ($n = 24$), and 30% of patients aged 45 years and older ($n = 35$). Overall, 65.5% of all PP patients felt that the health care closures harmed their physical health. Patients aged 24 years and younger were more likely to report that the effect on their physical health of surgery postponement was more negative. 21% of patients aged 24 years and younger reported a “very negative effect” on their physical health ($n = 5$), compared to only 7% of patients aged 25-44 years ($n = 4$), and 9% of patients aged 45 years and older ($n = 3$) (Fig 3).

Overall, 75% of patients aged 24 years and younger reported being more negatively impacted in their ability to return to work due to surgery postponement ($n = 18$).

A quarter of patients aged 24 years and younger reported “very negative effects” when asked about their ability to return to work ($n = 6$), compared to only 11% of patients aged 25-44 years ($n = 6$), and 9% of patients aged 45 years and older ($n = 3$) (Fig 4). Further, patients aged 24 years and younger reported more substantial negative impacts when asked whether they were worried that the postponement of their surgery had impacted their physical and/or emotional health.

Age-related differences were also observed in the EQ-5D-3L domains of mobility and pain/discomfort. Greater than two-thirds (71%) of patients aged 45 years and older reported problems with mobility compared with only 41% of patients aged 25 to 44 years and 38% of patients aged 24 years and younger ($X^2 [2, N = 115] = 9.706; P = .0078$). A significant proportion of patients in all age groups identified pain as a concern, including 91% of patients aged 25 to 44 years, compared with 77% of patients aged 45 years and older, and 71% of patients aged 24 years and younger ($X^2 [2, N = 115] = 5.8; P = .54$).

Despite our analysis revealing age-related differences on several questions, a comparison of EQ VAS health state using a one-way ANOVA revealed no statistically significant differences between the PP age groups ($F[2,112] = 1.16; P = .32$).

In the PO group, the majority of patients were between 25 to 44 years of age (55%, $n = 109$), with 17% of patients aged 24 years and younger ($n = 34$), and 28% of patients aged 45 years and older ($n = 55$). A comparison of the EQ-5D-3L anxiety/depression dimension revealed that 35% of patients aged 24 years and younger ($n = 34$) and 43% of patients aged 25-44 ($n = 47$) reported feelings of anxiety and depression, compared with only 18% of patients aged 45 years and older ($n = 55$).

A comparison of EQ VAS health states revealed statistically significant differences between the PO age

Table 2. EQ-5D-3L Frequencies Reported by Problem, Level, and Sex, and Mean VAS Health State Reported by Sex for Post-Operative Patients

	Mobility n (%)		Self-care n (%)		Usual Activities n (%)		Pain/Discomfort n (%)		Anxiety/Depression n (%)		VAS X̄ (SD)
	No Problems	Any Problems	No Problems	Any Problems	No Problems	Any Problems	No Problems	Any Problems	No Problems	Any Problems	
Females	75 (68.8)	34 (31.2)	97 (89.0)	12 (11.0)	41 (37.6)**	68 (62.4)**	20 (18.3)	89 (81.7)	65 (59.6)	44 (40.4)	76.4 (15.6)
Males	67 (75.3)	22 (24.7)	85 (95.5)	4 (4.5)	46 (51.7)**	43 (48.3)**	25 (28.1)	64 (71.9)	64 (71.9)	25 (28.1)	77.6 (15.6)

**Statistically significant difference between females and males (χ^2 (1, N = 198) = 3.938, P = .047). SD, standard deviation; VAS, visual analog scale; X̄, mean.

groups. Patients aged over 45 years reported a higher mean EQ VAS health state of 82, compared with a mean score of 76 for those aged 24 years and younger, and a mean score of 75 for those between 25 and 44 years; ($F[2,195] = 4.18$; $P = 0.017$).

Discussion

This study revealed that age and sex significantly impacted how preoperative and postoperative orthopaedic sports medicine patients were affected by COVID-19 health care closures. Females were more likely to report negative emotions, such as anxiety, concern, and frustration. Females were also more likely to experience an increase in physical symptoms and greater difficulty returning to work. Despite increased use of virtual medical resources, younger patients in our cohort were more likely to report negative effects on emotional and physical health. This is in contrast to our hypothesis that improved access to virtual care in younger age groups would reduce the negative impact of the COVID-19 closures. In addition to this, younger patients also expressed more difficulty returning to work.

The greater psychological impact of MSK injury in females is supported by a previous study of trauma patients, indicating decreased short and long-term psychological and functional outcomes in females.⁹ Although there is limited research investigating this discrepancy, a possible consideration is that females are more likely to overtly express distress and emotion than males due to societal gender norms. Males are generally taught to be less expressive about illness and discomfort, while females are permitted to be more open in acknowledging distress and pain.¹⁰ This societal conditioning to express emotion may also explain why females were more likely than males to respond to the survey. These differences in communication of symptoms are important to consider, given that this study determined that there were no statistically significant differences in the EQ VAS health status scores based on sex.

In the PP group, females were more likely to experience an increase in pain and other physical symptoms. This is consistent with a study of patients undergoing rotator cuff repair surgery by Daniels et al.,⁵ which showed that females reported significantly higher VAS pain scores preoperatively and postoperatively than males. Glass et al.¹¹ investigated 2,712 individuals with knee osteoarthritis in a cross-sectional study and determined that females reported higher VAS pain scores at all radiographic grades of osteoarthritis. These findings parallel those of the present survey study, in which females were more likely to report negative symptoms or worsening pain in the postponed group of patients. These differences in physical symptoms between males and females may be due to neurobiological variations in how pain is processed in the central nervous system and possibly contributions from androgenic hormones.¹²

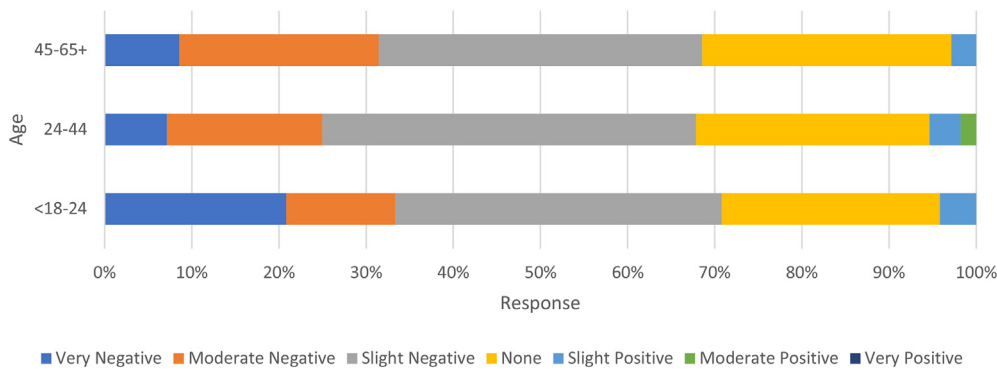


Fig 3. The impact of delayed surgery on physical health in different age groups.

Further, there may be a difference in how males and females describe their symptoms, with females generally demonstrating greater bodily vigilance and awareness.¹³

This study also found that females in the PP group experienced greater difficulty in returning to work than males. This may be a manifestation of the overall increase in physical and emotional symptoms. It may also be due to the increased domestic duties that females often take on as a result of societal biases in unpaid work.¹⁴ School closures and virtual curriculums imposed by COVID-19 restrictions resulted in an increased workload in the home, while travel and strict cohort guidelines created further barriers to obtaining assistance from external sources.¹⁵ Regardless of the etiology of these differences, it is important to be aware that males and females are affected by and report MSK injury in different ways. Consequently, standardized questionnaires may not be sensitive and/or specific enough to assess sex-specific outcomes, and more targeted questions may need to be posed. Ultimately, sex-specific or sex-neutral patient-reported outcome measures may need to be developed to better appreciate the burden and impact of MSK disease in males and females.

This study also revealed that COVID-19 health care closures affected younger and older patients in

significantly different ways. In the PP group, younger individuals were more likely to report negative effects on their physical and emotional health. These results are similar to an online survey assessing the impact of COVID-19 on 13,000 patients in a provincial registry, which found that those under the age of 45 years were more likely to experience a decline in their physical and mental health.¹⁶ There was an important association between physical and emotional health, which was more apparent in the younger patient population. This may be due to younger individuals being more involved in physically demanding activities and, thus, experiencing greater limitations in resuming these activities following MSK injury. These restrictions may, in turn, lead to a deterioration in mental and emotional health. Patients younger than 25 years in the PP group were also more likely to report difficulties in returning to work. This may be the result of younger patients having more physically demanding occupations. Regardless, these findings are of significance when evaluating the impact of MSK injuries and devising strategies for reopening the health care system during the COVID-19 pandemic.

As previously published¹, patients <25 years were more likely to access virtual health care resources. This is

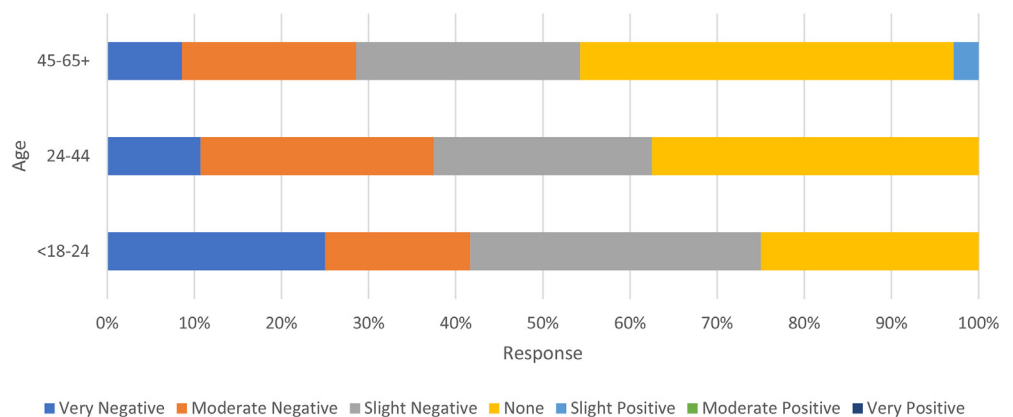


Fig 4. The impact of delayed surgery on the ability to return to work in different age groups.

consistent with other studies that have shown that older individuals are less likely to use technology and Web-based resources. A study by Onyeaka et al.¹⁷ surveyed 6,789 adults and found that older age was correlated with a decreased likelihood of owning technological devices and subsequently using them for health monitoring and communication. Recognizing that individuals >25 years are less likely to take advantage of Web-based medical resources is of particular importance as virtual medicine becomes the standard of care during (and possibly after) the COVID-19 pandemic. It will be critical to implement appropriate educational strategies to allow older individuals to access the resources necessary for health care delivery and optimization.

These findings build on the results of a previous investigation that revealed overall negative effects on the physical and emotional well-being of orthopaedic sports medicine patients who had their restorative surgeries postponed or their postoperative rehabilitation interrupted by COVID-19 health care closures. Of 115 PP patients, 71.3% reported a negative impact on their physical and emotional health and 62.6% described difficulty returning to work. Of 198 PO patients, 69.7% indicated that their recovery was negatively affected by the interruption in regular follow-up, and only 41.4% accessed virtual physiotherapy.¹

Limitations

This study has some important limitations. As with all survey-based research, there is a concern for sampling bias and other related issues such as survey fatigue. Further, the response rate was less than 50% in both the postponed surgery and postoperative groups. Also, the survey was not specifically designed to assess the differences between sexes and age groups. Age groups were assigned to assess young, middle-aged, and older individuals. Sex was categorically defined as male and female, and nonbinary individuals are not represented. Additionally, other potential confounding factors, such as socioeconomic status and underlying mental health conditions, were not accounted for.

Conclusion

This study demonstrated significant sex- and age-specific differences in health and recovery among orthopaedic sport medicine patients as a result of the COVID-19 health care closures. Females reported significantly more pain, anxiety, and delay in their rehabilitation, while younger patients reported greater negative impacts and worse overall health state.

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