Changes in clinical practice perceptions and mental health of sports medicine physicians due to the SARS-CoV-2 pandemic

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**ABSTRACT**

**Objective:** The SARS-CoV-2 pandemic has had an immense impact on healthcare, but little has been published on its impact on sports medicine physicians. This study aimed to assess the perceived impacts of the pandemic on practice changes, financial implications, and mental health of the physician members of the American Medical Society for Sports Medicine (AMSSM).

**Methods:** Online surveys were sent to physician members of the AMSSM, with questions asking about demographic information and personal associations to COVID-19. The main outcome measures included self-reported clinical practice volumes, visit types (telemedicine, face-to-face), Patient Health Questionnaire (PHQ-4) scores, personal finances, clarity of practice guidelines, and personal protective equipment (PPE) availability.

**Results:** A total of 825 respondents completed the initial survey, with a subset completing follow-ups. In-person clinical and procedural volumes were reported to be reduced to just 17.9% and 13.7% of the pre-pandemic baseline volumes at the first survey (March 2020), but increased to 81.1% and 77.3% (August 2020), respectively. PHQ-4 anxiety subscores significantly decreased over time ($p < 0.001$); younger physicians and female physicians were more likely to have higher scores ($p < 0.05$). Reported physician income significantly increased over time ($p < 0.05$), and financial concerns steadily decreased ($p < 0.001$). The perception of having an adequate PPE significantly increased over the study ($p < 0.001$) but not for having clear practice guidelines ($p > 0.05$). Physicians have become increasingly aware of others testing positive for the virus, but not themselves or someone they live with.

**Conclusions:** Sports medicine physicians have been heavily impacted by the SARS-CoV-2 pandemic, with some recovery since it started. Sports medicine physicians should be aware of pandemic-related practice changes and resulting mental health and financial implications.

**Introduction**

Healthcare systems across the world have been significantly affected by the novel SARS-CoV-2 global pandemic. The impact of the pandemic on emergency room and inpatient hospital settings is well documented, and ongoing research continues to examine the effects of the global pandemic on other clinical settings [1–3], though little has been published in sports medicine. Significant decrements were seen in outpatient medical visits across multiple specialties, with a loss of up to 60% of patient volumes [4]. It is unclear if sports medicine practitioners have seen similar patterns.

Over the last several months, significant efforts have been made by national organizations, government bodies, public health institutions, and expert panels to provide recommendations and guidance in order to limit the spread of this deadly virus [5–7]. In addition, sports medicine consensus statements and reports have been issued in regard to the treatment of athletes and sports medicine patients [8–12]; however, the effects of this evolving pandemic on sports medicine physicians and their clinical practice has not been studied systematically, to the authors’ knowledge. Additionally, the financial impacts on physicians has been described, demonstrating significant personal effects on physicians [13–15].

The purpose of this study was to prospectively analyze changes in perceived clinical metrics, beliefs, and mental health of sports medicine physicians through a survey sent to members of the American Medical Society for Sports Medicine (AMSSM) at sequential time points during the SARS-CoV2 global pandemic. This information may inform future practice guidelines and aid in identifying critical knowledge gaps in order to address the emotional and financial impacts of the pandemic on sports medicine physicians.

**Materials and methods**

For timeline reference, statewide school closures in the United States began on 15th March 2020 on average. The first
statewide stay-at-home measures (California) took place on March 18, 2020 [16]. This survey study was deemed exempt by the principal investigator’s Institutional Review Board.

Survey

An anonymous REDCap [17,18] survey (included in appendix A) was distributed initially by e-mail on 25th March 2020 to physician members of the AMSSM and was viewed by 2,437 members (3,952 physician members were eligible to receive the e-mail, but many did not view it); a reminder to complete the initial survey was sent on 4th April 2020. Within this initial survey, respondents could elect to receive future follow-up e-mail surveys. Four follow-up surveys (included in appendix B) were sent on the following dates: 14th April, 8th May, 9th June, and 3rd August 2020. The survey examined demographic information, clinical volumes, and awareness of others who have tested positive for COVID-19, and financial questions, in addition to the Patient Health Questionnaire-4 (PHQ-4) [19] questionnaire, examining depression and anxiety. With the exception of the PHQ-4, all questions were original and not previously used in other surveys.

Respondents were allowed 3 weeks to respond to the initial survey and 1 week to respond to each follow-up survey. Incomplete surveys were excluded from the analysis as only one incomplete initial survey contained any information. Respondents were allowed to opt out of completing the PHQ-4 given the sensitivity of this information. The PHQ-4 has demonstrated high internal consistency and construct validity in the general population [20]. A few new questions were added at the first follow-up survey (appendix B), based on the recommendations of survey respondents in the changing environment. Specifically, questions were added regarding: 1) physicians/staff losing their job, 2) personal income, 3) having clear practice guidelines, and 4) having adequate personal protective equipment (PPE). The AMSSM separately provided the investigators with available full membership demographics for comparison to the survey respondents in order to assess for possible selection bias.

Statistical analysis

Primary outcome variables included: patient volume change, adequate PPE, clear practice guidelines, and physician tendency toward anxiety and depression as measured by the PHQ-4. To identify if the initial respondents represented a similar demographic to respondents of the follow-up surveys and to AMSSM membership as a whole, $\chi^2$ and independent t-tests were used on categorical and continuous data, respectively. Temporal trends (comparing data from each follow-up timepoint to the initial survey) were evaluated using McNemar’s $\chi^2$ tests (for categorical outcome variables) and dependent t-tests (for continuous outcome variables) for pairwise comparisons (i.e. analysis was carried out for complete paired data). Based on preliminary examinations of the data, some of the continuous outcome variables had large variances and skewed distributions. Hence, median and interquartile range (IQR), along with mean and standard deviation are reported for those variables. With regard to change scores for the continuous variables used to examine temporal trends, physician income and PHQ-4 showed non-normal distributions, and therefore Wilcoxon matched-pairs signed-rank tests were used, instead of dependent t-tests. In a multivariate analysis, random-effects linear and logit models were fit to the data on the continuous and dichotomous outcome variables, respectively, in order to examine the association of each of the following covariates: gender, age, specialty, years out of training, region of the United States (US), practice type, pre-pandemic clinical, and pre-pandemic procedural volume. Significance was set at an $\alpha$ level of 0.05. In terms of the analysis on temporal trends described above, because of multiple comparisons over four different follow-up timepoints, Bonferroni corrections were used to control Type I error rates with adjusted $p$-values calculated (adjusted $p$-value = observed $p$-value multiplied by the number of comparisons; number of comparisons = 4 for all outcome variables; except physician income, adequate personal protective equipment, and clear practice guidelines for which the number of comparisons was 3 because the data were not collected at initial survey) [21]. Stata v16.1 (College Station, TX) was used for statistical analysis.

Results

Participants

A total of 825 respondents completed the initial survey (33.2% response rate of those who received the e-mail, or 20.9% of those eligible to receive the e-mail). Of the 825 initial respondents, 334, 309, 306, and 211 completed each of the four follow-up surveys, respectively. Demographic information of the initial survey is outlined in Table 1. Small but significant differences were noted for gender, region of the US, and age. There were no significant differences in demographic information in the four follow-up surveys compared to the initial survey ($p > 0.05$ for all surveys and all demographic variables), suggesting reasonable similarities across the samples over the different follow-up timepoints.

Clinical changes

Figure 1 demonstrates reported changes in clinical volumes as a percentage of pre-pandemic baseline volumes. For example, if a clinician had typically seen 50 patients per week (in any manner) prior to the pandemic, and they reported seeing 20 in-clinic patients, 5 telephone visits, and 10 telemedicine visits during the pandemic, they would report a 40%, 10%, and 20% for those respective visit types. At the time of the initial survey, in-person clinic visits were self-reported to be 17.9 ± 18.7% (median = 10%; IQR = 20%) of pre-pandemic baseline volumes, while procedure volumes were 13.7 ± 19.8% (median = 5%; IQR = 20%) of the pre-pandemic baseline. The dependent t-tests showed that the reported in-person clinical and procedural visits significantly increased by May 2020 ($p < 0.001$) and continued to increase over the subsequent time points ($p < 0.001$). By the final survey, reported in-person clinic and procedural volumes were $81.1 \pm 21.7\%$
and 77.3 ± 27.9% (median = 87%; IQR = 30%) of pre-pandemic baselines, respectively. Reported telemedicine (video) visits increased significantly by April 2020 [from 21.7 ± 28.5% (median = 10%; IQR = 30%) to 28.3 ± 28.5% (median = 20%; IQR = 44%) of pre-pandemic in-clinic baseline volumes, p < 0.001] but tended to decrease in May [25.7 ± 25.2% (median = 19%; IQR = 34%); p = 0.068] and continued to significantly decrease in June and August [15.4 ± 18.2% (median = 10%; IQR = 18.5%), 9.8 ± 14.2% (median = 5%; IQR = 9%; p < 0.001]. Telephone visits were reported to be the highest at the time of the initial survey [24.3 ± 28.3% (median = 11%; IQR = 25%), but significantly decreased at all later time points [19.5 ± 24.1% (median = 10%; IQR = 20%), 14.7 ± 20.3% (median = 8%; IQR = 19%),
8.1 ± 14.2% (median = 3%; IQR = 10%), 6.1 ± 12.5% (median = 2%; IQR = 5%) for each subsequent survey, \( p < 0.05 \).

**Financial concerns**

Figure 2 outlines physician responses to questions regarding personal finances. One question asked whether the respondent had concerns that income would not meet expenses over the upcoming month. A second question was asked about the anticipated salary over the same time period. The concern noted in the first question steadily declined while reported personal income from the second question steadily increased by August 2020 (\( p < 0.001 \) from McNemar’s \( \chi^2 \) test and \( p = 0.006 \) from Wilcoxon signed-rank test, respectively). The random-effects logit model showed that sports medicine physicians in private practice (vs. academic/university, \( OR = 26.14 \) [95% CI 3.96, 172.41], \( p = 0.001 \)) was correlated with concern for income not meeting personal expenses as well as...
decreased reported income during the survey period. Those who reported staff reductions or layoffs in their practice did not change over time between the first and final follow-up timepoints (p > 0.05 for all timepoints, 29.5%-39.8% of respondents).

**Adequate personal protective equipment and clear practice guidelines**

Figure 3 shows the responses to questions regarding physician beliefs of having adequate PPE and clear practice guidelines. The perception of having an adequate PPE significantly increased over subsequent time points (p < 0.001 from McNemar’s χ² test by August 2020), while no significant trend was observed for having clear practice guidelines (p = 0.242 from McNemar’s χ² test by August 2020).

**Physicians’ awareness of persons who test positive for SARS-CoV-2**

Physician awareness of persons testing positive for SARS-CoV-2 significantly increased over subsequent time points in all categories, with the exception of infection of the respondent or those they currently live with, as illustrated in Table 2. Physician awareness of one of their patients, staff they work with, colleagues in department/group, someone in the building, and someone in the hospital system who have tested positive for SARS-CoV-2 started to show significant increases as early as in April 2020, and continued to show that trend through August 2020 (p < 0.05 from McNemar’s χ² tests). The random-effects logit model demonstrated that PM&R-trained sports medicine physicians were significantly less likely to have personal knowledge of patients who had tested positive (baseline family medicine, OR = 0.32 [95% CI 0.15, 0.69], p = 0.003). Emergency medicine-trained physicians (baseline family medicine, OR = 5.65 [95% CI 1.46, 21.87], p = 0.012), and younger age (OR = 1.12 [95% CI 1.01–1.24], p = 0.047) were significantly more likely to work with staff who tested positive. Similarly, emergency medicine-trained physicians (baseline family medicine, OR = 5.84 [95% CI 1.34, 25.57], p = 0.019), and younger age (OR = 1.15 [95% CI 1.02–1.29], p = 0.019) were significantly more likely to have a colleague in the department who tested positive, but so were those with internal medicine training (baseline family medicine, OR = 4.03 [95% CI 1.33–12.25], p = 0.014), and more years out since training (OR = 1.12 [95% CI 1.01–1.26], p = 0.043). Physicians in rural areas (baseline suburban, OR = 0.15 [95% CI 0.03–0.66], p = 0.013), working for hospital systems (baseline academic practice, OR = 0.432 [95% CI 0.20–0.93], p = 0.033), or working in private practice (baseline academic practice, OR = 0.32 [95% CI 0.14–0.76], p = 0.009) were significantly less likely to have a colleague in the department who tested positive. Those in private practice were the only significant predictors of physician knowledge of someone in the hospital system testing positive (less likely, baseline academic practice, OR = 0.450 [95% CI 0.25–0.80], p = 0.006) or knowledge of someone in the building testing positive (less likely, baseline academic practice, OR = 0.39 [95% CI 0.18–0.85], p = 0.018).

**Anxiety and depression**

Finally, Figure 4 illustrates PHQ-4 scores in sports medicine physicians plotted over time. The total score significantly decreased over all-time points (p < 0.001 from Wilcoxon signed-rank tests). Similarly, the anxiety subscores significantly decreased at all-time points as well (p < 0.001 from Wilcoxon signed-rank tests), while depression subscores also decreased significantly in August 2020 (p = 0.007 from Wilcoxon signed-rank test). The rate of respondents opting to skip the PHQ-4 ranged from 6.7% to 18.2% of the respondents for the five surveys. According to the random-effects models, male physicians, and more years since completion of training were significantly associated with lower PHQ-4 anxiety scores during the survey period (p < 0.05). With regard to PHQ-4 depression scores, more years since training and older physicians were significantly associated with lower scores (p = 0.001 and 0.008, respectively), while there was a trend that male physicians had lower scores (p = 0.092).

**Discussion**

This is the first study to demonstrate the evolving changes in perceived practice patterns, beliefs, and mental health of sports medicine physicians due to the ongoing SARS-CoV-2 global pandemic. These findings are important for several reasons. First, knowledge of the trajectory of these metrics can be useful for future natural disasters, should they arise. Identification of the depth of volume changes, practitioner mental health changes, and financial concerns may allow for better planning should another pandemic occur. Second, this study demonstrates that many practitioners do not feel that they have adequate PPE or clinical guidelines. These concerns should be addressed by local and national stakeholders to better care for our physicians. Third, variability is noted in practice types, suggesting that particular focus may need to be placed on sports medicine physicians in private practice. Finally, identifying the impact of the pandemic on the mental health of physicians is key to identifying the need for treatment and resources.

**Clinical changes**

At the time of the initial survey, sports medicine physicians reported performing less than 15% of their typical volume of

| Table 2. Physician knowledge of persons who have tested positive for SARS-CoV-2. Bold denotes p < 0.05 compared to the initial survey. |
|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | 3/25/2020      | 4/14/2020      | 5/8/2020       | 6/9/2020       | 8/3/2020       |
| Self            | 1.7%           | 1.2%           | 1.6%           | 2.0%           | 2.4%           |
| Someone you’re living with | 1.6%           | 0.6%           | 1.3%           | 2.3%           | 2.4%           |
| One of your patients | 17.8%          | 25.3%          | 39.1%          | 44.4%          | 62.3%          |
| Staff you work with | 13.3%          | 15.2%          | 20.7%          | 24.7%          | 42.5%          |
| Colleagues in department/group | 17.0%          | 20.1%          | 25.0%          | 25.7%          | 35.3%          |
| Someone in the building | 18.3%          | 21.6%          | 27.0%          | 30.9%          | 42.0%          |
| Someone in the hospital system | 54.7%          | 71.6%          | 76.3%          | 76.3%          | 81.6%          |
procedures, and seeing less than 20% of their usual volume of in-person visits as compared to pre-pandemic baseline volumes. As the pandemic progressed, these values steadily increased toward 80% and 75%, respectively, of pre-pandemic baseline volumes as of the August 2020 survey. Reported telemedicine visits had an initial increase, but steadily decreased toward 10% by August 2020; reported telephone visits steadily decreased throughout the survey time period. While no baseline question was asked regarding pre-pandemic telemedicine visit volume, it is unlikely sports medicine physicians were using a significant amount of internet- or telephone-based visits to aid in assessment and management, as reimbursement had not previously been covered for these methods prior to the pandemic [22]. In addition, sports medicine physicians often rely heavily on in-person examination, evaluations (such as ultrasonography [23]), and often procedures for appropriate pain control and diagnosis; this may explain the significant increase in reported in-person clinic visits and procedures over the course of this study. Telemedicine has been demonstrated to play a role in musculoskeletal medicine [24,25] and has even been found to be valid and reliable [26], with varying levels of practitioner acceptance [27], but this survey did not assess physicians’ thoughts on the technology. Finally, this shift from reported virtual to in-person visits may have been driven by patients. They may have decided to opt out of seeing a physician during the early phase of the pandemic, and either felt more comfortable to be seen in-person as the pandemic progressed, or the effects of their musculoskeletal injuries or pain overwhelmed their concern for catching the virus in the healthcare setting.

Clear practice guidelines

The Centers for Disease Control and Prevention (CDC) has been the central federal agency in the US for developing and providing guidelines for protecting healthcare workers, with support from regional, local, and hospital-level groups. The CDC has released specific guidelines for outpatient facilities, which includes having patients call ahead of time, practicing social distancing, and wearing face coverings [5]; however, these have evolved as the knowledge of the virus has increased with time. This pandemic has also presented a unique challenge with differing messages between national and local leaders on how to best navigate the crisis. Early survey results showed that only half of the physicians felt they had clear practice guidelines, which showed no significant increase over the following 4 months. The perceived lack of clear guidelines, which does not appear to have significantly improved over the study timeline, may be directly related to physician challenges with PPE, financial stability, and mental health. Without clear guidelines, practitioner behavior could be quite variable; for example, some could ‘shut down’ and see far fewer patients in person, while others may opt to treat patients in the office to keep them out of urgent care or the emergency rooms. Personal beliefs, local disease prevalence, prior clinical experience, and many other factors likely play into each practitioner’s actions. The evolution of scientific knowledge involving COVID-19 will hopefully allow for improved guidelines for practicing physicians.

Financial concerns

The financial ramifications caused by the significant reduction in clinical and procedural volumes of sports medicine physicians demonstrated in this study appear to be profound. The American Hospital Association reported that American hospitals and healthcare systems had losses of 202 USD billion from March to June 2020 [28]. This has surely had a direct impact on healthcare providers [22], including sports medicine
physicians. At the time of writing, no scientific literature exists on the effects of SARS-CoV-2 on physician salaries or employment, but numerous media stories have been written on the subject [29,30]. The April 2020 survey in this study indicated that almost half of all physicians were concerned their income would not meet their monthly needs, and were, on-average, being compensated around 80% of their pre-pandemic compensation (from Figure 2). This study also showed sports medicine physicians in private practice had more significant financial concerns compared to those in the academic setting, which may relate to staffing costs, personal expenses, and less of an ability to absorb large alterations in patient volume. Fortunately, these financial concerns have continued to decrease over time, likely related to the demonstrated recovery of clinical and procedural volumes.

The financial impact on medical staff was not assessed. As the survey was designed specifically for physicians, a secondhand account of the impact on staff would not have been reliable, but it is no less important. Often paid less than the physicians, the financial impact for other members of the healthcare team may be even more profound. The emotional impact on other members of the healthcare team have been well-documented [31–33], but the financial effects are likely also large in magnitude.

**Personal protective equipment**

Personal protective equipment is paramount in limiting the spread of SARS-CoV-2 and protecting healthcare workers. Appropriate face masks, eye protection, and hand hygiene all play roles in reducing transmission [34,35]. Early shortages in PPE were reported [36,37] though the outpatient clinical setting was not the largest concern. Little was also known about the potential spread of the virus in this setting. Physician concerns appeared greatest early on, based on the survey results, but have had only a small improvement over the past four months. This may be related to sports medicine physicians having low quantity of one or more types of PPE, may feel that they are running low, or may feel that their current stock is inadequate for a potential growth of cases in the near future. Low PPE may also affect patient and/or procedural volumes, which would often have a direct impact on physician income; this association is hard to prove and was not directly assessed in this study.

**Physicians’ awareness of persons who test positive for SARS-CoV-2**

Physicians had increasing awareness of persons testing positive for SARS-CoV-2. This mirrors the increase in cases seen throughout the world over this time period [38,39]. Interestingly, though awareness of infections (colleagues, staff, and patients) increased, physicians and their families did not appear to contract more known infections. Sports medicine physicians with an emergency medicine background were more likely to be aware of a positive test in staff they work with or a colleague. This may be related to these physicians more commonly working in the emergency room or interacting with other emergency medicine providers, who likely have a greater exposure, and therefore likelihood of being exposed. Around this time, the CDC noted that 55% of healthcare workers who tested positive for SARS-CoV-2 reported having such contact only in a healthcare setting [40], suggesting that it can indeed be spread in this manner. This could conceivably explain the similar association of internal medicine-trained sports medicine physicians being more aware of colleagues in their department testing positive, as many internal medicine physicians cover COVID-19 patients in the hospital wards or intensive care units [41]. Younger age was associated with an increased knowledge of a colleague in the department testing positive, yet those with more years out since training was as well. This seems to be somewhat paradoxical, as increasing age tends to correlate with years out of training, but this could suggest that older physicians who completed training later in life would have a smaller likelihood of having a colleague in the department test positive, but the explanation for this phenomenon remains elusive. Rural physicians were less likely to have a colleague in the department test positive. This very well could be related to the population density of the area, as urban environments are affected more often with SARS-CoV-2 [42]. Finally, private practice physicians tend to be less aware of someone in their building or hospital system testing positive, which may be due to the physical separation of many private practice locations from large hospitals that care for these patients. As the regression model utilized academic practices as a comparator, it may simply be related to academic hospitals caring for a majority of these patients, and thus those in non-academic systems (e.g. private practice) may not see these patients as often.

**Physician anxiety/depression**

Finally, as other studies have demonstrated a significant impact of anxiety and depression on healthcare workers in other fields [31,32], no data has been collected on sports medicine physicians. The impact of the pandemic on mental health is multifaceted, ranging from its impact on parameters assessed in this survey (financial strain, stress of inadequate PPE, unfamiliarity with the virus) to parameters that are too numerous to count, including fear of contracting infection, distress from uncertainty and conflicting information regarding the virus, and loneliness that comes with physical distancing, as examples [43]. In this cohort, anxiety subscores were the more notable finding, and they improved the most over the survey time period. As baseline scores were unavailable, it is impossible to surmise if the beginning of the pandemic increased tendencies for anxiety, though given the improvement over time, it is a definite possibility given its association in other fields [31,32]. Depressive subscores also significantly decreased, but only at the final time point, which may be due to lower baseline scores. Langusihing, a concept defined by low levels of emotional, psychological, and social well-being [44] may resonate with at least a portion of this population; this has already been described during the pandemic in the general population [45]. As many of the survey metrics improved (improvements in compensation, fewer physicians having trouble paying expenses, better perceived access to PPE, and restoration of clinical volumes), these may have
directly contributed to the lessening of physician anxiety and depression. It is also possible that as the SARS-CoV2 virus has become more widespread, it is becoming more normalized and commonplace, eliminating some of the anxiety that inherently comes with facing the unknown [46]. It has been well-documented that physician mental health can be associated with poorer patient outcomes [47], so it is of the utmost importance to continue to monitor and address this need going forward. Male physicians had lower anxiety scores, as well as those further out from training. Similarly, older physicians and those further out from training were associated with lower depressive scores. These findings are consistent with other COVID-19 healthcare worker studies [31,33]. This reinforces the importance of protecting the mental wellbeing of physicians, particularly younger physicians and female physicians. Maintaining the diversity of sports medicine physicians is an important priority, and special care should be taken to care for women and minority physicians.

**Comparisons to other specialties**

Prior studies have demonstrated large changes in clinic volumes at the time of the onset of the pandemic [4,48–50]. Sports medicine clinical volumes appear to have dropped even more precipitously than ambulatory fields as a whole, which reported a decline of 58–75% of baseline at its worst [4,51]. Procedural volumes across specialties have been reported to decrease similarly, with most physicians reporting at least 75% decrease in procedure volumes [51]. Primary care in-person visits are estimated to have dropped to around 30% of baseline at its nadir [14], which is also higher than the values reported by sports medicine physicians in this study. The same study noted that physicians were reimbursed at 85% of their typical salary [14], which is similar to the results in this study. Studies examining physicians’ views on PPE in the outpatient, non-front-line setting have identified similar findings [50–52] – concern about PPE availability. Additionally, similar to other specialties, telemedicine implementation became far more prevalent during the pandemic [51].

**Limitations**

This study has several limitations. The obvious limitation is that of non-response bias. Although the initial survey had significant demographic differences from the AMSSM sports medicine community as a whole, the differences were small in size as seen in Table 1. Additionally, the follow-up surveys appeared to have similar demographic information as the main sample of the initial survey. The global nature of this pandemic and the differences between countries definitely limits the generalization of this cohort to other sports medicine physicians globally. Pandemic restrictions were widely regional and had significant variations based on location and timing; this was not collected in the study. Respondents were given the option to opt out of the PHQ-4, which may have affected the related results. Many survey questions did not have a pre-pandemic baseline (such as PHQ-4 scores); thus, association of these variables with the presence of the pandemic is not possible to ascertain. However, asking such questions would have imposed a recall bias, and they were thus omitted. Importantly, overestimation bias and incentive bias may play a role given the nature of the effect the pandemic may have on practitioners; if practitioners are struggling in many ways, it is not unlikely they would overestimate the ‘good old days’ and overestimate their current struggles. When asked about clear practice guidelines, clarification was not given on whether this referred to guidelines for patient treatment, for practitioner safety, and/or for patient safety. This could have led to respondents viewing the question differently. Finally, the clinical volumes were based on self-report, both at the time of the survey and respondents’ pre-pandemic recollection – in addition to the aforementioned biases, these responses are not validated, and do not necessarily represent true clinical volumes.

**Conclusion**

This survey study of sports medicine physicians in the United States during the first 6 months of the SARS-CoV-2 pandemic suggests dramatic changes in perceived practice volumes that are now largely trending back toward pre-pandemic levels. Despite face-to-face visits and procedural visits in March 2020 reportedly decreasing to just 20% and 15% of the pre-pandemic volumes, respectively, volumes have reportedly increased to 80% and 75% of what patient volumes were prior to the pandemic by August 2020. Physician anxiety, personal income, and financial concerns also appear to also be improving for physicians over the same time period. Perception of access to PPE has also improved significantly in the course of 6 months although still with much room for improvement. This study has identified that addressing clarity of practice guidelines in the outpatient setting the need for PPE, and physician mental health, particularly for female and younger physicians, should be areas of focus going forward.

**Contributorship statement**

All authors contributed to the planning, conduct, and/or reporting of the work described in this article.

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**Declaration of interest**

No potential conflict of interest was reported by the author(s).
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