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COVID-19 return to sport: Collegiate baseball injury prevalence analysis

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Abstract
In the spring of 2020, the COVID-19 pandemic rapidly brought college baseball to a halt. Most college baseball players saw disruption of their training and development due to interruptions of their seasons. With these interruptions, it is necessary to examine the effects of the COVID-19 pandemic on collegiate baseball injury epidemiology. Data from a small-school Midwest collegiate conference was tallied for the number of collegiate conference injuries per year, and for the injuries per anatomic region. An unpaired t-test was conducted upon the overall conference mean injuries per year and on each anatomic region for the mean injuries per region per year. Results demonstrated no statistically significant difference between the mean injuries per season, or the mean injuries per anatomic region per year. This study showed that small-school collegiate baseball had no significant difference in injury prevalence after the COVID-19 pandemic, differing from research at the professional level.

Keywords: COVID-19, injury, physiology, sports, training, baseball

Introduction
The COVID-19 pandemic quickly spread across the world, ushering in measures to help mitigate the spread of COVID-19. Athletics, like many other aspects of our daily lives, were impacted by these COVID-19 measures. The 2020 spring collegiate baseball season was immediately suspended as COVID-19 spread across the United States [1]. Collegiate baseball training was shut down with no clear return time frame. Summer collegiate baseball, a valuable training and learning experience for development, was also canceled across most places in the United States. Summer collegiate baseball is not played with the athletes' institution of attendance, unlike the rest of the year. It is instead played with outside organizations across the United States and Canada.

The spring collegiate baseball season is a grueling time for players, often lasting 5 months, with many teams playing 50 or more games [2]. This is paired with an extensive travel schedule across the institution's conference [2]. The summer collegiate season often lasts a couple months, with many games played throughout the summer [2]. The summer and fall seasons are crucial for the development of the athletes for both performance and body preparation. Proper training is necessary to make it through the strenuous and long spring season [2-4]. Performance training has been shown to induce a protective effect from injury and boost athletic performance [5-8]. While there is no guarantee of preventing all injuries, training has been shown to be a key component in the prevention of sports injuries [5-7]. These adaptations are crucial to making it through such an extensive season.

Performance and sport training induces physiological adaptations to athletes' muscles, bones, joints, and tendons [9-12]. There are two common types of injury concern for baseball players, with the first being arm injuries, and the second being soft tissue injuries [13-16]. These are two injuries that are very common in baseball. Arm injuries are commonly an area of concern due to the high intensity activity and stress created from throwing a baseball [17]. Injuries to the Ulnar Collateral Ligament of the elbow, are of particular concern and often need surgical correction. These injuries are repaired with a well-known surgery to the baseball world called a Tommy John Surgery. It has even been said that baseball has had a Tommy John epidemic in recent years due to the frequency of the surgery [13-15, 17-19]. Arm injuries are important to study as they have the ability to end a baseball player's career [20]. The second area of concern is soft tissue injuries.

Soft tissue injuries are common in baseball and complications of these injuries can often linger throughout seasons [16-21]. Much preparation is done with special focus to prevent arm injuries and soft tissue injuries in collegiate baseball players including training and injury prevention exercises [22-24].

The COVID-19 pandemic led to loss of training in both the spring and summer 2020 college baseball seasons across most of the United States. Athletes in all sports across multiple levels lost the ability to train across the world. Many athletes most likely exhibited detraining during these periods, due to the inability to access training facilities in an effort to help slow the spread of COVID-19 [25-28]. Detraining is the loss of physiological and performance adaptations due to inactivity [27, 28]. Previous research has shown that professional athletes were impacted by this during the pandemic, which led to higher rates of injury [29, 30]. Detraining has been shown to impact injury epidemiology and athletic performance [27, 30, 31]. Loss of training for collegiate baseball athletes can be very impactful on injury prevalence due to the long strenuous spring collegiate baseball season. This research aims to examine the effects of the COVID-19 pandemic on injuries during the collegiate spring baseball season.

A small-school Midwest collegiate athletic conference that sponsors spring collegiate baseball was chosen for analysis in this study. The small-school collegiate athletic conference is composed of 13 member institutions across the Midwest in Kansas, Missouri, Oklahoma, and Nebraska. These institutions provide opportunities for student athletes to play collegiate athletics and obtain a collegiate level education. The conference is well recognized for its strong reputation in the promotion of student athlete success.

With the evidence of previous research and the understanding of the effects of training on the body, we hypothesize that there will be increased injuries in the 2020-2021 collegiate baseball season due to reduced training opportunities and the shutdown of the spring and summer 2020 collegiate baseball seasons due to the COVID-19 pandemic.

Methods

Study Design

A small-school collegiate athletic conference composed of 13 member institutions across the Midwest in Kansas, Missouri, Oklahoma, and Nebraska was chosen for this study. IRB approval was granted by the Kansas City University IRB, and approval was granted by the small-school collegiate conference commissioner and institution presidents. De-identified injury data for the 2017-2018, 2018-2019, and 2020-2021 collegiate baseball seasons were obtained from the athletic training staff and sports medicine staffs of the small-school collegiate institutions. Seven institutions were included in the study. Six schools were excluded due to limitations in their data set or choosing exclusion from the study. We believe that the seven institutions provide a representative sample size, as this is similar to the size of many collegiate conferences. The 2019-2020 season was not included in this study due its cancellation part way through the spring competitive season to help mitigate the spread of COVID-19 [1]. The injury data was tallied for an overall number of injuries for each of the collegiate baseball seasons. Illnesses, infections, and COVID-19 infections were not included, as injuries are defined as physical musculoskeletal complaints by previous research methodology [30, 32]. An additional analysis was conducted to examine the anatomic location of the injury with the following categories: Upper extremity, lower extremity, trunk, and head/neck.

Data Analysis

All data was tallied, and an unpaired t-test was conducted upon the overall conference mean injuries per year, comparing each season to each other, in similar fashion to previous epidemiology studies [30]. An unpaired t-test was also performed on each of the anatomic regions (upper extremity, lower extremity, trunk, and head/neck) for the mean injury per region per year, comparing each of the seasons to each other.

Results

The results of the study demonstrated that there were 145 overall conference injuries for the 2017-2018 season, 189 conference injuries for the 2018-2019 season, and 132 overall conference injuries for the 2020-2021 season. An unpaired t-test conducted for the mean injuries per year demonstrated that there was no statistically significant difference between the 2017-2018 and the 2018-2019 season (P=.66), the 2017-2018 and the 2020-2021 seasons (P=.85), and the 2018-2019 season and the 2020-2021 season (P=.56). Further analysis showed that the upper extremity region had the most total injuries per season with 68 in 2017-2018, 94 in 2018-2019, and 73 in 2020-2021. An unpaired t-test conducted for the mean injuries of the upper extremity region per year demonstrated that there was no statistically significant difference between the 2017-2018 and the 2018-2019 season (P=.61), the 2017-2018 and the 2020-2021 seasons (P=.88), and the 2018-2019 season and the 2020-2021 season (P=.67) The lower extremity region total injuries per season were 50 in 2017-2018, 52 in 2018-2019, and 37 in 2020-2021. An unpaired t-test conducted for the mean injuries of the lower extremity region per year demonstrated that there was no statistically significant difference between the 2017-2018 and the 2018-2019 season (P=.94), the 2017-2018 and the 2020-2021 seasons (P=.56), and the 2018-2019 season and the 2020-2021 season (P=.59). The trunk region total injuries per season were 17 in 2017-2018, 32 in 2018-2019, and 9 in 2020-2021. An unpaired t-test conducted for the mean injuries of the trunk region per year demonstrated that there was no statistically significant difference between the 2017-2018 and the 2018-2019 season (P=.47), the 2017-2018 and the 2020-2021 seasons (P=.33), and the 2018-2019 season and the 2020-2021 season (P=.25). The head and neck region total injuries per season were 10 in 2017-2018, 11 in 2018-2019, and 13 in 2020-2021. An unpaired t-test conducted for the mean injuries of the head and neck region per year demonstrated that there was no statistically significant difference between the 2017-2018 and the 2018-2019 season (P=.65), the 2017-2018 and the 2020-2021 seasons (P=.74), and the 2018-2019 season and the 2020-2021 season (P=1.00).

Discussion

The results of the study showed there was no statistically significant (P>.05) difference between the overall conference mean number of injuries per year when each of the seasons were compared. There was also no statistically

significant difference between the mean number of injuries by anatomical region between each of the seasons (P >.05).

The results of this study differ from our hypothesis and previously conducted COVID-19 related research which showed a rise in injury levels after the COVID-19 pandemic [29,30], and we believe there are several possible mechanisms that could have contributed to these results. The first is the possibility that the pandemic provided rest from the long continuous nature of collegiate baseball. College baseball is essentially a year-round sport with spring, summer, and fall seasons. Athletes participate in a vast number of games and practices throughout these seasons, which can be hard on the body. We believe it is possible that the rest from the canceled spring and summer seasons, as well as the shortened fall season, provided an opportunity for athletes to rest and progressively increase activity through a training period as restrictions slowly lifted before the spring season began. Chronic overuse can provide many negative effects on the body, which could lead to injury [33, 34]. The dichotomy of stress on the body is challenging, as stress is necessary to induce physiologic changes such as muscle growth and bone strength [34]. However, too much stress can lead to a breakdown of muscles, tendons, and bones leading to injury [34]. Therefore, we believe it is possible that there was a stress reduction, with allowance for healing and a corresponding ramp up time before the spring season. This differs from the previous professional sports studies [29, 30], where these athletes had to rapidly return to sport with a limited time to retrain.

We also believe there could be several other reasons as to why there was no difference in the injury prevalence between the seasons or between anatomic regions. One potential reason could be that the collegiate conference has the necessary interventions in practice and training hour rules, which may limit the increased stress that comes with being a student athlete [35]. It is also possible that the sports medicine, athletic training staffs, and coaching staffs are taking proactive roles in order to prevent injuries. In this case, these methods should be further studied for adaptation. Communication between athletes, coaches, and physiotherapists has been shown to be a crucial factor for injury prevention [36]. A third and final reason for these changes could be athletes were less willing to report injuries and be around health systems due to fears of COVID-19. Many people in the general population delayed or avoided healthcare due to COVID-19 [37]. It is possible that athletes could have also undertaken a similar pattern.

These possibilities must be further studied on a larger scale in order to further determine the impact that COVID-19 has had on collegiate baseball as well as to create protocols to improve injury prevention and return to sport guidelines. This data adds to the previously conducted research regarding COVID-19 at the professional and amateur athlete levels. We encourage future studies to continue to understand more about the prevalence of injuries, not only in baseball but other sports as well, in order to work to protect the athletes through injury prevention.

Conclusion

This study demonstrated that in small-school collegiate baseball, there was no significant difference in overall injury prevalence or injury prevalence by anatomic region before and after the COVID-19 pandemic. While this information differs from previous research at the professional level, we believe this adds another crucial data point that could help us better understand a difficult balancing topic relating to training, rest, and proper protocols for returning to sport. We conclude that these results could be due to several possibilities such as proper rest, proper protocols, and less willingness to report injuries, however, we know that these potential ideas must be further investigated to find the exact reasoning.

Limitations of the study

We acknowledge that this study had several limitations. We recognize that the exact practice and training hours were not attainable due to lack of records, and that survey of the hours would have had significant recall bias. However, there is sufficient evidence to show disruptions to athletes' practice and training due to the nationwide COVID-19 regulations. The next limitation of this study is that the total number of injuries may be underestimated due to athletes' refusal to report injuries to the sports medicine staff. This may or may not have been influenced by the COVID-19 pandemic. A third limitation of this study is that exclusion was undertaken for several schools due to gaps in their data, although we believe that this exclusion provided us with more accurate results. We believe that seven schools are a representative sample of many conferences. Exclusion was also undertaken for the 2019-2020 season that was abruptly ended due to the measures implemented to help prevent the spread of COVID-19. Exclusion was undertaken in both of these instances in order to produce the most accurate study results.

Conflicts of Interest

The authors of this research declare no conflicts of interest.

Author Contributions

TBP, JS, and KT developed the study design. TBP, JS, KT, GT, LR, and TP contributed to the data collection, analysis, the manuscript writing, and editing.

Ethical Approval

This research was approved by the Kansas City University Institutional Review Board.

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