Do popular notions about injury prevalence in sports align with the data?

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"We pledge our honor that we have abided by the Stevens Honor System." ~ JA, OC, DS

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Abstract

Injuries are an inevitable part of competitive sports, but the frequency of these injuries vary widely by sport. This study analyzes five seasons of injury data across five major professional sports leagues: the NFL, NBA, NHL, MLB, and English Premier League (EPL). We examined total injuries, normalized injuries per player, and we categorized injury types by location. Our results ultimately suggest the NBA suffers more injuries per player, while the NFL experienced the most total injuries. We also identified sport specific injury trends, such as MLB players suffering mostly from shoulder injuries and hamstring injuries being the most common in the EPL. These insights can inform players, coaches, trainers, and improve medical strategies across sports.

Keywords

Injury analytics, professional sports, sports medicine, injury prevalence, NFL, NBA, NHL, MLB, EPL

Introduction

Injuries alter careers, shift league dynamics, and cost organizations millions of dollars. Every year, athletes across all professional sports undergo surgeries and risk long term health outcomes from sports related injury risks. But which leagues are most prone to injuries? And can the data reveal patterns that lead us to preventable causes?

This study focuses on the central question: **Do popular notions about injury prevalence in sports align with the data?** While football and hockey are often assumed to be the most dangerous due to their high-contact nature, we examine how injury risk varies across leagues and can ultimately be more complex than the public is led to believe. Our analysis spans five seasons of injury data from five major professional sports leagues – National Football League (NFL), National Basketball League (NBA), National Hockey League (NHL), Major League Baseball (MLB), and EPL – to explore how often injuries occur, where they occur on the body, and how those trends vary by sport.

To guide this investigation, we consider the following:

1. Which sports experience the highest injury rates?
2. What types of injuries are most common in each league?
3. Are injury patterns changing over time?

The relevance of this research lies in its potential to challenge common assumptions and support decisions in sports training, player management, and overall injury prevention. Coaches and medical staff can use these findings to tailor conditioning, workloads, and recovery toward protecting the most vulnerable areas. Despite growing interest in injury analytics, few studies offer a normalized, cross league comparison – providing us with an educational gap which this paper aims to address.

The paper begins by exploring previous literature on sports injuries to understand what research has been uncovered about injury prevalence and risks. We then introduce the theoretical framework that shapes our analysis, emphasizing the relationship between each sports physical demands and the injuries suffered. Next we reveal our sources and the methods we used to normalize and visualize the injury data across each league. Leading into our overall findings on injury frequency and trends over time, followed by a discussion of what these results mean for all parties involved. The paper concludes with recommendations aimed at supporting long term athlete health.

Literature Review

Sports injuries - while not necessarily a new field by any stretch - has certainly matured in recent years and increased in sophistication. This development has arguably been driven by the emergence of new data analytics methods and technologies, which have seen significant integration into professional team management. The science, at least for now, seems to be catching up with the field. Although there exists an extensive volume of literature covering injury patterns in sports, our research is quite unique in its attempt to make cross-league, normalized comparisons in service to larger questions regarding injuries in sports.

Some notable published studies we learned from include Ekstrand et al. (2011), Drakos et al. (2010), and Broglio et al. (2017). These were studies we deemed to have been particularly aligned with our areas of interest.

In the Ekstrand et al. (2011) study, the relationship between biomechanics and injury risk is especially covered. Specifically highlighted here was the preponderance of hamstring injuries in soccer teams, where the data analysis yielded a strong correlation with insufficient recovery times provided for athletes. Such tendencies made repeated injuries a larger risk than necessary. It is also interesting that, although this study was conducted within UEFA soccer leagues, our data from the Premier League demonstrated a dominance of hamstring injuries.

In Drakos et al. (2010), the degree to which repetitive movements contribute to injury prevalence was most notably demonstrated. The scientists in that publication reported a uniquely-high prevalence of ankle and knee injuries in the NBA, almost conclusively because of the inherent need for agility among very tall athletes with long limbs and torsos. That combination often placed exceptional stress on leg joints, prompting injury in those areas specifically.

Broglio et al. (2017) tackles the popular topic of head injuries in the context of American football, where concussions and chronic traumatic encephalopathy were extensively studied. There were moments in this study where the authors acknowledged the disproportionate media attention for these categories of injury relative to their actual prevalence in the sport. Like our findings, there was some speculation about a potential media appetite for salacious and dramatic injuries despite a relatively low impact of them on the broader league. It was nonetheless interesting to learn about the nature of these head injuries, but altogether not critical to our specific area of interest.

Theoretical Framework

Our analysis is guided by several notable theories and models commonly used within the field.

Utilized first is the biomechanical stress theory, which mainly explains the extent to which physical demands differ between sports. This theory takes into account the prevalence of repetitive movements, high intensity movements, and collision frequency - among others - to explain why certain injuries may be more common in their respective sports. This theory is helpful in developing an understanding of why sports like football and basketball tend to be the most injury-intensive; they simply require the greatest degree of explosive movement and directional change. Such factors also contribute to the high prevalence of knee and ankle injuries present in both of those sports.

Risk compensation theory also comes into play. It posits that players may make more aggressive decisions when they wear equipment, due to their subconscious sense of protection (even when it's not necessarily the case). The flipside of this theory also begs consideration upon learning that hockey, despite its predisposition for intense contact, has astonishingly-low rates of injury. It is reasonable that, in this case, the inverse of the theory may be true; which is to say, that hockey players may be more conservative in their risk taking proclivities given that their equipment and the pace of the game act as constant reminders of the danger inherent to the sport. It is either this, or the efficacy of the equipment itself, that seeks to explain the low injury prevalence.

Our research also incorporates some popular epidemiological surveillance models, where the data can be more easily digested and understood. To negate this problem, significant efforts were made to establish consistency within injury classification and normalization, so as to facilitate comparisons between sports (whose data was not immediately compatible). By normalizing the injuries per player, you can generally negate the downsides of comparing data from leagues of varying sizes. This was a crucial step in establishing true comparisons across different sports.

Terms commonly used in our report include:

- Injury prevalence - Used when discussing the total amount of injuries recorded within a period of time
- Injury rate (per player) - A normalized rate where the total injuries are divided by the players per league
- Injury type - the area to which the injury is incurred, as mentioned in the data classes
- Contact intensity - the extent of physical contact present within a sport's given gameplay and permitted by its regulations

Our findings permit us to make a few propositions about the nature of sports injuries broadly.

For one, sports with exceptional rates of contact (like the NFL and NBA) may have higher figures of total injuries, but not necessarily feature the highest player-normalized injury rates.

Secondly, contact is not the only factor in determining high injury prevalence. Movement patterns also play a key role in these statistics and can cause certain sports to be more injury prone.

And lastly, it is evident that public perception seems not completely in line with our findings regarding which sports are the most “dangerous” in their given contexts. That perception is probably skewed by a salacious media apparatus which, knowingly or unknowingly, often misrepresents the statistical reality of sports injuries.

Materials and Methods

Research Design

This study utilized a quantitative research design analyzing secondary sports data. The primary goal was to evaluate injury trends across professional sports leagues using numerical data and normalization techniques.

Data Sources

After conducting and finalizing our research for the study, we were able to find datasets for the sports on Kaggle, Github, and Viz Blog. The datasets found were all comma separated values (csv) files, and chosen for their easy accessibility and consistency across seasons. These datasets included: National Basketball Association (NBA), entitled "NBA Injuries from 2010-2020" (Hopkins, 2020); English Premier League (EPL), "Athlete Injury and Performance Dataset" (Biswas, 2024); National Hockey League (NHL), entitled "NHL Injury Database 2000/01 to 2024/25" (LW3H, 2015); Major League Baseball (MLB), entitled "Baseball Injuries" (Robotallie, 2017); National Football League (NFL), entitled "NFL Injury Data" (jchernak96, 2021).

The NBA Injuries from 2010-2020 dataset (Hopkins, 2020) includes player names, injury dates, team affiliations, and detailed notes describing the nature of each injury. The Athlete Injury and Performance Dataset for the EPL (Biswas, 2024) spans the 2019-2023 seasons and provides extensive information such as player positions, FIFA ratings, age, injury type, duration, and return-to-play timelines. The NFL Injury Data (jchernak96, 2021) covers injuries from 2009 to 2020 and includes player names, injury dates, weeks of occurrence, team affiliation, player positions, and whether the injury occurred on offense or defense. The Baseball Injuries dataset (Robotallie, 2017), which covers the 1999-2017 MLB seasons is organized by injury types, affected body parts, and the length of player absences. Lastly, the NHL Injury Database (LW3H, 2015) spans the 2000/01 to 2024/25 seasons and captures player position, team, injury type, and number of games missed.

All datasets were imported into Microsoft Excel for further processing; more in depth processing techniques discussed in Filtering and Categorization. However, it is worth noting that the datasets were first reviewed for completeness then filtered to contain only the injury dates and descriptions. This allowed us to have a uniform structure across all league data that could be easily analyzed.

Filtering and Categorization

Each dataset was filtered from its original format to contain only the relevant fields: injury date and injury description. Using Microsoft Excel, we developed a working data organizer to further organize and clean our data. We applied Index and Match formulas to generalize the injuries into two categories: injury type and injury location. To pull the injury type we searched for keywords like sprain, break, tear, or fracture, and the result provided us with a single injury type to be

reported. To pull the injury location, we followed a similar method, and searched for keywords like arm, leg, head, etc. to be given a single injury location. These formulas used the text from the given descriptions and automatically assigned labels to create uniform comparison points across the leagues.

Normalization
To account for the major differences between the league sizes and rosters, we normalized injuries on a per-player basis:

- ➔ Total Players in NBA = 30 Teams (15 Players/Team) = 450 Players
- ➔ Total Players in NHL = 32 Teams (23 Players/Team) = 736 Players
- ➔ Total Players in NFL = 32 Teams (52 Players/Team) = 1664 Players
- ➔ Total Players in MLB = 30 Teams (26 Players/Team) = 780 Players
- ➔ Total Players in Premier League = 20 Teams (25 Players/Team) = 500 Players

The normalized injury rate was then calculated by dividing total injuries over five seasons by the number of players in that league.

Analyzing Tools
All data analysis and visualizations were done using Microsoft Excel. Excel allowed us to:

- ➔ Create pivot tables: assisted in summarizing the injury types, total injuries, and yearly trends
- ➔ Build bar charts to visualize league comparisons
- ➔ Implement filtering and conditional logic to organize injuries

Rationale
Given the volume and structure of publicly available sports injury data, Excel provided a flexible platform to automate, classify, and visualize our sports injury data. The quantitative approach ensured clean comparability across all five leagues.

Sample Size Estimation and Justification
Our study does not rely on a specific sample but instead analyzes the entire dataset of injury reports available for each league over a five-year span. We justified inclusions by ensuring each league's player count exceeded 450 playersand that the dataset included at least five complete seasons.

Player population estimates were derived from average team sizes multiplied by the number of teams per league. With over 3,600 players analyzed and 65,000 injuries reported, the dataset was

a sufficient size to draw meaningful comparisons between leagues without the need for much estimation.

Results

After conducting and analyzing these datasets in depth, we are able to find many key and valuable results. The first one demonstrates which sports have the most injuries as it applies the normalization method. As determined above, the total number of players was calculated. In terms of determining the total injuries throughout the 5 years, pivot tables were created and analyzed for total injuries and type of injuries.

Years	Total Injuries
2016	6103
2017	6525
2018	6048
2019	2105
2020	2349
Total	23130

Table 1: NFL Injuries

Seasons	Total Injuries
2019/2020	160
2020/2021	130
2021/2022	124
2022/2023	88
2023/2024	112
Total	614

Table 2: EPL Injuries

Seasons	Total Injuries
2013	478
2014	445
2015	491
2016	528
2017	678
Total	2620

Table 3: MLB Injuries

Seasons	Total Injuries
2016	569
2017	2740
2018	1240
2019	2469
2020	1370
Total	8388

Table 4: NBA Injuries

Seasons	Total Injuries
2019/2020	733
2020/2021	780
2021/2022	1432
2022/2023	899
2023/2024	850
Total	4694

Table 5: NHL Injuries

Since we determined these values, now the normalization technique can be applied to determine which sport has the most injuries per player in a given five seasons. The graph is represented below. From this, the results show that the NFL and NBA have the two highest injury rates per player. It is fascinating to see that the NBA has the highest number of injuries with around 18.64 injuries per player in a five season period. Additionally, it is shocking to see that the NBA and NFL has around two to three times the amount of injuries in comparison to NHL. Many people wouldn't believe it. This contradicts many assumptions as they felt that the more contact sports

would be the ones having the higher injury rates. Lastly, the Premier League has the least number of injuries with a little over 1 injury per player in five seasons.

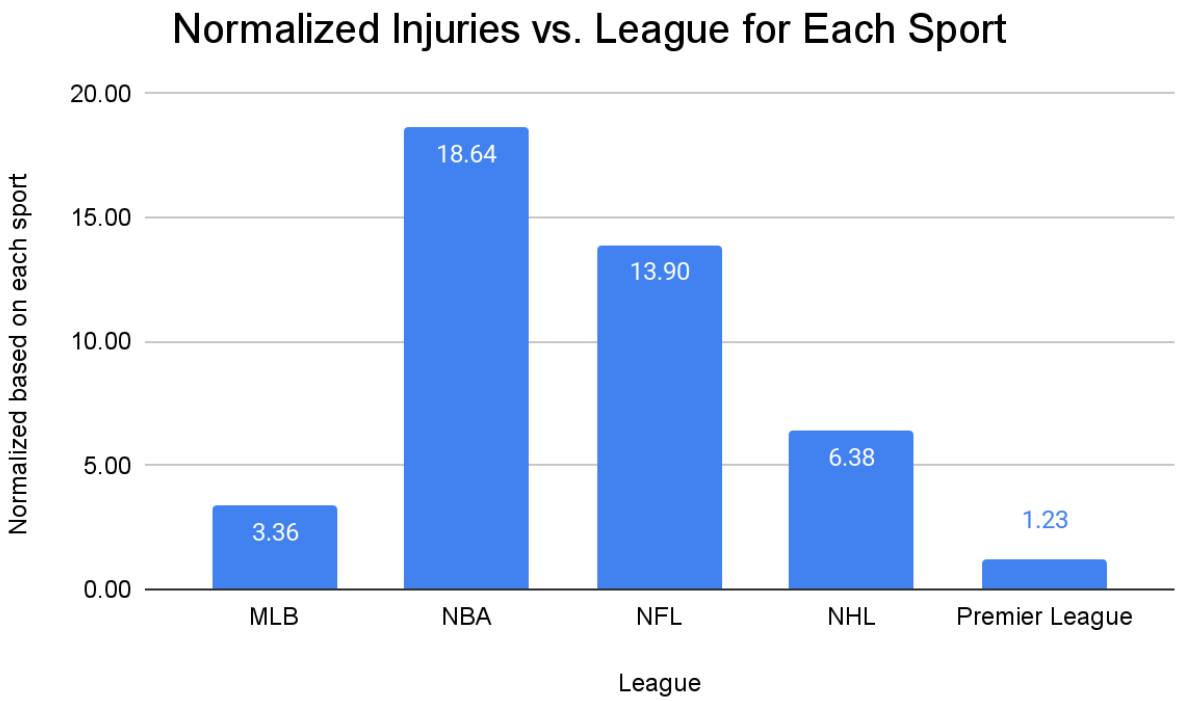

Table 6: Normalization of Injuries

While injury volumes tell one part of the story, injury location reveals where the athletes are most at risk. Understanding where these athletes are getting injured can play a significant role in the sporting industry as it will help trainers find and develop better workout routines, where they can take more precautionary steps in planning to help these athletes succeed in their respective sports and live a healthier life both now and in the future. Even though all these sports have different training routines, understanding this bar graph can be crucial for all trainers to know in determining the most prone injury per each sports' athletes.

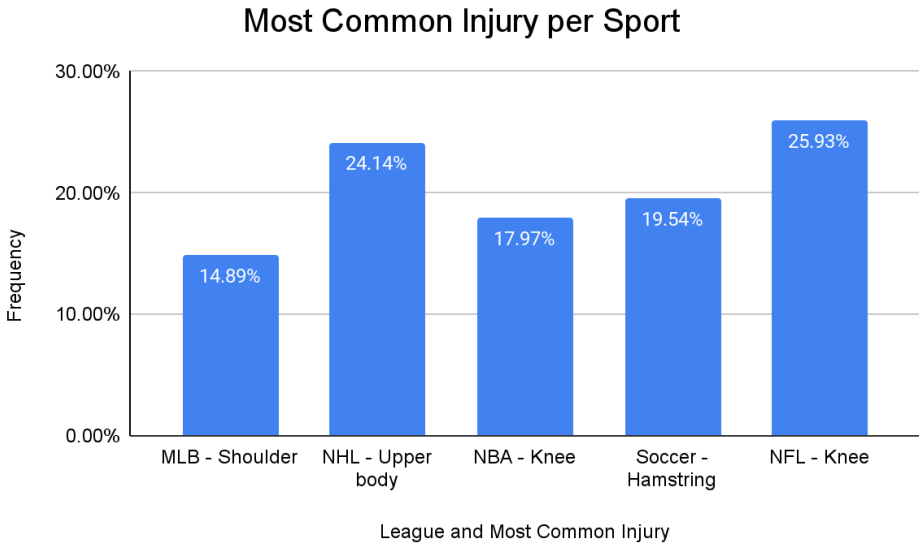

Table 7: Most Common Injury Per Sport

Above, the bar graph represents some fascinating results. It is important to note that each of these lines represent the highest frequency values for injuries in each sport in relation to the other injuries within the same sport. First of all, the most common injury in MLB is the shoulders as the pitchers repetitively apply throwing motions and players are throwing something, the frequent sliding into bases for the players, and the outfielder running in the walls when they are trying to catch a ball that they don't want to be a home run. For the NFL and NBA, the knees are the most frequently occurring for the athletes. For the NFL, this is due to explosive movements and constant resistive impact on other players from tackling. For the NBA, this is due to constant sprinting, jumping, and quick directional changes. In the NHL, the upper body injuries are the most common, specifically the shoulder injuries. This can be credited to the heavy and frequent upper body contact with other players and boards. Lastly, for the Premier League athletes, they most often suffer hamstring injuries due to the high intensity, long lasting running and frequent kicking.

While injury volumes and location tell important parts of the story, analyzing how injury rates have changed over the past five seasons for each sport completes the picture and reinforces our key findings. These trends play a key role in highlighting the impact of improved equipment, enhanced safety protocols, technological advancements, and other evolving factors within the sporting industry. All of the sports injuries trends throughout the five years are represented below.

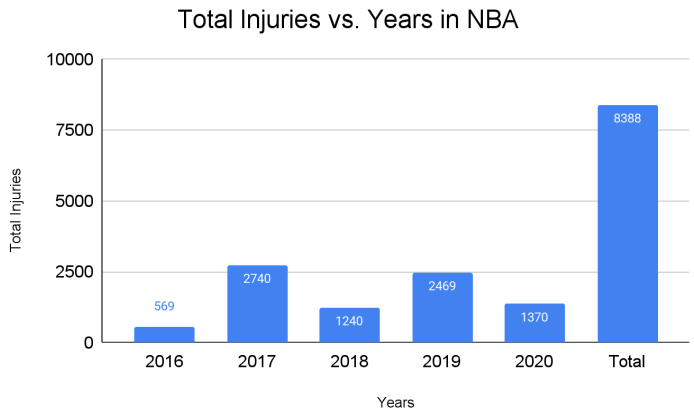

Table 8: Total Injuries Across 5 Year in NBA

For the NBA, there were significant trends throughout the five seasons. 2016 had the lowest amount of injuries with 569, while 2017 had the highest amount with 2,740. The trends that occurred for this sport were that there were increases from 2016 to 2017 and 2018 to 2019. There were over 1,000 injuries, which is concerning and shocking because it is interesting how this can happen immediately in a year. The decreases occurred from 2017 to 2018 and 2019 to 2020. The decrease is significant as there were over 1,000 injuries less, which is beneficial as the organization helped in potentially saving athletes' lives. However, the massive increase from 2016 to 2017 warrants further investigations and is concerning as the organization could have changed one of the policies they had implemented for safety.

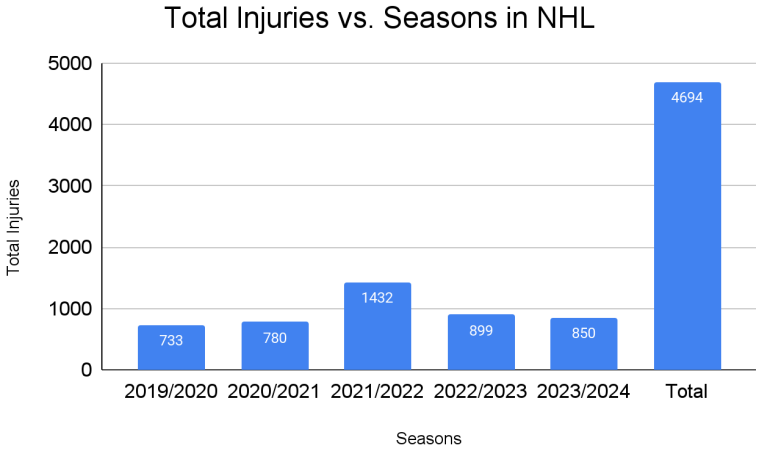

Table 8: Total Injuries Across 5 Year in NHL

For the NHL, there were significant trends throughout the five seasons. The 2019/2020 season had the lowest number of injuries with 733, while 2021/2022 had the highest number of 1,432. The trends that occurred for this sport were that there were small increases from the 2019/2020 season to the 2020/2021 season with a little less than 50. Additionally, there was a larger increase from the 2020/2021 season to the 2021/2022, which is concerning. The decrease in injuries occurred during the transition of the 2021/2022 season to the 2022/2023 season and there was slight decrease from the 2022/2023 to 2023/2024 seasons. The number of injuries for all of the year are all less than 1000, except for the 2021/2022 season, which is significant and represents that the NHL organization has taken great initiatives with their policies as they have reduced the number of players injuries in the last five seasons. It is fascinating to see this random increase in the 2021/2022 season, which can be further investigated.

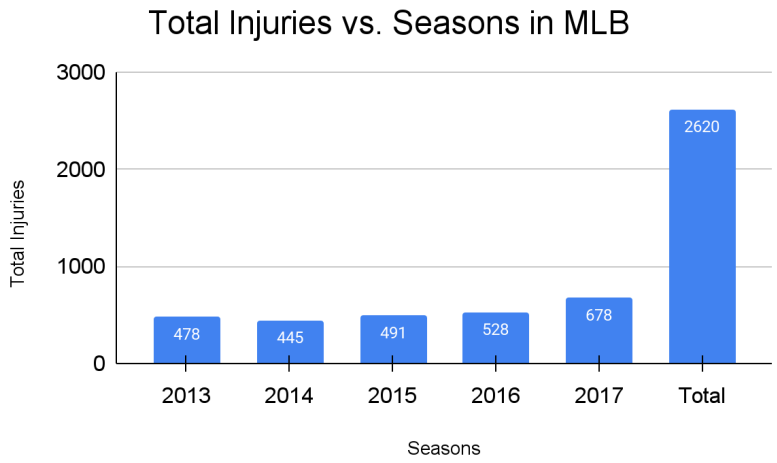

Table 9: Total Injuries Across 5 Year in MLB

For the MLB, there were significant trends throughout the five seasons. All the seasons have shockingly low results with under 700 injuries, which is a crucial result. The 2014 season had the lowest amount of injuries with 445 injuries, while the 2017 season had the highest amount with 678. The trends that occurred through the years showed that there was a small decrease from the 2013 season to the 2014 season and increase from 2014 season to the 2015 season. From the 2015 season to 2016, there is a slight increase of under 50 injuries and lastly from 2016 to 2017, there is an increase of over 100. Overall, these results are important as they show very little increase in their values and the MLB organization has taken the great initiative with their safety policies as they have reduced the number of players injuries and kept the same amount of injuries, which is consistent throughout the five seasons.

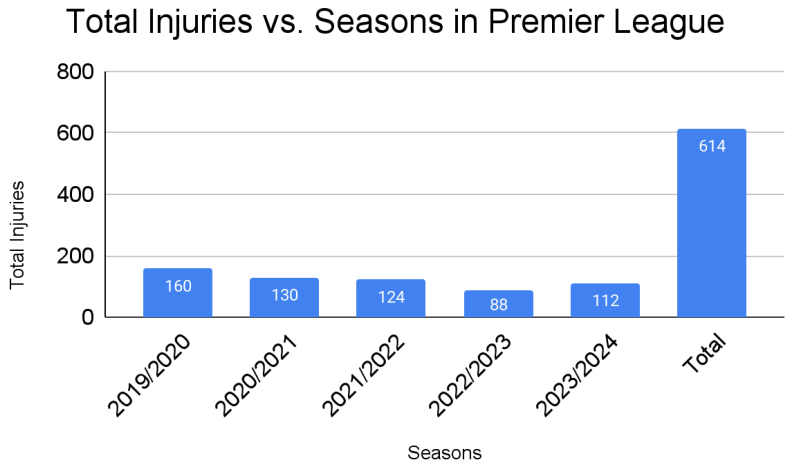

Table 10: Total Injuries Across 5 Year in Premier League

For the Premier League, there were significant trends throughout the five seasons. All the seasons have notable results with under 200 injuries. The 2022/2023 season had the lowest number of injuries with 130, while the 2019/2020 season had the highest amount with 160. The trends that occurred through the years showed that there was a decrease in the number of injuries from the 2019/2020 season to the 2022/2023. From the 2022/2023 season to the 2023/2024 season, there was a slight increase in injuries. Overall, these results are significant as they show very little increase in their values and Premier League organization has taken the great initiative with their safety policies as they have reduced the number of players injuries and kept the same amount of injuries, which is consistent throughout the five seasons.

Table 11: Total Injuries Across 5 Year in NFL

For the NFL, there were significant trends throughout the five seasons. All the seasons have shockingly had high results with over 2000 injuries. Having a higher number of injuries implies more people are at risk of their lives, which is important to note for the organization as they take more initiative to improve the gear, equipment, and safety of the player. Specifically, the 2019 season had the lowest amount of injuries with 2,105 injuries, while the 2017 season had the highest amount with 6,525 injuries. The trends that occurred through the years showed that there was an increase in the number of injuries from the 2016 season to the 2017 by around 400 injuries. From the 2017 season to the 2018 season, there was a slight decrease in injuries, which the NFL might be taking protocol but haven't fully worked for all athletes. Additionally, there was a significant decrease in the number of injuries from 2018 to 2019, spanning a decrease of over 3500 injuries, which is saving many lives and the organization is taking initiative and optimal ways to make the sport safe for all. This is similar to what happened with the 2020 season. Overall, these results are shocking to see, but it is somewhat understandable as there are 1164 players in this league. The more people, the more there is a risk of injuries to occur, especially when there are a lot of players on the field.

Discussion

MLB and the Premier League had lower total injuries, but we were able to identify unique trends. In baseball, shoulder and elbow injuries dominated the league, likely as a result of pitching injuries related to repetitive high-speed movement throughout the game. As discussed in the ASC podcast, the pitchers are constantly throwing pitches at around 90-100 miles per hour and are throwing around 70-80 pitches in a game or even more, resulting in their elbows and shoulders wearing out, and they would need rest days after a game. When comparing this to what the other positions on the field do, they would have to be ready for any play to happen to them, but they wouldn't have to be the ones constantly throwing on every single play like the pitcher would.

In soccer, the most common injury locations are the hamstrings and knees. Soccer injuries can be related to similar situations seen in other sports. The intense movements produce strain on the knees and other joints, as seen in the NBA. And the repetitive running throughout the game results in extreme strain on muscles like the hamstrings, which are being used for nearly the whole game by running up and down the field, similar to pitchers in the MLB.

Any sports enthusiast would argue that the NHL would rival the NFL in injury counts and severity. But our findings revealed that the NHL reported significantly fewer injuries than both the NFL and the NBA. This raised questions about the reporting standards and the effectiveness of protective equipment.

Upper body injuries were most common in the NHL, with the majority being shoulder injuries. Discussed in the ASC Podcast, these shoulder injuries are likely due to frequent checks into the boards and high-speed contact from man-on-man contact. Yet, the lack of total injuries might be a result of the NHL's equipment standards, which protect these players more than any other sport we studied.

While we can only speculate as to why the NHL is so much safer than its reputation might suggest, it is immediately apparent that NHL players wear far more protective equipment than nearly any other sport we monitored. It would seem that players move faster and more recklessly than other sports, but they are simultaneously clad in protective padding specific to their position and level of risk exposure. The goalie, for instance, had his own specialized set of equipment designed to incur impact from fast rubber pucks, which would otherwise devastate a regular player. There was also some discussion as to whether players feel empowered by the equipment to make more reckless decisions, or whether the equipment serves to remind them of how dangerous the sport can be - it is difficult to definitively say much else about the equipment beyond it being more physically protective than not.

The highest in total injuries reported was the NBA. Despite the lower contact nature of this sport, our analysis proved the physical intensity of basketball's quick direction changes and repetitive movements to be more strenuous than other physical sports.

Lower body injuries were most common in the NBA, specifically in the knees and ankles. As we discussed in ASC, they constantly move from one side of the court to the other, leading their ankles to be overworked and worn out. For the knees, if they are constantly jumping to shoot or block a shot, their knees or ankles may come into contact with the opponents, which could lead to this common injury. Even just jumping and overworking it will lead to immediate injuries occurring.

Shockingly similar injuries to the NFL, regardless of the ways these injuries are produced, we see a clear relationship between these two leagues' most common injuries.

Knee and ankle injuries dominated the NFL data, aligning with the sport's explosive movements and driving contact. While head injuries garner the most attention in the media (likely due to a host of high-profile CTE-induced incidents), most NFL players will encounter a knee or ankle injury many times before they ever suffer a head injury. It is perhaps the severity of a head injury, not the frequency, that drives the constant attention. While a knee or ankle injury can be resolved in relatively short order and will have few latent consequences, head injuries in the NFL will necessarily involve a longer recovery period and affect the player for years after the injury has occurred. While head injuries can be catastrophic when they occur, our data suggested that they were not as common as most people have been led to believe, and the figures have been improving in recent years due to a crackdown on head-to-head contact rules and improvements in helmet technology.

Conclusion

This study analyzed injury data from five major professional sports leagues over a five-year span. By normalizing the injuries according to player count and categorizing injury types by location, we offered a more accurate and comparative understanding of injury prevalence.

Our key findings include:

- ➔ The NFL has the highest total injuries, while the NBA has the highest injuries per player.
- ➔ Injury types vary significantly by sport, driven by movement patterns and physical demands.
- ➔ Common assumptions about which sports are most dangerous may not reflect the true data.

Our findings, and the data from which they derive, tell a compelling story about the danger of trusting popular notions. Perhaps more interestingly, they allude to the massive potential for new insights in preventative therapy and gametime decision making.

The data also teaches us that, even when the initial assumption may be directionally correct, buried within it is a more complicated reality. Take the NFL for instance - it being a dangerous league is common knowledge, but most people associate it with head injuries; arguably because of the disproportionate media coverage. So while most people would be correct in their assumption of danger in the NFL, they'd be incorrect as to the origin of that danger, and therefore, would probably diagnose the problem incorrectly. The opportunity for growth in this area lies in the proper and thorough understanding of the data. It's also a reminder that media can drive public perception in many directions depending on the salaciousness of the topic. Knee injuries are not nearly as interesting to the readership as the prospect of CTE and its resulting implications.

For coaches and leadership staff, there is also opportunity to be found in our data. During critical games, there is almost as much value in what you choose *not* to do as there is in what you choose to do. In this sense, it is important to understand when *not* to deploy a star player, depending upon the time and context of the decision (and which injuries are most likely to occur in that scenario). Some decisions are more critical than others, but all decisions require a multifaceted analysis of the situation and a thorough familiarity with the actual biggest injury liabilities at play. That's not even to speak of the collective billions of dollars lost every year across these leagues due to injured player contracts, which stand to contribute little to the team. There is certainly a benefit to a more balanced risk-reward analysis when it comes to deploying and benching star players…

These insights can help coaches and medical staff develop targeted injury prevention routines. Future research should further explore causal relationships between game intensity, recovery plans, and injury rates. A data-driven approach to sports medicine can enhance player health, prolong careers, and reshape how teams manage athlete performance.

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Appendices

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Table 1: NFL Injuries

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Total	4694

Table 5: NHL Injuries

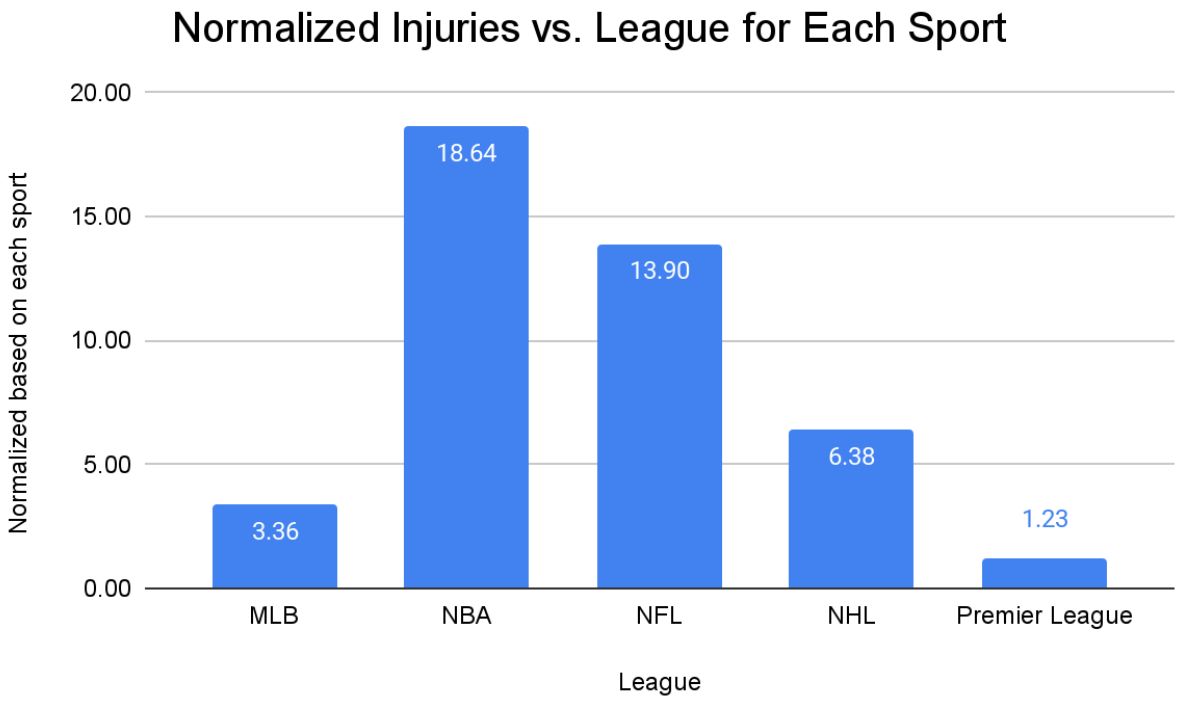

Table 6: Normalization of Injuries

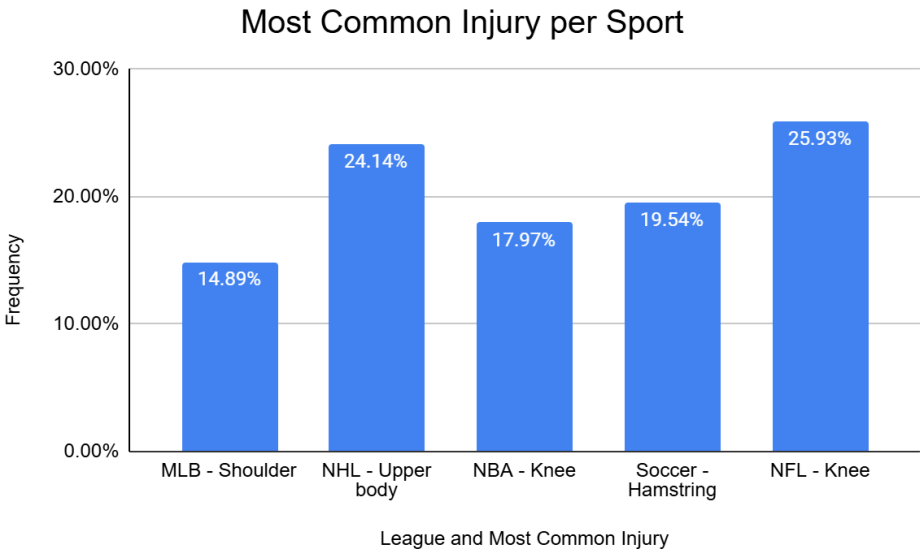

Table 7: Most Common Injury Per Sport

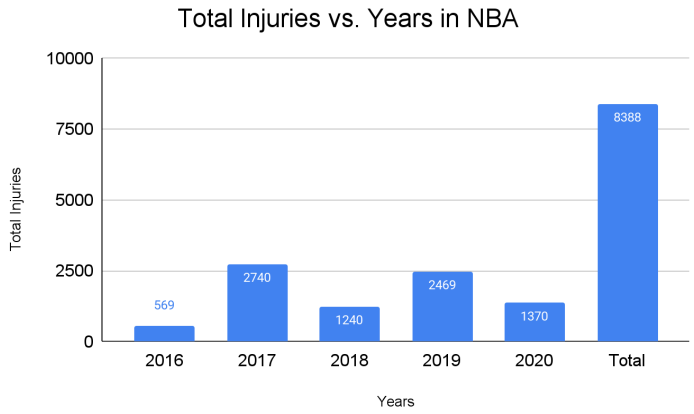

Table 8: Total Injuries Across 5 Year in NBA

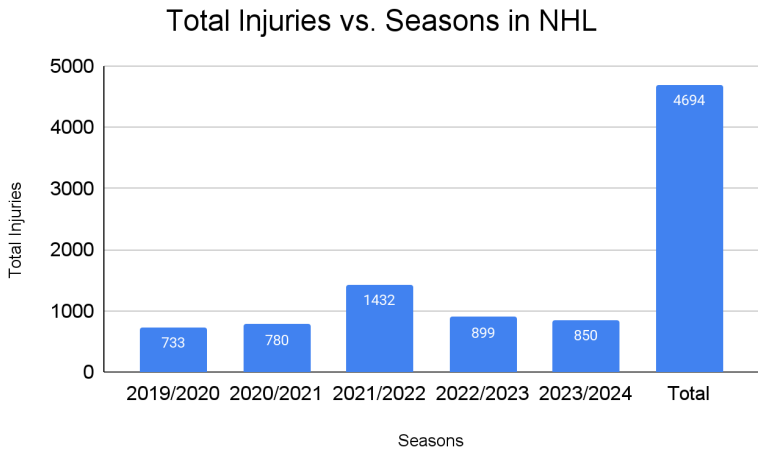

Table 8: Total Injuries Across 5 Year in NHL

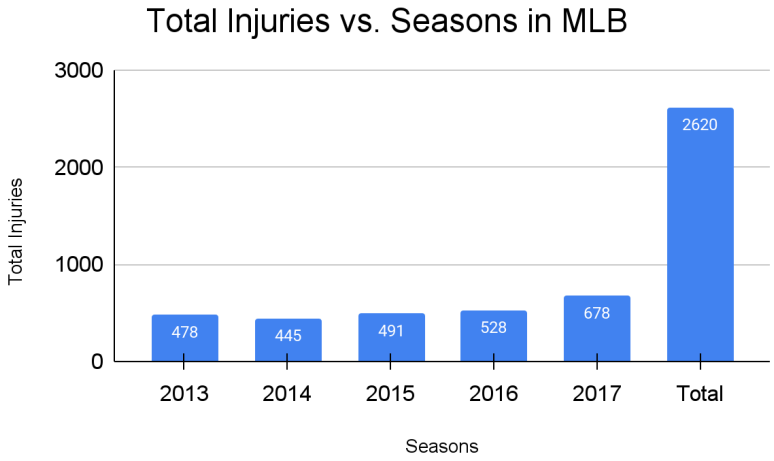

Table 9: Total Injuries Across 5 Year in MLB

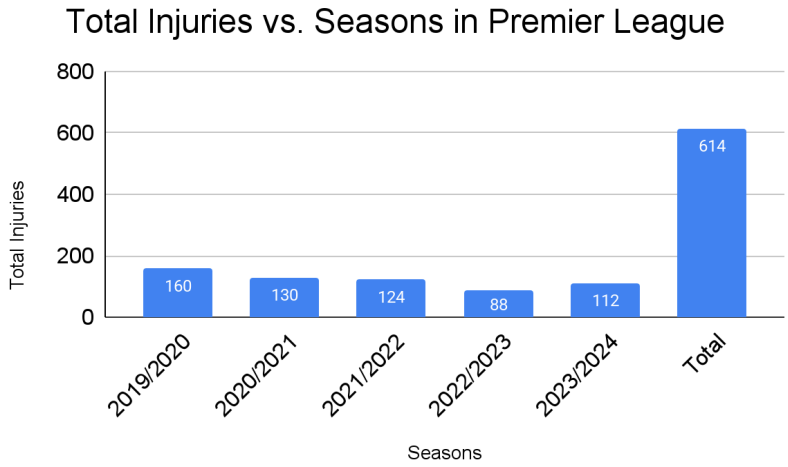

Table 10: Total Injuries Across 5 Year in Premier League

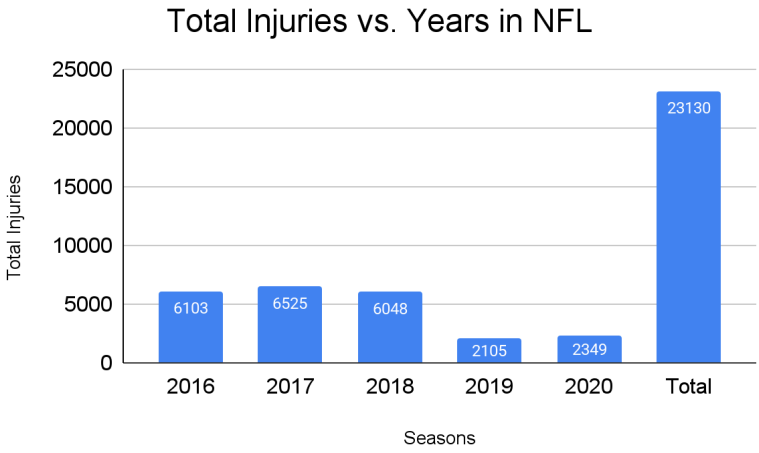

Table 11: Total Injuries Across 5 Year in NFL