

Estimates of the Cost of Contact in Ivy League Sports

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Abstract

The numbers of concussions and other injuries in Ivy League contact sports for both men and women are estimated in this paper. Those that are due to contact are also estimated. The contact sports are football, ice hockey, soccer, basketball, lacrosse, and field hockey. The estimated number of concussions per year across the eight Ivy League universities is 145.3 for men, with 130.9 due to contact, and 64.2 for women, with 53.1 due to contact. The estimate number of total injuries is 1,532.6 for men, with 957.3 due to contact, and 481.7 for women, with 229.6 due to contact. For an athlete who plays all four years of football, the estimated probability of a concussion is 32.1 percent. For women in soccer the estimated probability is 23.7 percent.

Introduction

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due to contact. For an athlete who plays all four years of football, the estimated probability of a concussion is 32.1 percent. For women in soccer the estimated probability is 23.7 percent. The estimates of the injuries due to contact in the contact sports are derived under the assumption that the injury rates in the contact sports would be the same as those in the non-contact sports if there were no contact in the contact sports.

Estimates of Concussions

The data are as follows. The Big Ten-Ivy League Traumatic Brain Injury Research Collaboration (TBI) has collected concussion data by sport for the eight Ivy League universities and some of the Big Ten universities for the six academic years 2013/14 through 2018/19. Two main reports from the TBI have so far been published—Putukian et al. (2019) and Bretzin et al. (2021). In Table 2 in Bretzin et al. (2021) the total number of concussions is presented for men and women for each sport summed over the six years and the eight Ivy League universities.¹ For example, there were 487 concussions in football. If it is assumed that each year is the same, dividing this number by 6 gives the number of concussions per year, which is 81.2. The values for six contact sports are presented in Table 1.

It turns out that there is an independent check on the 81.2 number for football concussions to see if it is in the ballpark of what one might expect. In Fair and Champa (2019) we have computed using NCAA data collected for the five academic years 2009/10 through 2013/14 the number of concussions in college football per 1,000 exposures. (An exposure is one practice or game per athlete.) This number is 0.92. On Yale's 2018 football team there were 110 players, and there are about 100 practices plus games per season, so about 11,000 exposures.

¹The Ivy League has data on the number of concussions by year and by university, but it will not release them to the public. Information across years and universities would be useful for examining possible changes over time and possible differences across universities, but given that the data are not released, one must rely on the aggregate numbers in the TBI reports.

Table 1
Estimates of Concussions and Total Injuries
per Year in the Ivy League

| | Men | | | | Women | | | |
|--------------|------------------------|--------------------------|---------------------------|--------------------------|------------------------|--------------------------|---------------------------|--------------------------|
| | (1) concus total | (2) due to contact | (3) total inj total | (4) due to contact | (5) concus total | (6) due to contact | (7) total inj total | (8) due to contact |
| Football | 81.2 | 75.6 | 687.6 | 456.3 | | | | |
| Ice Hockey | 20.3 | 18.7 | 181.3 | 119.7 | 15.5 | 13.1 | 106.4 | 45.3 |
| Soccer | 14.5 | 12.1 | 254.7 | 152.0 | 15.7 | 12.6 | 164.3 | 99.8 |
| Basketball | 10.3 | 8.7 | 148.2 | 86.8 | 10.7 | 8.2 | 83.4 | 38.0 |
| Lacrosse | 19.0 | 15.8 | 260.8 | 142.5 | 12.5 | 10.2 | 85.8 | 29.1 |
| Field Hockey | | | | | 9.8 | 9.0 | 41.8 | 17.4 |
| TOTAL | 145.3 | 130.9 | 1,532.6 | 957.3 | 64.2 | 53.1 | 481.7 | 229.6 |

- **total inj = concus** times NCAA ratio of **total inj** to **concus**.
- “due to contact” = number of concussions or injuries eliminated if the contact sports were changed to be non contact.

If this is true for the seven other Ivy League universities, there are 88,000 exposures. Dividing 81.2 by 88,000 gives 0.92, the same as the NCAA number. Also, in Figure 2 in Putukian et al. (2019) a rate of 1.26 is given for the two academic years 2016/17 and 2017/18. Finally, Carolyn S. Campbell-McGovern in a March 2017 talk at the MIT/Sloan Analytics Conference reported football concussion rates for the four academic years 2013/14–2016/17 of 1.18, 1.62, 1.08, and 0.99, respectively. The reported Ivy League rates are thus a little higher than 0.92, but not too far off. This closeness suggests that the Ivy League has similar outcomes than the overall NCAA, which provides support for the use of some NCAA results below.

Estimates of Total Injuries

Given results in Fair and Champa (2019, 2022), which will be denoted “FC,” it is possible to estimate the total number of injuries in the Ivy League using NCAA data. The NCAA data include concussions plus other injuries. From the NCAA data one can compute the ratio of total injuries to concussions for each sport for men and women. Each ratio can then be multiplied by the number of Ivy League concussions to get an estimate of the number of total injuries in the Ivy League per sport and gender.² These estimates are presented in columns (3) and (7) in Table 1.

Estimates of Concussion Probabilities

The numbers in columns (1) and (5) in Table 1 are repeated in columns (1) in Table 2. Given these numbers and the number of players, one can calculate the probability that a given player gets a concussion during the season. Yale data for 2018/2019 were used to estimate the number of players per each sport. This number was then multiplied by 8, assuming that the other universities are like Yale. The data were taken from various Yale sports websites. Assuming that no player has more than one concussion in a season one can compute the probability that a player has a concussion in the season. These estimates are presented in columns (3) in Table 2. Some players do get more than one concussion in a season, and so these probabilities are at least slightly biased upward.

Under the assumption that no player has more than one concussion in four seasons, one can estimate the probability that a player gets a concussion in four seasons. These estimates are presented in columns (4) in Table 2. They range between 14.7 and 32.1. Again, these estimates are at least slightly biased upward.

²Total injuries used here do not cover all recorded injuries by the NCAA. The injuries covered are concussions, nervous system, exostosis, fracture, fracture (stress), myositis ossificans, osteochondritis, cartilage injury, dislocation, sprain, strain, strain/tear, subluxation, contusion (hematoma), and spasm.

Table 2
Estimated Probabilities of Concussions in Ivy League Contact Sports

| | Men | | | | Women | | | |
|--------------|--------------------|---------------------|-------------------------|--------------------------|--------------------|---------------------|-------------------------|--------------------------|
| | (1) # concus | (2) # players | (3) prob 1 season | (4) prob 4 seasons | (1) # concus | (2) # players | (3) prob 1 season | (4) prob 4 seasons |
| Football | 81.2 | 880 | 9.2 | 32.1 | | | | |
| Ice Hockey | 20.3 | 224 | 9.1 | 31.6 | 15.5 | 192 | 8.1 | 28.6 |
| Soccer | 14.5 | 256 | 5.7 | 20.8 | 15.7 | 240 | 6.5 | 23.7 |
| Basketball | 10.3 | 144 | 7.2 | 25.7 | 10.7 | 128 | 8.4 | 29.5 |
| Lacrosse | 19.0 | 368 | 5.2 | 19.1 | 12.5 | 320 | 3.9 | 14.7 |
| Field Hockey | | | | | 9.8 | 168 | 5.8 | 21.4 |

Column (1) computed from data in Bretzin et al. (2021).

Column (2) from Yale web sites multiplied by 8.

Column (3) is $100 \cdot [(1)/(2)]$.

Column (4) is $100 \cdot [1.0 - [1.0 - (1)/(2)]^4]$.

Estimates of Concussions and Total Injuries Due to Contact

The numbers under the “due to contact” columns in Table 1 are estimates of injuries that would be saved—not have occurred—if the contact sports were changed to have the same injury rates as the non contact sports. These estimates are based on results in FC comparing contact to non contact sports. For example, for football it is estimated that 75.6 of the 81.2 concussions in the year would be not occur if there were no contact in football. For football the total number of injuries would fall from 687.6 to 456.3.

Conclusion

It is interesting to speculate on why the Ivy League has put student athletes in harms way? There are many benefits of college sports. Sports are an important part of campus life, both playing and watching. They build character; they lead to comradeship; they teach cooperation and selflessness. These are all positive attributes of college sports. The question, however, is whether contact is necessary to achieve these aims. Could not the rules be changed in the above six sports to eliminate contact and still have these sports be an important part of campus life? If this were to be done, a committee of experts for each sport would need to be formed to change the rules. Aside from tighter refereeing, headers in soccer would need to be eliminated, since there is evidence that these can cause CTE. For basketball perhaps no dunking since playing above the rim seems to be injury prone. Checking if it exists would need to be eliminated in ice hockey.

The largest change would be in football, where something like flag football would be needed. Although this is the largest change, it is also the largest gain in fewer concussions and other injuries. Even for flag football, the advantages of college sports mentioned above would still exist, and there could still be tail gate parties! An example of a rule change in this direction is a change made by the National Hockey League for the 2021-22 season. The change is to have strict enforcement against cross checking. Some experimentation would undoubtedly be needed in each sport to see what is necessary to eliminate contact.

References

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