The Effect of 3G Artificial Turf and Natural Grass on Knee Injuries in High School Football

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TOHS AP Research

Research Question: How do Artificial and Natural Playing Surfaces Affect Knee Injuries

Abstract

The number of knee injuries per player exposure in boy's high school football was analyzed in comparison to the percentage of 3G(third generation) turf in high schools across the U.S. to test the hypothesis that there is an increase of knee injuries on artificial playing surfaces. From the 2006-2007 season to the 2016-2017 season, the number of knee injuries calculated using the data from the high school RIO data on the University of Colorado Denver's school of public health's website. The correlation between the number of injuries per game exposure as well as practice exposure both proved to disprove the hypothesis. In both practice and games, the artificial playing surfaces resulted in safer playing conditions.

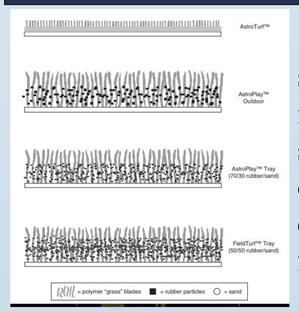
Purpose

With new safety concerns among coaches and trainers alike, it is necessary to understand if a correlation between playing surface, either artificial turf of natural grass, and the rate of knee injuries.

Hypothesis

Alternate: 3G artificial turf will result in a higher knee injury per exposure as compared to natural grass.
Null: There will be no difference in knee injury per exposure between 3G turf and natural grass.

Background



It is commonly believed that artificial turf surfaces lead to a higher number of knee injuries when compared to natural grass surfaces. It is often speculated that an increase of friction on artificial surfaces is the major contributor to knee injuries in high school football.

Methods

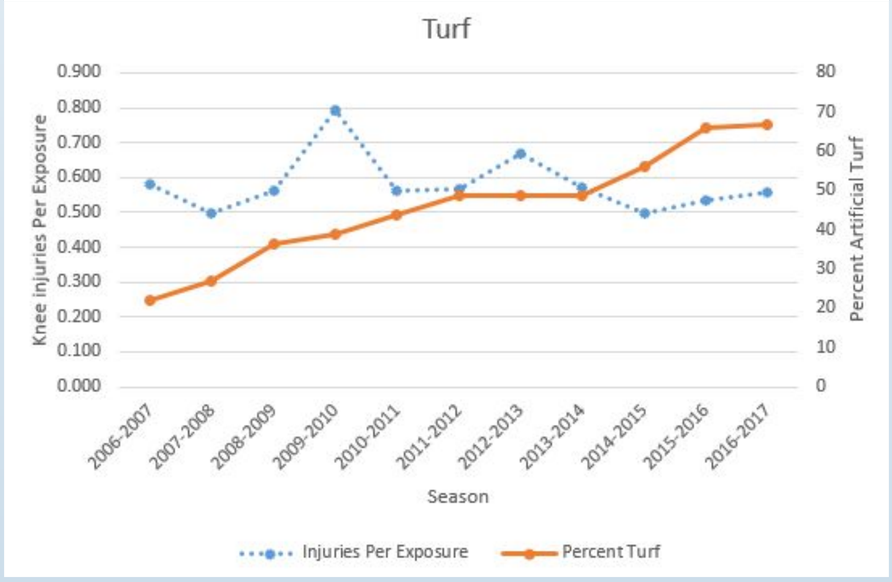
This paper is a secondary data analysis Dr. Comstock's work on HIGH SCHOOL RIO dataset. The dataset spans from 2005 to 2017 and has a section each year in which it gives a total number of knee injuries in football as well as a total number of player exposures. Exposures in the RIO datasets are simply the number of games played by every player. Say there is 11 men on the field for both teams at one point in the game. This would mean there is a total of 22 game exposures for those players in that game. These are the numbers that were used for data collection. For the ten year span of data that was worked with, 2006-2007 season to 2016-20017 season, the percent of turf fields in high school football programs, found via email survey sent to to over 150 high schools across the country, will be compared to the number of knee injuries per exposure for each season. For the data collection in this project, it is important to note that the school field information, collected via email survey, was spread across the United States with the intent to contact more schools in more densely populated states as opposed to having equal data from every state regardless of size. This injury per exposure is calculated from the numbers from Dr. Comstock's data in order to prevent the skewing of data as result of more knee injuries in one season simply as a result of more exposure to receiving said injury.

From the collected data, the number of injuries per exposure can be calculated. The injuries per exposure calculation is essential to the data collection of this paper as it prevents the appearance of more injuries on turf one year simply due to more players playing in games. It prevents the skewing of data by creating an average number of injuries per exposure. To calculate the number of injuries per exposure, the total number of knee injuries in game situations was divided by the number of exposures for each season. This data was then compared to the percentage increase of turf fields using a population correlation coefficient. The formula used to calculate a population correlation coefficient is as follows.

$X,Y=\mathrm{cov}(X,Y) / \sigma x \sigma y$

The population correlation coefficient is used to calculate a p value, between -1 and +1, that shows the correlation of one variable to a set of data. The cov is the covariance, or the relation of two datasets of different magnitudes or measures. The is the standard deviation of both variables, X and Y.

Results



Discussion

The data analysis conducted, CHISQ.TEST as well as the population correlation coefficient test, yield the result that turf has no connection to an increase in injury rate. Further, the negative correlation coefficient states the opposite of the hypothesis that turf will cause an increase of injury. Not only does it not lead to more injuries, but it leads to less, making it safer than grass in the case of knee injury. The CHISQ.TEST yielded an extremely high p value meaning that the null hypothesis should be accepted and the alternate declined. With both of these values pointing to the acceptance of the null hypothesis, it is logical that it should be accepted and assumed correct.

Conclusion

With data showing no obvious connection between the increase of turf fields in high school football and the number of injuries per game and practice exposure from season to season, as well as the findings of a slightly negative correlation between turf and knee injuries lead to the conclusion that artificial turf surfaces are safer than natural grass surfaces.

Further Work

- Test non contact injuries only
- Test common shoe types from season to season and analyze in accordance to the injuries per exposure
- Analyze the non contact injuries cause by common movements

References & Acknowledgements

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Dr. Comstock's work on HIGH SCHOOL RIO (REPORTING INFORMATION ONLINE): INTERNET-BASED SURVEILLANCE OF INJURIES SUSTAINED BY US HIGH SCHOOL ATHLETES.