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The Effect of Rule Changes on Concussion Rates

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In this article, we analyze the effect of two rule changes made between the 2017-2018 and 2018-2019 National Football League (NFL) seasons on the number of concussions. The touchback yard line was moved from the 20 to the 25 to reduce returns, which are a disproportionately dangerous play. Also, lowering the helmet to initiate contact was made illegal, and could result in ejection and suspension of the player. This second rule change was especially controversial due to extreme penalties for formerly "good" plays. We fit fixed effect Poisson and Negative Binomial models to aggregated week level data (all the concussions in a given week), and found a significant and negative effect of the rule change. We found $\beta = -0.411$ and $\beta = -0.410$, respectively. These results show that under the rule changes, there were fewer concussions in a given week, and this decrease was statistically significant. We also fit a logistic mixed effect model to player-level data to estimate the change in odds ratio that a player would receive a concussion in a given game. We found a significant and negative coefficient for this model as well, with $\beta = -0.490$. This result shows that the odds that a given player will receive a concussion in a given week is less under the rule change. Between these models, we conclude that the NFL's rule changes were effective in reducing the amount of concussions across the league and reducing the odds that a given player would receive a concussion.