

# Letters

## RESEARCH LETTER

### Association Between the Experimental Kickoff Rule and Concussion Rates in Ivy League Football

The kickoff return in football, in which athletes run at speed toward each other over a long distance with the potential for significant impacts, has been associated with a substantial number of concussions.<sup>1</sup> In 2015 in the Ivy League, a Division 1 conference of 8 private universities in the National Collegiate Athletic Association (NCAA), kickoffs accounted for 6% of all plays but 21% of concussions.<sup>2</sup> In response, Ivy League football coaches recommended a rule change. In 2016, the kickoff line was moved from the 35-yd to the 40-yd line and the touchback line was moved from the 25-yd to the 20-yd line. The intention was to have more kickoffs land in the end zone and thereby reduce the likelihood the receiving player will advance the ball, thus increasing touchbacks. However, moving the touchback line to the 20-yd line could cause receivers to try to advance the ball, possibly decreasing touchbacks.

We investigated whether the experimental rule was associated with changes in the number of touchbacks and the rate of concussion in kickoffs in Ivy League football.

**Methods** | Each Ivy League football team has approximately 100 players and plays 10 games per season. Each team participates in the Ivy League's concussion surveillance system, whereby at the start of each season, players are invited to participate using written informed consent.<sup>2</sup> Participants who have a concussion are identified by athletic trainers; concussions are diagnosed by a team physician and entered into a web-based repository. Participation is 95%.

From the repository, we identified concussions occurring during regular-season in-conference games during the 5 seasons from 2013 through 2017. Each concussion was evaluated for what type of play it occurred in: kickoff, play from scrimmage, punt, or field-goal or point-after-touchdown at-

tempt. The total number of each play type run each season was accessed from the NCAA archive.

Annual concussion rates before (2013-2015) and after (2016-2017) the 2016 rule, during kickoffs compared with the other play types (that presumably were not affected by the rule change), were analyzed using a difference-in-differences approach. Annual concussion counts were modeled by year and play type, with play counts as exposures, using maximum likelihood Poisson regression to estimate rate differences, difference-in-differences, and 95% confidence intervals. Stata MP 15 (StataCorp) was used for analysis. The University of Pennsylvania institutional review board waived review.

**Results** | During 68 479 plays from 2013 through 2017, 159 concussions occurred (126 before and 33 after the rule), for an overall concussion rate of 2.3 per 1000 plays. Kickoffs resulting in touchbacks increased from a mean of 17.9% annually before the rule change to 48.0% after. The mean annual concussion rate per 1000 plays during kickoff plays was 10.93 before the rule change and 2.04 after (difference, -8.88; 95% CI, -13.68 to -4.09) (Table). For other play types, the concussion rate was 2.56 before the rule change and 1.18 after (difference, -1.38; 95% CI, -2.04 to -0.73). The difference-in-differences analysis showed that 7.51 fewer concussions (95% CI, -12.88 to -2.14) occurred for every 1000 kickoff plays after vs before the rule change.

**Discussion** | The kickoff rule change in Ivy League football was associated with a reduction in concussions. Moving the touchback line<sup>3</sup> and the kickoff line are debated. In 2011, the National Football League moved the kickoff line to the 35-yd line from the 30-yd line.<sup>4</sup> One analysis concluded that this reduced kickoff play injuries overall but not head injuries,<sup>4</sup> but the analysis was vulnerable to bias by not including a control injury rate change.

Limitations include possible bias by a rule that in 2016 eliminated full-contact hitting in practices in response to concerns about injuries generally.<sup>5</sup> This rule likely did not

Table. Concussions by Play Type During Seasons Before (2013-2015) and After (2016-2017) the Experimental Kickoff Rule Change in Ivy League Football<sup>a</sup>

Play Type	Before Rule Change (2013-2015)			After Rule Change (2016-2017)			
	Concussions, No.	Plays, No.	Rate	Concussions, No.	Plays, No.	Rate	Rate Difference (95% CI)
Total	126	41 486	3.04	33	26 993	1.22	-1.82 (-2.49 to -1.14)
Kickoffs	26	2379	10.93	3	1467	2.04	-8.88 (-13.68 to -4.09)
Other play types							
Scrimmages	92	34 521	2.67	28	22 467	1.24	-1.43 (-2.13 to -0.70)
Punts	6	2496	2.40	2	1791	1.12	-1.28 (-3.76 to 1.18)
Field goals/point after attempts	2	2090	0.96	0	1268	0	-0.96 (-2.28 to 0.37)
Other play types combined	100	39 107	2.56	30	25 526	1.18	-1.38 (-2.04 to -0.73)

<sup>a</sup> Rates are concussions per 1000 plays, and rate differences were calculated as the rate in the period after the rule change minus the rate in the period before the rule change.

differentially affect activities during different types of plays during competitions and hence would not bias this analysis. Confounding by player or game characteristics changing over time and surveillance bias are possible.

The action taken by Ivy League leadership based on epidemiologic evidence demonstrates how targeted policy changes can reduce sport-related concussion. Although these results may not generalize beyond the Ivy League, they may inform the NCAA as it considers adjusting the kickoff rules in football in all collegiate conferences.<sup>6</sup>

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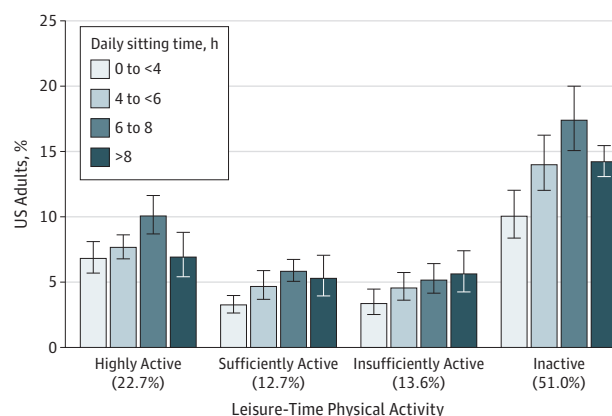
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## Joint Prevalence of Sitting Time and Leisure-Time Physical Activity Among US Adults, 2015-2016

High amounts of sedentary behavior and low levels of physical activity are associated with increased risk of premature mortality and some chronic diseases.<sup>1</sup> Engaging in high volumes of moderate- to vigorous-intensity physical activity may reduce the mortality risk associated with excessive sedentary behavior.<sup>1,2</sup> Understanding the combined prevalence of these behaviors could help practitioners determine whether to prioritize interventions targeting sedentary time, physical activity, or both. We examined patterns in joint categories of sitting time and leisure-time physical activity among US adults.

**Methods** | We used data from the 2015-2016 National Health and Nutrition Examination Survey (NHANES), a nationally representative survey of the noninstitutionalized, civilian US population.<sup>3</sup> NHANES collects health information through in-home interviews and physical examinations. The National Center for Health Statistics research ethics review board approved NHANES. Adult participants (aged ≥18 years) provided written consent. The overall 2015-2016 interview response rate was 61.3%, and there were 5992 adult respondents.

**Figure. Joint Distribution of Self-Reported Sitting Time and Leisure-Time Physical Activity Among US Adults, NHANES, 2015-2016**



Data are percentage of US adults who reported each joint category of daily sitting time and leisure-time physical activity. Error bars indicate 95% confidence intervals. NHANES indicates National Health and Nutrition Examination Survey.