Association of Use of a Mobile Tackling Dummy During College Football Practice With Reduced Sport-Related Concussion

Results of a Pilot Investigation

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Background: Considering the multifaceted consequences of improperly managed sport-related concussions (SRCs) in American football, identifying efficacious prevention measures for enhancing player safety is crucial.

Purpose: To investigate the association of primary prevention measures (no-tackle practices and using a mobile tackling dummy in practice) with the frequency of SRCs within college football programs in the United States.

Study Design: Descriptive epidemiology study.

Methods: In this pilot study, we analyzed the frequency of new SRCs recorded during various settings (total, in preseason, in season, in practice, and game) across 14 seasons (2007-2019 and 2021) for Dartmouth College and across 7 seasons (2013-2019) for the 7 other teams in the Ivy League men's athletic football conference. Trends between seasons and the number of SRCs sustained were examined using correlations and basic descriptive statistics. We also examined SRC frequency in relation to primary prevention measures (no-tackle practices, use of mobile tackling dummies during practice) in the Dartmouth College football program, and we compared SRCs with regard to the no-tackle practice policy in the other Ivy League teams.

Results: There was a statistically significant reduction in the number of SRCs over the seasons studied, with the strongest finding observed for Dartmouth College in-game SRCs ($r = –0.52$; $P = .029$). Relatedly, the strongest between-season effect was seen for the Dartmouth College practice policy on in-game SRCs ($\eta^2 = 0.510$; $P = .01$). The use of mobile tackling dummies was found to be independently associated (adjusting for no-tackle practice) with a lower number total ($\beta = –0.53$; $P = .049$), in-season ($\beta = –0.63$; $P = .023$), and in-game ($\beta = –0.79$; $P = .003$) SRCs. While seasons with the no-tackle practice were not meaningfully associated with SRCs for Dartmouth College, stronger trends were observed in the other Ivy League teams, such that seasons with this policy were associated with lower SRC prevalence.

Conclusion: Our data indicate that the use of the mobile tackling dummy in practice was related to the reduced number of SRCs sustained at multiple settings during the football season. To a lesser extent, the no-tackle practice policy was also associated with a reduced number of SRCs.

Keywords: college football; head injury; prevention; sports medicine; sport-related concussion

Concussion is a public health concern, with approximately 3.8 million occurring in the United States every year.[9] As a brain injury, concussions can acutely disrupt several areas of functioning—including physiological, cognitive, academic, vestibular, oculomotor, sleep, social, and emotional domains.[14] When not properly treated, concussions can have chronic implications in both the medical and economic realms.[5,10] Indeed, delay of evidence-based treatment/management of concussion may result in a prolonged course of recovery from the complex multidomain sequela (ie, postconcussion syndrome).[6] The rate of postconcussion syndrome can vary from 40% to 80% in the weeks after injury, 50% up to 3 months after injury, and 10% to 15% at 12 months after injury and beyond.[1,3] To illustrate economic ramifications, health care utilization

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costs within the Veterans Health Administration system among veterans with history of traumatic brain injury in the year 2009 were 4 times higher than those without.[18] Moreover, base rates of psychiatric (89%) and complex pain syndromes (70%) were considerable among veterans with traumatic brain injury, and, predictably, the financial burden was highest among them.[18] In this context, head injury prevention efforts are crucial.

In football, sport-related concussion (SRC) is one of the most common injuries.[11] Increased attention has also been devoted to head impact exposure in football, not just concussion, as repeated head impacts may influence long-term brain health.[12] More recent empirical evidence indicates a robust positive association between higher postconcussion symptom burden in the acute injury period and slower functional recovery.[8] To this end, research on acute impact and recovery has fueled policy changes to improve player safety[16,17,19]; nonetheless, these measures have yielded variable results. Not surprisingly, the frequency and intensity of college football practices are positively associated with odds of head impact and subsequent SRC such that athletes who are exposed to frequent sessions with intense physical contact are at an increased risk for these adverse health outcomes.[16] The follow-up empirical investigation of the effect of reduced practice sessions in the National Collegiate Athletic Association (NCAA) Division I football teams provided mixed results regarding mitigating head impact burden but highlighted additional parameters of importance: duration and physical intensity of practice sessions.[17] Other studies have observed promising trends of reduced physical impact and resultant SRCs through practice and in-game policy changes in youth and collegiate football, such as implementing safe tackling techniques in practices (ie, vertical, head-up tackling style) using tackle dummies[15] and modifying kickoff return rules.[19]

In 2016, all Ivy League football programs agreed to eliminate player-on-player tackling during practice to reduce head injuries during in-season practices.[2] One Ivy League program, Dartmouth College, banned player-on-player tackling in 2010 as part of a primary prevention (ie, interventions, in this context, to prevent a play from sustaining an SRC) approach to player safety. In 2015, the Dartmouth Big Green Football Team introduced a mobile tackling dummy (Mobile Virtual Player [MVP] | Drive; MVP Robotics) into their practice routine. Using a tackling dummy that moves is purportedly designed to better simulate the dynamic tackling of another moving player than static and stationary dummies. The remote-controlled mobile dummy allows players to practice tackling while pursuing a moving target, requiring greater flexibility and response to movement.

In the present study, we quantified the association between multiple injury prevention strategies and SRC frequencies over several college football seasons (2007-2021) in the Ivy League Conference. As the elimination of tackling in practice within the Ivy League began later than this rule was instituted within Dartmouth Football, the factor of time was also included in our approach. Finally, we broadly hypothesized that implementing both primary prevention measures (no-tackle practice and practice with a mobile tackling dummy) would be associated with attenuated frequency of concussions.

METHODS

Study Sample

We studied SRCs within and across men's football seasons for the Ivy League collegiate athletic conference (n = 8 teams), emphasizing Dartmouth College. SRC data were analyzed season by season from 2007 to 2021, excluding 2020, as there was no season this year due to the COVID-19 pandemic (n = 14 seasons) for the Dartmouth College men's football team, and from 2013 to 2019 (n = 7 seasons) for the other Ivy League men's football teams (n = 7 teams). Methods for data collection and how SRCs were defined have been previously published.[13] SRCs were diagnosed by sports medicine professionals at each institution using the Zurich or Berlin consensus criteria.[11] These professionals also recorded and collated data. Dartmouth football data were provided through the Dartmouth College Sports Medicine Department. Aggregated Ivy League data were provided by the Ivy League–Big Ten Epidemiology of Concussion Study.[13] The protocol for this study was considered exempt from institutional review board approval.

Outcome Measures

The primary unit of analysis (dependent variable) was the number of SRCs sustained. We examined the SRCs

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TABLE 1
Frequency of SRCs in the 2007-2021 Season for Dartmouth College and the 2013-2019 Seasons for 7 Other Ivy League Football Teams[a]

	SRCs per Season, n													
Setting	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2021
Dartmouth														
Total	8	6	8	6	11	5	12	7	2	6	10	2	7	3
In preseason	1	2	3	1	0	1	4	3	2	3	4	1	2	0
In season	7	4	5	5	11	4	8	4	0	3	6	1	5	3
In practice	3	4	3	1	3	1	6	3	2	4	6	1	3	3
In game	5	2	5	5	8	4	6	4	0	2	4	1	4	0
Other teams[b]														
Total	—	—	—	—	—	—	60 ± 9	88 ± 13	64 ± 9	67 ± 10	48 ± 7	63 ± 9	31 ± 4	—
In preseason	—	—	—	—	—	—	20 ± 3	27 ± 4	19 ± 3	28 ± 4	19 ± 3	17 ± 2	7 ± 1	—
In season	—	—	—	—	—	—	36 ± 5	58 ± 8	43 ± 6	36 ± 5	25 ± 4	45 ± 6	22 ± 3	—
In practice	—	—	—	—	—	—	7 ± 1	11 ± 2	11 ± 2	10 ± 1	8 ± 1	9 ± 1	6 ± 1	—
In game	—	—	—	—	—	—	29 ± 4	47 ± 7	32 ± 5	26 ± 4	17 ± 2	36 ± 5	16 ± 2	—

[a]SRC, sports-related concussion. Dashes indicate areas where data were not available.
[b]For convenience and to facilitate comparison of data from the 7 other Ivy League teams to those of Dartmouth College, the frequency of SRCs was formatted as mean ± SD.

sustained during the following settings: total (preseason practice + regular-season total), in-preseason (preseason practice), in-season (regular season competition + practice), in-practice (regular season practice), and in-game (regular-season competition).

To explore the effects of specific practice policies on the number of SRCs sustained within a particular outcome setting (eg, total, in-season, in-game), the seasons were also coded for whether the practice was no-tackle (±tackling) and/or whether mobile tackling dummies were used (±dummies). Dartmouth College implemented no-tackle practices starting in 2010; the other Ivy League teams did so starting in 2016. Dartmouth College added mobile tackling dummies in 2015. No information on using the mobile tackling dummy from other schools was available. Across all analyses, a number of SRCs were analyzed within each outcome setting.

Statistical Analysis

We explored trends in the number of SRCs for Dartmouth College over time using bivariate parametric correlations. Next, we constructed generalized linear models to test the association of the various Dartmouth College primary prevention policies implemented (+tackling/–dummies, –tackling/–dummies, or –tackling/+dummies) with the number of SRCs sustained in each outcome setting. Post hoc pairwise comparisons of the number of SRCs at different time intervals—thereby representing policy and rule changes—were performed using Tukey tests for significant or near-significant ($P < .10$) models. Finally, the 2 Dartmouth College primary prevention policies were binary-coded and concurrently entered into generalized linear models to test their independent associations with SRCs. Using data from the 2013-2019 seasons for the other 7 Ivy League football teams, we conducted supplemental parametric correlations assessing trends in the number of SRCs over time, as well as independent-samples t tests to compare SRCs sustained in the seasons with versus without no-tackle practice.

We hypothesized that the frequency of SRCs would be lower during the seasons where (1) tackling was banned in Dartmouth College and other Ivy League team practices and/or (2) the mobile tackling dummy was used in Dartmouth College practices. In this context, P values for these respective analyses were 1-tailed; P values were otherwise 2-tailed (α set at .05 for all analyses). Considering the small sample of seasons available for data analysis, adjunctive to P values, we also interpreted the magnitude of effect sizes to determine practice significance based on the minimum thresholds set by Ferguson[7]: Cohen $d \geq 0.41$, r and $\beta \geq 0.20$, and η^2, and $R^2 \geq 0.04$. We also computed the Hedge g, an effect metric comparable to d, to adjust findings for a small sample size (where appropriate).

RESULTS

Dartmouth College

Table 1 presents basic descriptive information for the number of SRCs sustained in each outcome setting across the 2007-2021 seasons for Dartmouth College. The number of SRCs for Dartmouth College ranged from 2 to 12 across the 14 seasons analyzed. Correlation analysis showed strong trends of a negative association between season and total ($r = –0.355$, in-season ($r = –0.416$), and in-game ($r = –0.517$) SRCs, such that as the seasons progressed, the frequency of SRCs in each of these settings tended to decline (see Table 2 for all r values and Figure 1A for graphical representation of this trend for total SRCs).

TABLE 2
Bivariate Correlation Matrix for Season and SRC Frequency for Dartmouth College and Other Ivy League Teams[a]

	Season	Total	In-Preseason	In-Season	In-Practice	In-Game
Dartmouth						
Season	—	—	—	—	—	—
Total	−0.355	—	—	—	—	—
In preseason	–0.048	0.426	—	—	—	—
In season	–0.416	0.902[d]	–0.006	—	—	—
In practice	0.064	0.681[c]	0.690[c]	0.421	—	—
In game	–0.517[b]	0.863[d]	0.090	0.912[d]	0.218	—
Other teams						
Season	—	—	—	—	—	—
Total	–0.674[e]	—	—	—	—	—
In preseason	–0.653	0.857[b]	—	—	—	—
In season	–0.540	0.934[c]	0.619	—	—	—
In practice	–0.395	0.829[b]	0.730[e]	0.784[b]	—	—
In game	–0.541	0.910[c]	0.572	0.994[d]	0.709[e]	—

[a]SRC, sports-related concussion.
[b]$P < .05$.
[c]$P < .01$.
[d]$P < .001$.
[e]$P < .10$.

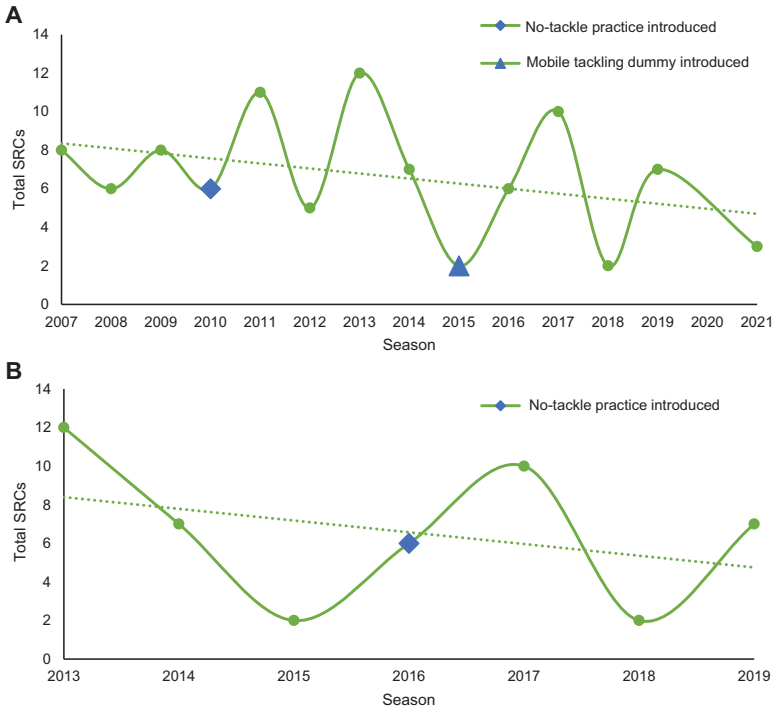

Figure 1. The trend of overall frequency of sport-related concussions (total SRCs), (A) for Dartmouth College as a function of the introduction of practice interventions (ie, no-tackle practices and mobile tackling dummies) and (B) for the 7 other Ivy League teams as a function of the introduction of a unitary practice intervention (ie, no-tackle practices).

Because of limited statistical power (n = 14 seasons for analysis), the only association that reached statistical significance was for in-game SRCs ($P = .029$). Nevertheless, these associations fell well above the Ferguson[7] criteria for a practically significant effect and were broadly of moderate strength.

Table 3 presents descriptive and comparative data for SRCs in Dartmouth College as a function of the primary

TABLE 3
Descriptive and Comparative Statistics of SRCs Before and After Implementation of the No-Tackle Policy and Mobile Tackling Dummy in Dartmouth College Football Practice Across 14 Seasons[a]

					Post Hoc Comparison			
Practice Policy[b]	SRC, mean ± SD	*F*	*P*	η^2	Pair	*P*	*d*	*g*
Total								
(a) +tackling/–dummies	7.3 ± 1.2	1.75	.110	0.241	a > c	.080	0.96	0.83
(b) −tackling/−dummies	8.2 ± 3.1				b > c	.066	1.01	1
(c) –tackling/+dummies	5 ± 3.2							
In preseason								
(a) +tackling/–dummies	2 ± 1	0.03	.485	0.006	—	—	—	—
(b) −tackling/−dummies	1.8 ± 1.6							
(c) –tackling/+dummies	2 ± 1.4							
In season								
(a) +tackling/–dummies	5.3 ± 1.5	2.67	.057	0.327	a > c	.080	1.20	1.11
(b) −tackling/−dummies	6.4 ± 3				b > c	**.032**	1.26	1.35
(c) –tackling/+dummies	3 ± 2.3							
In practice								
(a) +tackling/–dummies	3.3 ± 0.6	0.11	.450	0.019	—	—	—	—
(b) −tackling/−dummies	2.8 ± 2							
(c) –tackling/+dummies	3.2 ± 1.7							
In game								
(a) +tackling/–dummies	4 ± 1.7	5.72	**.010**	0.510	a > c	.067	1.21	1.20
(b) −tackling/−dummies	5.4 ± 1.7				b > c	**.004**	2.03	1.99
(c) –tackling/+dummies	1.8 ± 1.8							

[a]Bold *P* values indicate statistical significance ($P < .05$). SRC, sports-related concussion.
[b]Seasons for practice policy: a = 2007-2009 (n = 3); b = 2010-2014 (n = 5); and c = 2015-2019 and 2021 (n = 6).

prevention policy in use. Analysis indicated a significant effect of year on in-game SRCs ($\eta^2 = 0.510$; $P = .010$). In-season SRCs trended toward significance ($\eta^2 = 0.327$; $P = .057$), and this model, along with total SRCs ($\eta^2 = 0.241$), produced practically significant effects (ie, those that are considered clinically meaningful according to the Ferguson criteria[7]). Pairwise comparisons showed that the policy of –tackling/+dummies yielded significantly lower in-season and in-game SRCs versus –tackling/–dummies ($P = .032$ and $P = .004$, respectively). Total SRCs trended toward significance ($P = .066$), with a weaker trend of lower SRCs with –tackling/+dummies versus +tackling/–dummies regarding total ($P = .080$), in-season ($P = .080$), and in-game ($P = .067$) SRCs.

Table 4 presents multivariable generalized linear models testing the relative associations of no-tackle practices and mobile tackling dummy use with SRC frequency. These revealed incremental validity in the latter versus the former variable. That is, the no-tackle practice was not significant in any model, whereas the mobile tackling dummy was significantly and independently predictive of total ($\beta = –0.53$; $P = .049$), in-season ($\beta = –0.63$; $P = .023$), and in-game ($\beta = –0.79$; $P = .003$) SRCs. The no-tackle practice yielded a practically significant effect in predicting lower in-game SRCs when adjusting for mobile tackling dummy use, although this was nonsignificant ($\beta = –0.26$; $P = .150$). Notably, the variance of SRCs accounted for in these models ($R^2 = 0.24$, 0.33, and 0.51, respectively) was well above what may be considered practically significant, suggesting that these effects go beyond statistical significance in their potential for observable impact in clinical practice.[7]

Other Ivy League Teams

The mean number of SRCs for the 7 other Ivy League teams ranged from 4 to 13 across the 7 seasons with valid data (2013-2019) (see Table 1). As with Dartmouth College, SRC frequencies were inversely associated with season. Later seasons were associated with fewer SRCs (*r*s ranging from –0.395 to –0.674) (see Table 2 and Figure 1B). Interestingly, examination of intercorrelations among SRC settings revealed a strong positive association between the number of in-practice and in-game SRCs ($r = 0.709$), such that a greater number of SRCs sustained in practice was associated with a greater number of SRCs sustained in games. Next, a consistent trend of lower frequency of SRCs during the seasons with the no-tackle practice policy was observed, although these did not reach statistical significance, likely because of limited power (see Table 5). However, effects from all tests exceeded the Ferguson threshold for practical significance (*d* and *g* ranging[7] from 0.58 to 1.29). The largest effects (ie, the greatest reduction in SRC frequencies in relation to no-tackle practices), which were moderate in magnitude, were observed for the total ($d = 1.17$), in-season ($d = 1.26$), and in-game ($d = 1.29$) SRCs.

TABLE 4
Generalized Linear Models Assessing Incremental Validity of Dartmouth College Football Practice Policies in Predicting SRCs[a]

	Variable Summary				Model Summary	
Practice Policy Variable	B	SE(B)	β	*P*	R^2	*P*
Total					.24	.110
No-tackle practice	–0.87	2.13	–.12	.346		
Mobile tackling dummy	3.20	1.77	–.53	.049		
In preseason					.01	.485
No-tackle practice	0.20	1.05	.06	.427		
Mobile tackling dummy	0.20	0.87	.08	.412		
In season					.33	.057
No-tackle practice	–1.07	1.81	–.16	.284		
Mobile tackling dummy	–3.40	1.50	–.63	.023		
In practice					.02	.450
No-tackle practice	0.53	1.25	.14	.339		
Mobile tackling dummy	0.37	1.04	.12	.365		
In game					.51	.010
No-tackle practice	–1.40	1.29	–.26	.150		
Mobile tackling dummy	–3.57	1.07	–.79	.003		

[a]B, unstandardized estimate; β, standardized estimate; SRC, sports-related concussion.

TABLE 5
Descriptive and Comparative Statistics of SRCs Before and After Implementation of the No-Tackle Practice Policy in Other Ivy League Football Teams for the 2013-2019 Seasons[a]

		Comparison			
Tackling in Practice[b]	SRC, mean ± SD	*t*	*P*	*d*	*g*
Total		–1.52	.095	1.17	1.16
No	52.3 ± 16.4				
Yes	70.7 ± 15.1				
In preseason		–0.77	.238	0.61	0.58
No	17.8 ± 8.6				
Yes	22 ± 4.4				
In season		–1.65	.080	1.26	1.26
No	32 ± 10.6				
Yes	45.7 ± 11.2				
In practice		–0.94	.195	0.69	0.71
No	8.3 ± 1.7				
Yes	9.7 ± 2.3				
In game		–1.70	.075	1.29	1.29
No	23.8 ± 9.3				
Yes	36 ± 9.6				

[a]SRC, sports-related concussion.
[b]Seasons without no-tackle policy: 2013-2015 (n = 3); seasons with no-tackle policy: 2016-2019 (n = 4).

DISCUSSION

The findings of this study suggest that the primary prevention measures of no-tackle practices and the use of mobile tackling dummies are associated with reduced concussions in college football. Despite the small sample of data analyzed, effect sizes were generally robust. After the no-tackle practice policy, seasons were not associated with lower SRC frequency at Dartmouth College. However, aggregated data for the rest of the Ivy League colleges suggested that the no-tackle practice policy was associated with lower concussion frequency (mean number of total SRCs, 52.3 vs 70.7). Nevertheless, the addition of a mobile tackling dummy to the no-tackle practice culture at Dartmouth College was associated with significant further reductions in the frequency of reported SRCs (5 vs 8.2). That is, the combination of no-tackle and mobile tackle dummies in practice was correlated with marked decreases

in the number of SRCs sustained in the Dartmouth College program (β = –0.53 vs –0.12 for predicting the number of total SRCs). This innovative mobile tackling dummy technology shows promise as a primary prevention tool for concussion reduction in football.

Importantly, Dartmouth College has engaged in no-tackle practices since 2010, giving their program ample time to integrate this approach into their practice culture. More seasons of no-tackle programming may lead to fewer concussions, consistent with the trends in our data for Dartmouth College and the other Ivy League teams. In addition, the use of a mobile tackling dummy, while innovative, was introduced in the context of a longstanding no-tackle practice program. We had insufficient data to examine the interaction effects between the no-tackle and mobile tackling dummy practice policies. Indeed, in an ideal experimental setting, we would have ample data from seasons where a complete set of practice policies (ie, no-practice policies , no-tackle alone, tackling dummy alone, and combined no-tackle and tackling dummy) randomized across multiple teams. Thus, it is unclear whether these policies in tandem or mobile tackling dummy alone were driving the relation with lower SRC frequencies. Additionally, data constraints of the present project prevented us from empirically evaluating potential unidentified confounding factors in the association between SRC frequency and season. For instance, we could not capture game-to-game and team-to-team idiosyncrasies in coaching and refereeing (eg, strictness of enforcement of contact rules by coaches in practice or officials during games; team-specific cultural milieus). A surprising trend across analyses may speak to this issue. It is reasonable to assume that the greatest effects (ie, reduction of the number of SRCs) should be seen in practice settings, as the policies are directly implemented in these settings. Our data did not support this notion, as larger effects for lower numbers of SRCs were observed during the comparison of in-game versus in-practice settings across analyses. Conceptually, this may speak to the transfer of safe tackling practices to active gameplay, although it is also plausible that unaccounted-for, extraneous variables played a role in these findings. In a separate vein, despite its independent statistical significance, concussion prevention with the mobile tackling dummy may not generalize to programs that do not have a paramount culture of player safety.

Removing tackling from practice and using alternative mobile tackling dummy technology may foment fears of reduced player performance among the coaching staff. To this end, we offer anecdotal evidence—using average Ivy League team standings—to support the efficacy of these practice policies further and perhaps evidence against reduced athlete performance. Dartmouth College averaged 6.6th place in Ivy League standings for the 10 years (2000-2009 seasons) before implementing the no-tackle practice policy. This is a stark contrast to the 3.4th-place average standing of Dartmouth College for the 11 years (2011-2021 seasons) after implementing practice policies (first no-tackle and subsequent use of mobile tackling dummy technology). In offering this correlational anecdotal evidence, we appreciate that many other factors are germane to college football team success, such as quality of coaching and player recruitment, which fell outside the scope of the current report. Moreover, we stress that causal inferences cannot and should not be drawn from these observations. Together, this example indicates that the Dartmouth College team performance did not worsen when compared with a cohort of their peers over time, in view of their adopting these practice methodologies.

Limitations

A pervasive limitation of this study was the small sample of seasons (n = 14 for Dartmouth College and n = 7 for other Ivy League schools) available for data analysis. Despite the signals of varying salience we observed across statistical analyses, most did not cross the conventional threshold for statistical significance, as this study was statistically underpowered largely because of the small sample of seasons and range restriction in values of SRC frequency counts. We attempted to circumvent this limitation, in part, by interpreting the magnitude of effect sizes yielded from each analysis against the minimum recommended effect size for what may be considered a practically significant (ie, clinically meaningful) finding proposed by Ferguson.[7]

As this study was limited to Ivy League teams, it is unclear how these findings generalize to other football leagues/conferences. Relatedly, we did not have data on the number of players featured in each Ivy League team in each season. As such, it is unclear whether teams with larger rosters systematically yield more SRCs per season. However, standardized limits on the number of active players imposed by the NCAA would arguably mollify this extraneous factor. Next, the observational/correlational nature of this retrospective study precludes causal inferences from being made based on these pilot data findings. Broadly, the circumscribed set of parameters in the present data precluded our ability to explore and identify other potential confounding factors (described above) that may be pertinent to the SRC frequency trends studied here. As such, the risk of misattributing reductions of SRC frequencies to tackle dummies when unidentified third variables are driving the relations remains.

Finally, it is possible that SRC frequency data used here underrepresented actual tallies of concussions, as underreporting of these injuries is a pervasive problem in athletics.[4] Considering these limitations, future lines of research are needed to study no-tackle and mobile tackling dummy practice policies in relation to the number of SRCs across a broader band of seasons and in other football conferences/contexts—eg, such as the National Football League, NCAA college football conferences outside of the Ivy League, high schools, and youth football programs. To understand injury prevention more broadly, future research could also examine how no-tackle policies and mobile tackling dummies affect other football injuries—eg, soft tissue and joints.

CONCLUSION

While the no-tackle practice policy alone did not affect the number of SRCs in Dartmouth College, a stronger trend

was observed in the rest of the Ivy League. Significantly, the addition of a mobile tackling dummy to the no-tackle practice culture at Dartmouth College was associated with significant added decreases in the frequency of reported SRCs. This innovative mobile dummy technology—perhaps in conjunction with no tackling in practice—shows promise as a primary prevention tool for concussion reduction in football. As the more recent seasons at Dartmouth College and other Ivy League teams were associated with lower SRC rates, it is possible that having more experience with no-tackle and tackling dummy practice methodologies matters. Perhaps more importantly, policy changes such as barring tackling and using mobile tackling dummies in practices must be enacted within the broader context of a team culture that places a premium on maintaining player safety and health both on and off the field.

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