

Game Schedules and Injury Occurrence in the National Football League – Are Injuries Affected by the Number of Days between Games?

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ABSTRACT

American professional football has one of the highest rates of sport injury. Despite this high rate of injuries, little is known on injury occurrence from unconventional game schedules or shortened rest periods. To determine whether time between games in the National Football League was associated with injury occurrence, time missed, body part injured, and player position, we examined injuries and game schedules from 32 NFL teams from 2012-2016. Data was collected from online resources and summarized by regular-season weeks and quarters. Time between games was classified as short: <7 days, regular: 7 days, or long: >9 days. Chi-square determined significance and true relationships between variables. Secondary analyses were performed to assess time between games and anatomical location, player position, and time missed. A total of 4,228 injuries were observed over 5 seasons. Longer rest periods between games resulted in a higher frequency of injuries in the second and third quarters of the season, but fewer injuries at the beginning and end. Shorter rest

periods and regular game schedules did not show a difference in injury occurrence. There was no difference in injury occurrence when analyzing rest between games and player position, anatomical body region, or amount of time missed by players.

Key Terms: epidemiology, game schedules, injury, national football league

Clinical Relevance: Game schedules, measured by time between games, affected injury occurrence. This may help teams plan game schedules to reduce the risk of athlete injury and cost to the player and organization.

What is known about the subject: American football has one of the highest rates of injury among sports. Unconventional game schedules have been proposed as a risk factor for injuries in these athletes.

What this study adds to existing knowledge: Game schedules, measured by time between games, affected injury occurrence. Longer rest periods between games resulted in fewer injuries in the 1st and 4th quarters of the season and more injuries in the 2nd and 3rd quarters of the season. Shorter rest periods and regular game schedules did not show higher injury occurrences. Rest periods between games did not affect player position, anatomical region injured, or amount of time missed by players. This may be helpful for teams when planning game schedules to reduce the risk of athlete injury and cost to the player and organization.

INTRODUCTION

Among sports, football has one of the highest injury rates.¹⁻³ Players in the National Football League (NFL) often sustain significant injuries during games. These impact the length of their career,⁴ the outcome of their performance, and the overall success of the team.⁵ For example, anterior cruciate ligament (ACL) injuries are common in the NFL and result in an inability to play the remainder of the season and entail a long rehabilitation.⁶ Interestingly, players who have ACL injuries in the NFL earn ~\$2M less in the 4 years following the injury, and 21-37% of NFL players who injured their ACL do not return to play (RTP) another game.⁷ In addition, Achilles tendon ruptures are a growing trend in football with an average recovery time of 375 days.^{2,8} American football has also been associated with one of the highest incidences of traumatic brain injury of all sports with concussions being one of the most frequent injuries occurring, leading to expensive league rule and policy changes.⁹

With high injury rates, research has examined risk factors for injuries in the NFL.^{10,11} Proposed risk factors include time in season, altitude, temperature, time zone, distance traveled to game, playing surface, and fatigue.^{10,11} Along with playing one game per week, NFL athletes practice up to 5 days a week.⁵ Jet lag from travel along with increased amounts of exercise can lead to central nervous system fatigue, which may affect player performance, and increase risk of sustaining injuries during a game.¹² Dependent on the day of the week of a scheduled game, the player may be more fatigued from lack of adequate rest and recovery from a prior game.² Additionally, NFL players can be deconditioned, resulting in overtraining, leading to injuries in the season.¹²

In 2006, modified game schedules were introduced in the NFL, beginning with the addition

of Thursday night football games. Schedules were again altered in 2008 with elimination of many Saturday night games.¹³ A concern was that unconventional game schedules, or shorter time between games, could lead to increased injury risk in athletes.^{14,15} Most games are played on Sunday with a smaller number of games on weekdays. Little is known on the effect of shortened rest periods due to playing on a weekday rather than on Sunday. To our knowledge, few studies have attempted to look at this.^{14,16} Perez et al. investigated the effect of time between games on in-game injury rates in the NFL and found short rest periods between games were not associated with increased injury rates. Quarterbacks were the only position with more injuries with shortened rest periods between games, however this finding was not significant and was underpowered.¹⁴ They concluded future research correlating rest and quarterback injury and possible causal effects of rest time on injury are warranted. Their study only looked at in-game injury rates, which could have led to underreported injuries from not taking practices or less severe injuries (not resulting in stoppage of play) into account. Lawrence et al. also examined the effect of time between games on injury rates, utilizing publicly available injury reports and found no correlation between injury risk and time in season; however, this was only over two player seasons.¹⁶ They utilized publicly available injury reports, not official NFL gamebooks. Unconventional schedules may create challenges for teams and players with shorter recovery times, decreased preparedness, and condensed travel schedules, possibly affecting their health, performance, and injury occurrence. Game schedules are a concern in other sports as well. The interval between games is associated with injury risk in other sports such as professional soccer, professional field hockey, and within the National Basketball Association (NBA).^{15,17,18} Despite several studies documenting the prevalence of specific injury types in the NFL,¹⁹ there is more evidence needed documenting the effect of rest between games and injury occurrence, as well as patterns of injury. This information could provide insight into the influence of future interventions for NFL injury prevention and game schedule planning.²⁰

The primary aim of this study was to determine if unconventional game schedules, measured by time between games, were associated with injury occurrence, time missed, body part injured, and player position in the NFL. It was hypothesized that less rest time between games would increase injury occurrence.

METHODS

A thorough online review was conducted by two co-authors to document NFL injuries during the 2012-2013 to 2016-2017 seasons. The online information consisted of player news and team injury reports from a variety of sources that included Pro Football Reference (PFR), Rotoworld.com, NFL.com, ESPN.com, SBNation.com, and SI.com as well as each team's local sports blogs. Injury occurrence was defined as requiring physician referral, advanced imaging, missed practice or game, or if emergency care was provided. Injury information was supplemented by searches on Google.com with search terms incorporating player name, team, and year of injury. Weekly injury reports and team injury reserve lists were utilized to identify players who sustained injuries. Injuries were confirmed by monitoring official injury report sites that use the information from weekly injury reports from NFL teams, following previously published methods.²¹ No institutional review board approval was needed, as the data is publicly available.

Each team's schedule information was gathered through PFR and the official team websites. Annual team schedules and location of each game were recorded to determine the home team and the day of the week a game was played. Through the online search and reports, additional player-specific details including team, position, and date of injury were gathered. Player position groups were defined as offensive linemen, defensive lineman, quarterbacks, offensive backs (running backs and full backs), wide receivers, tight ends, defensive backs, linebackers, and special teams (kickers, long-snappers, punters, and special teams).^{22,23} The games recorded consisted of the NFL regular season (16 games and 1 bye week for each team, played during a 17-week stretch).

The date was recorded for each injury. Because of the lack of regular interval rest before other games and because players would have had to suffer their injury from either the previous season, offseason, training camp (including practices and preseason games), or during the limited practices leading up to the opening game, exclusion criteria included injuries sustained during week 1. Injuries sustained outside of football activities were eliminated and removed from the data set. Descriptive statistics looking at the actual time between the game in which there was an injury, and the date of the previous game (days between games) was calculated. Further analysis characterizing the injuries by actual days between games, (classified as short: <7 days, regular: 7 days, or long: >9 days), time in the season, (broken up by both regular-season weeks and quarters of the season), and player position details were calculated. Anatomical location of injury was broken down categorically as head, core, upper or lower extremity, and undisclosed injuries. Amount of time missed by players was grouped as 0-2 weeks, 3-4 weeks, 1-2 months, >2 months.

Statistical analyses performed include chi-square to determine significance between all variables. Post hoc chi-square was used to determine true relationship between variables. Chi-square cut offs for statistical significance utilizing degrees of freedom were determined in accordance with Schield et al.²⁴ All calculations were performed in JMP 14 Pro (Statistical Analysis System, Cary, NC). Significance was set *a priori* at $\alpha < 0.05$.

RESULTS

There were a total of 4,228 injuries observed from the 32 NFL teams across the 5 player seasons. There were 1,131 injuries in the first, 972 in the second, 946 in the third, and 1,179 in the fourth quarter of the season, with a median of 255 injuries per week. Game schedules in the NFL, measured by time between games, did effect injury occurrence. To determine effects of time off between games on injury occurrence, a chi-square test was conducted with quarter of season by game day injury as categorized by short rest: <7 days, regular: 7 days, or long rest: >9 days. There was a statistically significant higher frequency of injuries in the second ($\chi^2=19.321, p<0.05$) and third quarters of the season ($\chi^2=57.475; p<0.05$) when there was a longer rest period (>9 days) between games (**Table 1**). Longer rest periods were associated with higher injuries mid-season; but statistically significantly fewer injuries at the beginning ($\chi^2=28.87, p<0.05$) and end ($\chi^2=37.731, p<0.05$) of the season ($p<0.001$; **Table 1**). Shorter rest periods and regular game schedules did not show a statistically significant difference in injury occurrence when analyzed by quarter of the season ($p<0.001$). When broken down by game week (1-16), there was no significant difference in injury occurrence regardless of short, regular, or long periods between games ($p<0.001$; **Table 2**).

TABLE 1. Number of Injuries by Days between Games in each Quarter of the Season during the 2012-2016 National Football League Regular Season

Days between games		<7 Days	7 Days	>9 Days	Total	
		Quarter of the Season	1	# Injuries	111	701
	Expected		126.4	624.6	129.0	
	Cell χ^2		1.9	9.3	28.9 † ↓	
2	# Injuries		134	643	195	972
	Expected		139.6	689.9	142.5	
	Cell χ^2		0.2	3.2	19.3 *↑	
3	# Injuries		133	585	228	946
	Expected		135.9	671.4	138.7	
	Cell χ^2		0.1	11.1	57.5 *↑	
4	# Injuries		193	893	92	1178
	Expected		169.2	836.1	172.7	
	Cell χ^2		3.4	3.9	37.7 † ↓	
Total Injuries		571	2822	583	3976	

Abbreviations: *Days between Games*, (<7 Days = *Short*), (7 Days = *Regular*), (>9 Days = *Long*).

*↑ indicates a statistically significant increase for cell χ^2

† ↓ indicates a statistically significant decrease for cell χ^2

Higher values of a Cell χ^2 equate to higher contribution of significance to the overall result.

TABLE 2. Number of Injuries by Days between Games during each Regular Season Week during the 2012-2016 National Football League Seasons

Days between Games		<7 Days	7 Days	>9 Days	Total
1	# Injuries	0	0	1	
	Expected	0.1	0.7	0.1	1
	Cell χ^2	0.1	0.7	5.0	
2	# Injuries	48	233	23	
	Expected	43.7	215.8	44.6	304
	Cell χ^2	0.4	1.4	10.4	
3	# Injuries	36	262	18	
	Expected	45.4	224.3	46.3	316
	Cell χ^2	1.9	6.	17.3	
4	# Injuries	27	206	26	
	Expected	37.2	183.8	38.0	259
	Cell χ^2	2.8	2.7	3.8	
5	# Injuries	31	157	45	
	Expected	33.5	165.4	34.2	233
	Cell χ^2	0.2	0.4	3.4	
6	# Injuries	33	155	51	
	Expected	34.3	169.6	35.0	239
	Cell χ^2	0.1	1.3	7.3	
7	# Injuries	41	175	54	
	Expected	38.8	191.6	39.59	270
	Cell χ^2	0.1	1.4	5.2	

Week of Season

	# Injuries	29	156	45	
8	Expected	33.0	163.2	33.7	230
	Cell χ^2	0.5	0.3	3.8	
	# Injuries	25	131	43	
9	Expected	28.6	141.2	29.2	199
	Cell χ^2	0.4	0.7	6.5	
	# Injuries	19	143	75	
10	Expected	34.0	168.2	34.8	237
	Cell χ^2	6.6	3.8	46.6	
	# Injuries	33	146	59	
11	Expected	34.2	168.9	34.9	238
	Cell χ^2	0.0	3.1	16.6	
	# Injuries	56	165	51	
12	Expected	39.0	193.0	39.9	272
	Cell χ^2	7.3	4.1	3.1	
	# Injuries	41	216	39	
13	Expected	42.5	210.1	43.4	296
	Cell χ^2	0.1	0.2	0.4	
	# Injuries	30	200	19	
14	Expected	35.8	176.7	36.5	249
	Cell χ^2	0.9	3.1	8.4	
	# Injuries	34	248	18	
15	Expected	43.1	212.9	44.0	300
	Cell χ^2	1.9	5.8	15.4	

	# Injuries	88	229	16	
16	Expected	47.8	236.4	48.8	333
	Cell χ^2	33.8	0.2	22.1	
	Total Injuries	571	2822	583	3976

Abbreviations: *Days between Games*, (<7 Days = *Short*), (7 Days = *Regular*), (>9 Days = *Long*). Higher values of a Cell χ^2 equate to higher contribution of significance to the overall result.

Subgroup analysis revealed no significant difference in injury occurrence when comparing player position and rest between games ($\chi^2 > 25$, $p < 0.05$; **Table 3**). When analyzing anatomical location and rest between games, head, core, and upper and lower extremities had the same susceptibility to being injured regardless of time between games ($\chi^2 > 12$, $p = 0.001$; **Table 4**). Similarly, rest between games had no effect on amount of time missed by players ($\chi^2 > 12$, $p = 0.040$; **Table 5**).

TABLE 3. Number of Injuries by Player Position and Days between Games during the 2012-2016 National Football League Regular Seasons

Days between games		<7 Days	7 Days	>9 Days	Total	
Player Position	DB	# Injuries	145	603	124	
		Expected	125.2	618.9	127.9	872
		Cell χ^2	3.1	0.4	0.1	
	DL	# Injuries	82	398	86	
		Expected	81.3	401.7	83.0	566
		Cell χ^2	0.0	0.0	0.1	
	LB	# Injuries	82	432	93	
		Expected	87.2	430.8	89.0	607
		Cell χ^2	0.3	0.0	0.2	
	OB	# Injuries	60	285	58	
		Expected	57.9	286.0	59.1	403
		Cell χ^2	0.1	0.0	0.0	
	OL	# Injuries	78	439	82	
		Expected	86.0	425.1	87.8	599
		Cell χ^2	0.7	0.5	0.4	
	QB	# Injuries	23	94	21	
		Expected	19.8	97.9	20.2	138
		Cell χ^2	0.5	0.2	0.0	

ST	# Injuries	1	22	2	25
	Expected	3.6	17.7	3.7	
	Cell χ^2	1.9	1.0	0.8	
TE	# Injuries	34	229	38	301
	Expected	43.2	213.6	44.1	
	Cell χ^2	2.0	1.1	0.9	
WR	# Injuries	66	320	79	465
	Expected	66.8	330.0	68.1	
	Cell χ^2	0.0	0.3	1.7	
Total Injuries		571	2822	583	3976

Abbreviations: *Days between Games*, (<7 Days = Short), (7 Days =Regular), (>9 Days =Long).
Abbreviations: Player Position- DB, Defensive Back; DL, Defensive Lineman; LB, Linebacker; OB, Offensive Backs (Running Backs, Full Backs); OL, Offensive Lineman; QB, Quarter Back; ST, Special Teams (Kickers, Punters, Long Snappers, Special Teams); TE, Tight End; WR, Wide Receiver.
Higher values of a Cell χ^2 equate to higher contribution of significance to the overall result.

TABLE 4. Number of Injuries by Anatomical Location and Days between Games during the 2012-2016 National Football League Regular Seasons

Days between games		<7 Days	7 Days	>9 Days	Total	
Anatomical Location	LE	# Injuries	422	1902	378	2702
		Expected	388.0	1,917.8	396.2	
		Cell χ^2	3.0	0.1	0.8	
	Head	# Injuries	44	292	72	408
		Expected	58.5	289.6	59.8	
		Cell χ^2	3.6	0.0	2.5	
	UE	# Injuries	58	410	76	544
		Expected	78.1	386.1	79.8	
		Cell χ^2	5.2	1.5	0.2	
Core	# Injuries	46	206	50	302	
	Expected	43.7	214.3	44.3		
	Cell χ^2	0.2	0.3	0.7		
Undisclosed	# Injuries	1	12	7	20	
	Expected	2.9	14.2	2.9		
	Cell χ^2	1.2	0.3	5.6		
Total Injuries		571	2822	583	3976	

Abbreviations: *Days between Games*, (<7 Days = Short), (7 Days =Regular), (>9 Days =Long).
Abbreviations: Anatomical Location- LE, Lower Extremity (hip, knee, ankle, foot); Head, Head (concussion, head, neck); UE, Upper Extremity (shoulder, elbow, wrist, hand, finger); Core, Core (abdomen, pelvis, back, rib); Undisclosed, injury recorded but not specified.
Higher values of a Cell χ^2 equate to higher contribution of significance to the overall result.

TABLE 5. Number of Injuries and Amount of Time Missed by Days between Games during the 2012-2016 National Football League Seasons

Days between Games		<7 Days	7 Days	>9 Days	Total
0-2 weeks	# Injuries	351	1707	319	2377
	Expected	341.5	1,686.9	348.6	
	Cell χ^2	0.3	0.2	2.5	
3-4 weeks	# Injuries	91	517	116	724
	Expected	104.0	513.8	106.2	
	Cell χ^2	1.6	0.0	0.9	
1-2 months	# Injuries	68	291	84	443
	Expected	63.6	314.4	65.0	
	Cell χ^2	0.3	1.7	5.6	
>2 months	# Injuries	62	306	64	432
	Expected	61.9	305.9	63.2	
	Cell χ^2	0.0	0.0	0.0	
Total Injuries		572	2821	583	3976

Abbreviations: *Days between Games*, (<7 Days = *Short*), (7 Days = *Regular*), (>9 Days = *Long*). Higher values of a Cell χ^2 equate to higher contribution of significance to the overall result.

DISCUSSION

Since the NFL has one of the highest rates of injuries among sports and the effect of shortened or lengthened rest periods from playing on a weekday versus the weekend has not been thoroughly studied, this study is highly valuable. The primary purpose of this study was to determine if there was an association between injuries and rest periods between games, or unconventional game schedules. Some propose that shorter rest breaks between games could lead to higher injury rates in the NFL¹² from associations between fatigue, overuse, and muscle injuries,²⁵ however this has not been validated.

Players argue a shortened rest period remains a concern for player safety and suggest a shortened week reduces preparation time and increases injury risk.²⁶ Previous research that documents the association of myofascial injuries, muscle injuries, and muscle fatigue support their findings.²⁷ In our study, shorter rest periods and regular game schedules did not

show a statistically significant difference in injury occurrence. This agrees with existing literature which also failed to observe increased injury rates with shortened rest periods.^{14,16,28,29} Perez et al. found significantly lower injury rates when playing with shorter rest breaks and longer rest breaks compared to regular schedules.¹⁴ Lawrence et al. showed no correlation between injury risk and time in season.¹⁶ Additionally, Teramoto et al. found no significant association between rate of concussion and unconventional game schedules in the NFL.¹⁵ Similarly, the NFL released statistics finding the rate of game injuries on Thursdays similar or even lower than the rate on Sunday games.³⁰ Some medical reports also suggest that Thursday night football, requiring a shortened week, was not associated with increased injury rates.³¹ Despite this, our data did reveal the time between games had significance on the occurrence of injuries. Longer rest periods between games were linked with increased injury occurrence in the 2nd and 3rd quarters of the season but significantly fewer injuries in the 1st and 4th quarters of the season. This data differs from Perez et al. who found significantly lower rates when playing with shorter rest breaks and longer rest breaks compared to regular schedules.¹⁴ More data on injuries by game schedules is needed to increase statistical power and warrants future analysis.

In this study, longer rest periods between games were linked with increased injury occurrence in the 2nd and 3rd quarters of the season but significantly fewer injuries in the 1st and 4th quarters of the season. This could occur if players come into the season deconditioned, requiring more time for recovery in the beginning of the season, thus needing additional rest breaks between games to be prepared, benefiting from longer rest time between games. Additionally as the season nears the end, players may: 1) become physically or mentally fatigued,³² or 2) experience additional exertion and need for high performance from high stake games,³² requiring additional recovery days to keep injuries down. Higher injury occurrence midseason when there were longer rest breaks between games may be explained by 1) workload differences that may contribute to injury timing,³³ 2) decreases in training demand with less time for strength and movement training and more sports specific training during this time, or 3) possibly due to bye weeks beginning week four followed by a subsequent intense week or two at higher game speeds, acceleration, deceleration, or contact hits in these players.³³ Although researchers have attempted to investigate fatigue as a risk factor for injuries, the literature is varied in regards to their findings.^{34,35} It remains unclear whether injuries are from muscle fatigue or other factors (i.e. mental, emotional, performance demand). Other considerations that could influence injury risk include minutes played, stress level, age, or experience. Future research is needed to elucidate why more injuries occurred with longer rest breaks during the 2nd and 3rd quarters of the season, but significantly fewer injuries were observed at the beginning and end of the season.

Subgroup analysis was used to determine if time between games was associated with body part injured, player position, and time missed in the NFL. Baseline information on injury occurrence and injury patterns in the NFL over a 5-year period from 2012-2017 was analyzed and a total of 4,228 injuries were evaluated. When analyzing anatomical location and rest between games, head, core, and upper and lower extremities had the same susceptibility to being injured regardless of time between games (**Table 4**). This is in agreement with Perez et. al, who found no significant difference in type of injury players sustained in relation to rest when analyzing official NFL game books.¹⁴ By obtaining similar

results, this provides credibility to alternate methods utilized to gather information from analysis of varying databases. The current study showed 68% of injuries occurred in the lower extremity, 13.7% in the upper extremity, 10.3% in the head, 7.6% in the core, and 0.5% undisclosed (**Table 4**). Similar to other epidemiologic studies in football,^{16,20,29} lower extremity injuries were most common. Lawrence et al. reported knee injuries were observed most, followed by ankle, hamstring, shoulder, and concussions,^{20,36} similar to the current report. Other published studies confirmed similar anatomical injury results reported in the NFL,^{3,37} soccer,³⁸ rugby,³⁹ and ice hockey leagues.⁴⁰

Data revealed no significant difference in injury occurrence when comparing player position and rest between games (**Table 3**). Every position was susceptible to injury regardless of time between games, showing time off may be generalizable to all players regardless of position. Trends showed defensive backs (21.9%) were injured the most followed by linebackers (15.3%), offensive lineman (15.1%), defensive lineman (14.2%), and wide receivers (11.7%) (**Table 3**). Perez et al found tight ends, full backs, and linebackers had a lower rate of injuries with short rest between games; quarterbacks had a nonsignificant, higher rate with shortened rest, however the analysis was underpowered.¹⁴ Differences in injuries by position could be due to workload differences at these positions including changes in game speeds, acceleration, deceleration, pivoting, cutting, and contact hits in these players.³³ A study by Dodson et al. found that wide receivers and tight ends, as well as line backers, half and full backs were at higher risk for ACL injuries.⁴¹ Krill et al. found that defensive players sustained the majority of Achilles tendon ruptures in the NFL.²¹ Despite having different physical and athletic requirements, player position did not appear to modify the effect of time between games on injury rates. Rest time between games equally affected all player position types in our study. Similarly, rest between games had no effect on amount of time missed by players (**Table 5**). When broken down (0-2 weeks, 3-4 weeks, 1-2 months, >2 months), time missed was not different based on time between games.

CONCLUSION

This study suggests a significant relationship between amount of rest between games and observed injuries in the NFL. Long rest periods between games in the 2nd and 3rd quarters of the season were associated with higher injury occurrence but lower injury occurrence in the 1st and 4th quarters of the season. Shorter rest periods and regular game schedules did not show an association with increased injury occurrence in the NFL. There was no difference in injury occurrence when analyzing rest between games and player position, anatomical body region, or amount of time missed by players. These findings could be useful for team staff and medical professionals in the NFL to plan game schedules and attempt to limit the negative effects injuries have on teams and players. In addition, this data demonstrates that season fatigue does not lead to increased rates of injury.

LIMITATIONS

In this study, we relied on public website data for injury information, since we did not have access to the NFL injury surveillance system, therefore there is possible injury information not available to us for analysis in this study. This could have led to overreporting total injuries by including injuries sustained in practice as well as possible reporting bias because of reporting variability from team-to-team. Although our study considers heterogeneity in

team practice schedules and player exposures, it paints a strong picture of actual injuries that occur over time, not just what is reported in a game. There can be discrepancies in reporting injury data from one team to another. While teams can be fined for providing false information, these fines are rare. Despite not having paid access to official NFL game books, our results produced similar findings to a recently published study that had this access¹⁴ providing credibility to alternate methods and resources for obtaining similar data. Publicly reported injuries on multiple sites likely produced consistent results regarding association of game schedules and injuries with data similar to the NFL injury surveillance system. Counting the number of injuries in a given season is important in understanding how effective new NFL rules have been on player safety but there is no standard measure of seriousness of injury. Medical records are not released to the public for justifiable reasons but even if released, there is no medical consensus on injury severity.⁴² Injury data was limited to anatomic location, however specific diagnosis, severity, injury history, and skill level information was not available. We were unable to consider contact versus non-contact injuries as this data was extremely challenging to accurately determine with a lack of video analysis of all injuries and that many of the injuries were chronic in nature. The NFL has evolved significantly with faster and stronger players. This results in players with more momentum when they make contact with another athlete or the ground, increasing the likelihood of more serious injuries. Additionally, when observing trends, the NFL has become a more offensive-dominant game, leading to more plays per game and more players involved per play.^{43,44} Future research with focused analyses on these specific criteria is needed. The number of games played on weekdays is small in comparison to Sunday games. Up to 15 different games occur on Sunday, while only 1-5 games are played on weekdays, showing the need for additional data on the effects of playing on a weekday. In this study, only NFL injuries were observed. Consequently, the results could be different for other sports requiring different game time or total time in season or frequency of competitions. Furthermore, investigation of time played in game or time in season and its effects on injury occurrence in different sports is recommended,³⁵ as research is emerging in other sports indicating a relationship between stage of the season and injury risk, specifically in soccer and field hockey.^{17,45} This study is observational; therefore, we cannot draw causal inferences of injury and game schedules from our data. For future investigations, researchers should observe different types of injury occurrences and identify whether age and sex apply to these trends.⁴⁶ More data on injuries by game schedules is needed and warrants future analysis. The findings of this study could be useful for team medical professionals in the NFL in terms of monitoring injuries and determining game schedules. By determining appropriate time off between games, this could decrease the cost to teams and players and could keep athletes at a lower risk of developing a season or career-ending injury.

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COMPETING INTERESTS

The authors have no conflicts of interest to disclose.

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