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Epidemiology of National Football League Training Camp Injuries From 1998 to 2007

Brian T. Feeley,* MD, Steve Kennelly,[†] ATC, Ronnie P. Barnes,[†] ATC, Mark S. Muller,* MD, Bryan T. Kelly,* MD, Scott A. Rodeo,* MD, and Russell F. Warren,*[‡] MD
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Background: Football is one of the leading causes of athletic-related injuries. Injury rates and patterns of the training camp period of the National Football League are unknown.

Hypothesis: Injury rates will vary with time, and injury patterns will differ between training camp practices and preseason games.

Study Design: Descriptive epidemiology study.

Methods: From 1998 to 2007, injury data were collected from 1 National Football League team during its training camp period. Injuries were recorded as a strain, sprain, concussion, contusion, fracture/dislocation, or other injury. The injury was further categorized by location on the body. Injury rates were determined based on the exposure of an athlete to a game or practice event. An athlete exposure was defined as 1 athlete participating in 1 practice or game. The injury rate was calculated as the ratio of injuries per 1000 athlete exposures.

Results: There were 72.8 (range, 58-109) injuries per year during training camp. Injuries were more common during weeks 1 and 2 than during weeks 3 to 5. The rate of injury was significantly higher during games (64.7/1000 athlete exposures) than practices (12.7/1000 athlete exposures, $P < .01$). The rate of season-ending injuries was also much higher in games (5.4/1000 athlete exposures) than practices (0.4/1000 athlete exposures). The most common injury during the training camp period was a knee sprain, followed by hamstring strains and contusions.

Conclusion: Muscle strains are the most common injury type in practices. Contact type injuries are most common during preseason games, and the number of significant injuries that occur during preseason games is high.

Keywords: National Football League; injury; concussion; hamstring

Football is an extremely common sport in the United States with more than 60 000 collegiate athletes and 1 million high school athletes participating in 2005.^{17,18} Each National Football League (NFL) team holds an annual training camp at the start of the season to prepare for the upcoming regular season. The training camp consists of 1 to 2 practices daily for approximately 5 weeks, as well as 4 to 5 preseason "practice" games. The practices consist of conditioning activities, position-specific drills, and limited-contact scrimmages. The training camp serves as the primary determinant for which players will participate in the regular season, as those who do not perform well are released from the team. It also serves as the primary time for conditioning athletes for the rigors of the upcoming professional season.

Many previous studies have focused on specific injury types, such as fractures, ankle sprains, concussions, or anterior cruciate ligament (ACL) injuries in football players^{6,9,10,15,16,20-22,24} or examined injury patterns in college or high school football players.^{2,23} Brooks et al^{4,5} found that training injuries in professional rugby are responsible for a loss of 5% of the players during the season and higher rates of injuries due to match play. Preseason training injuries accounted for a high percentage of all the training injuries in these studies. However, the authors are not aware of any study examining injury patterns during the NFL preseason. Injuries that occur before the season are often detrimental to the outcome of the season for the team, especially if key players are injured.

The purpose of this study was to determine the injury patterns that occur during an NFL team's training camp. We hypothesized that injury rates would be higher earlier in training camp because the athletes were not as well conditioned. We also hypothesized that injury patterns would differ between practices and preseason games. The information on injury patterns allows for the prediction of injury rates and recovery times from multiple types of injuries

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incurred during the NFL training camp. Understanding the prevalence and trends of specific injuries during the training camp period may be useful in designing injury prevention strategies to limit future injuries during preseason.

METHODS

The injury data presented were prospectively collected from 1 NFL team's training camps from 1998 to 2007. A practice or game injury was defined as an event that occurred as a result of participation in an organized practice or game, required medical attention by an athletic trainer or physician, and resulted in restriction of the athlete's participation for at least 1 day beyond the day of injury. The injury was diagnosed and classified by the senior author. Injuries were entered into a database by one of the athletic trainers on a daily basis. All players who reported to training camp at the start of camp or were added as free agents during the time of training camp were included in the study. Players were excluded from this study if they had a preexisting injury at the opening of training camp or if their data were incomplete for any reason. Thirty-two players were excluded, 5 for incomplete data and 27 for a preexisting injury. Approval for the study was obtained from the NFL and the institutional review board.

Injury Classification

Injuries were classified by the training or medical staff and categorized as a strain, sprain, concussion, contusion, fracture/dislocation, or other injury. The injury was further categorized by location on the body (eg, shoulder, knee, hip, ankle). For the purpose of data collection, multiple types of injury were grouped under a single injury classification. For example, both ACL and medial collateral ligament (MCL) sprains were classified under knee sprains, and high and low ankle sprains were classified under ankle sprains. Shoulder sprains included all acromioclavicular joint sprains as well as shoulder injuries that were not classified as a dislocation or subluxation. Contusions included soft tissue (ie, quadriceps) and bony contusions (ie, knee or rib) in any anatomic location.

Injury Severity

The length of time missed was calculated by determining the number of days an athlete missed after a specific injury. Athletes were categorized as "out" if they were unable to perform any team activities during practice and "limited" if they could perform only individual drills. The decision of whether an athlete was limited or out was made by the medical and training staff on a daily basis. The total days missed was a sum of the days an athlete was out and limited from participating in practice. In addition, injury severity was divided into 4 groups (A to D) based on the amount of time missed. An injury received an A grade if the athlete missed less than 7 days; B, 7 to 14 days; and C, more than 14 days. All athletes who received an A, B, or C grade were able to return to play. For the purpose of this study, a grade D, or major injury, was defined as an injury

event that resulted in the athlete needing surgery that required more than 8 weeks of restricted activity or being placed on injured reserve. Athletes who were placed on injured reserve or required surgery were excluded from the remainder of training camp. An athlete placed on injured reserve during the preseason missed the entire camp period and, in most cases, the entire season.

Calculation of Injury Rates

To control for the different numbers of practices and games yearly, the injury rates were determined based on the exposure of an athlete to a game or practice event. An athlete exposure (AE) was defined as 1 athlete participating in 1 practice or game.²³ Exposure was estimated by the total number of athletes in camp at any time minus the number of athletes who were out and limited. The injury rate was calculated as the ratio of injuries per 1000 AE. Injury proportions were determined between practices and games with a 95% confidence interval (CI). Statistical analyses included the *t* test and a χ^2 test with Yates correction for values less than 5. Risk ratios were calculated using the team as a control group with a 95% CI. Statistical significance was determined as $P < .05$.

RESULTS

During the 10-year period reviewed, 696 different players participated in the NFL training camp, with approximately 90 players in camp each year. The average age of the players was 25.8 years (range, 21.2-41.0 years). There were 41 games and 427 practices. There were 42 030 AEs during the 10-year period, with 728 injuries during that time (Table 1). A total of 489 injuries occurred in practices and 239 during preseason games. The overall rate of injury was 17.3 per 1000 AE. The injury rate was significantly higher in preseason games (64.7/1000 AE) compared with practices (12.7/1000 AE, $P < .001$). The average of days missed because of an injury was 6.4 days. Approximately 3.2 days missed were classified as "out," and 3.2 days missed were classified as "limited." There were a total of 35 major injuries, classified as injuries that resulted in surgery or a player being placed on injured reserve for the year. The average number of injuries was 72.8 per year. The fewest number of injuries was 58 (1999, 2000), and the most was 109 (2007) (Figure 1).

Timing of Injuries During Training Camp

There were an average of 52.2 injuries per year that occurred during training camp practices with a rate of 1.23 injuries per practice (13.6 injuries/1000 AE). However, the number of injuries that occurred during the weeks of training camp varied considerably. There were significantly more injuries during weeks 1 and 2 than during weeks 3, 4, and 5 (Figure 2A). During this time period, the number of players in camp remained between 80 and 90, as significant cuts were not made until after this time point. In addition, the severity of injury decreased as training camp progressed. The average of days missed due to an injury at practice was

TABLE 1
Total Injuries and Exposures During 10 Years of NFL Training Camp^a

	Practice	Preseason Games	Total
Injuries	489	239	728
Exposures	38 340	3690	42 030
Injury rate/1000 AE	12.7	64.7 ^b	17.3

^aAE, athlete exposure.

^b*P* < .001 vs practice.

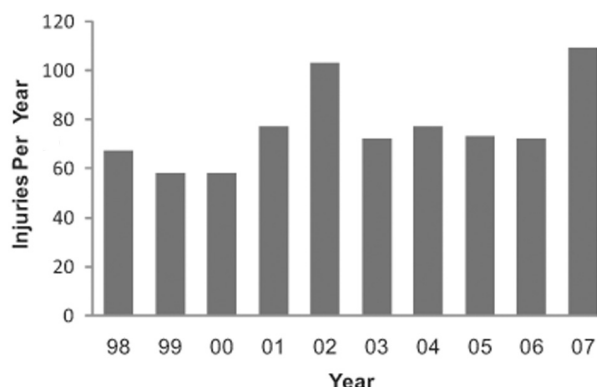


Figure 1. Total injuries that occurred from 1998 to 2007 in 1 NFL training camp.

6.6 days (range, 1-35), with a peak during the first week (n = 7.8) and a nadir during the final week (n = 4.1). The average of days missed due to an injury at practice did not significantly differ between weeks 1 and 2 but was significantly less in weeks 3 through 5 compared with week 1. In addition, there were significantly more minor injuries in weeks 3 to 5 than in weeks 1 and 2, suggesting that more severe injuries occur during the early period of training camp (Table 2). A total of 15 major “grade D” injuries occurred during training camp, 12 of which happened in the first 2 weeks.

Preseason Game Injuries

An average of 24 injuries per year occurred during preseason games, accounting for 31% of all training camp injuries. There were 4 preseason games per year for each year with the exception of 2002, which had 5. The average number of injuries during a game was 5.8 (range, 1-15), for an injury rate of 64.7 injuries/1000 AE. By comparison, the rate of injuries in practices was 13.6 injuries/1000 AE (*P* < .001). There was no significant difference in the number of injuries that occurred between the games (Figure 2B). Although there was a trend toward fewer days missed in game 4 compared with games 1 through 3, this was not significant.

A majority of the injuries from games were classified as minor, or grade A, injuries (60%), similar to the percentage of grade A injuries seen from practice (65%). However, despite the relatively small numbers of games compared with practices during training camp, there were more major (grade D) injuries resulting from games (n = 20) than from practices (n = 15). The rate of grade D injuries per 1000 AE

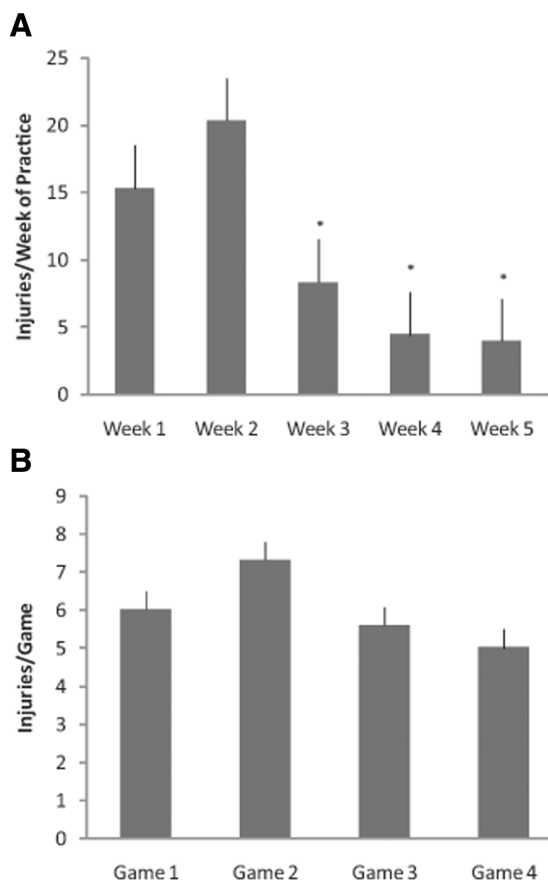


Figure 2. A, injuries per week of training camp. Data shown as the rate of injuries/1000 athlete exposures (AE) that occurred per week during the 10-year period. B, injuries per preseason game. Data shown as the rate of injuries/1000 AE that occurred per game during the 10-year period. **P* < .05 vs weeks 1, 2.

in games was 5.4, compared with only 0.4 in practices (*P* < .0001), which suggests significantly more risk of season-ending injuries in preseason games compared with practices. Despite the increased intensity of preseason games compared with practice, the average of days missed from an injury that did not result in an athlete being placed on injured reserve from a preseason game injury did not significantly differ from an injury that occurred in practice (6.6 days from practice vs 6.4 days from games). Players who were placed on injured reserve were no longer included in the database and not included in the calculation of days lost from training camp practices, as this could falsely lower the number of days lost from injuries incurred from games.

Characteristics of Specific Injuries

The most common injury occurring during the study period was a knee sprain, followed by hamstring strains and contusions (Table 3). The pattern of injuries was different in games compared with practices (Figure 3). Overall, muscle strains were more common in practices (46% of all injuries in practice) than in games (23% of all injuries in games, *P* = .07), and

TABLE 2
Summary of Training Camp Injuries by Week

	Week 1	Week 2	Week 3	Week 4	Week 5	Total
Practice injuries, n	153	203	83	44	39	527
Injuries/exposure in week/1000 athlete exposures	21.2	28.1	11.5 ^a	6.1 ^a	5.4 ^a	13.6
Average injury severity						
Days missed, total	7.8	6.8	5.6 ^a	4.9 ^a	4.1 ^a	6.6
Days "out"	4.4	3.8	2.3 ^a	2.2 ^a	1.1 ^a	3.4
Days "limited"	3.5	3.1	3.3	2.8	2.8	3.2
Injury severity, days (%)						
Grade A (<7 days)	99 (65)	121 (60)	57 (69)	33 (75) ^b	31 (79) ^b	341 (65)
Grade B (7-14 days)	21 (14)	40 (20)	19 (23)	7 (16)	5 (13)	92 (18)
Grade C (14 days)	29 (19)	34 (17)	5 (6)	3 (7)	3 (8)	74 (14)
Grade D (major)	4 (3)	8 (4)	2 (2)	1 (2)	0 (0)	15 (3)

^aP < .01 vs weeks 1 and 2.

^bP < .05 vs weeks 1 and 2.

TABLE 3
Injury Rates of Specific Injuries^a

Injury	Total Occurrences	AE/1000		IRR ^b	95% CI ^c
		in Practice	in Games		
Knee sprain	120	2.12	10.84	5.1	4.8-5.4
Hamstring strain	85	1.79	4.07	2.3	2.1-2.5
Contusion	83	0.92	12.47	13.5	13.3-13.7
Ankle sprain	69	1.10	6.78	6.2	6.0-6.4
Lumbar strain	51	1.17	2.44	2.1	1.9-2.1
Shoulder sprain	52	0.80	5.42	6.8	6.2-7.2
Fracture/dislocation	50	0.67	6.23	9.3	9.1-9.5
Groin strain	34	0.70	1.63	2.3	2.1-2.5
Foot sprain	32	0.52	3.52	6.7	6.4-7.0
Cervical strain	29	0.60	1.36	2.3	2.1-2.5
Hip flexor strain	29	0.65	1.08	1.7	1.4-2.0
Quadriceps strain	28	0.60	1.08	1.8	1.5-2.1
Achilles strain	24	0.55	1.36	2.5	2.0-3.0
Concussion	19	0.17	3.25	18.6	17.8-19.4
Abdominal strain	10	0.17	0.81	4.7	4.3-5.1
Elbow sprain	10	0.10	1.63	16.3	16.0-16.6
Gluteal strain	5	0.12	0.00	0.0	0.0-0.9

^aAE, athlete exposure; IRR, injury rate ratio; CI, confidence interval.

^bIRR comparing rate of injury in games to rate of injury in practices.

^cP = .05.

contact-type injuries such as contusions, concussions, sprains, and fractures/dislocations were more common in games. The rate of strains compared with total injuries stayed relatively constant during the training camp period. Fifty-two percent of the injuries during week 1 were strains, 41% in week 2, 42% in week 3, 48% in week 4, and 41% in week 5. There was no statistical difference between these groups. Over the 10-year collection period, strains represented between 33% and 47% of all injuries on a yearly basis. Sprains represented between 33% and 44% of all injuries yearly.

Contusions were the most common injury incurred in games (12.5 injuries/1000 AE), followed by knee sprains (10.8 injuries/1000 AE) and ankle sprains (7.8 injuries/1000

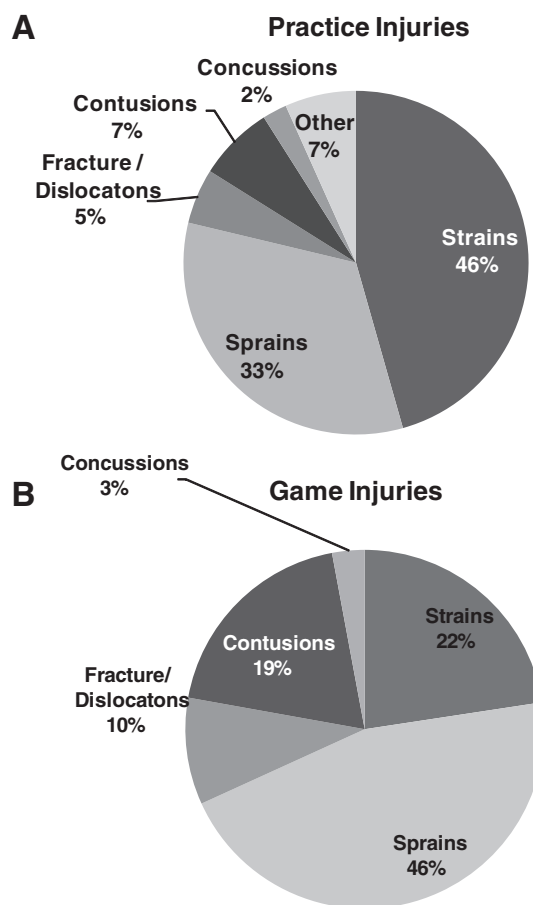


Figure 3. Most common injury diagnoses occurring during NFL training camp in (A) practices and (B) games.

AE). The injuries with the highest rate in practices were knee sprains (3.1 injuries/1000 AE), hamstring strains (2.2 injuries/1000 AE), and hip flexor strains (2.2 injuries/1000 AE). However, all injuries had a higher risk of occurring in games than in practices (Table 3).

The average time lost from a specific injury ranged from 3.2 days for a contusion to 8.8 days for a knee sprain (Table 4).

TABLE 4
Injury Severity of the Most Common Training Camp Injuries

	Achilles Strain	Ankle Sprain	Cervical Strain	Concussion	Contusion	Fracture/ Dislocation	Foot Sprain	Groin Strain	Hamstring Strain	Hip Flexor Strain	Knee Sprain	Lumbar Strain	Quad Strain	Shoulder Sprain
Average days lost	3.8	7.0	6.1	3.7	3.2	7.8	6.1	4.8	8.3	6.6	8.8	4.9	5.4	5.4
Injury severity in practices														
Average days missed, total	7.3	6.1	6.0	6.3	4.1	9.1	7.5	4.3	8.0	6.8	9.0	4.4	5.7	4.5
Average days "out"	4.1	3.0	3.5	3.9	1.3	5.5	4.4	0.9	4.7	3.2	5.1	1.8	3.2	1.2
Average days "limited"	3.2	3.1	2.5	2.4	2.8	3.6	3.1	3.4	3.3	3.6	3.9	2.6	2.5	3.3
Injury severity in games														
Average days missed, total	6.1	8.3	6.3	3.1	3.5	6.3	6.4	7.1	9.5	4.7	8.5	6.8	3.6	6.7
Average days "out"	3.4	3.8	2.4	1.1	1.9	4.1	3.0	3.3	5.1	4.5	5.4	3.1	1.6	2.2
Average days "limited"	2.7	4.5	3.9	2.0	2.7	2.2	3.4	3.8	4.4	0.3	3.1	3.7	2.0	4.5

TABLE 5
Injury Rates by Position^a

	Total Injuries	Injuries/1000 AE	Risk Ratio (95% CI)	Avg Days Lost	Strains, n (%)	Sprains, n (%)	Contusions, n (%)	Fractures/Dislocations, n (%)
Offense	384	2.0	1.05 (1.0-1.1)	6.1	139 (36)	146 (38)	51 (13)	30 (8)
Quarterback	27	1.2	0.63 (0.49-0.82)	5.3	8 (30)	10 (37)	5 (19)	1 (4)
Running back	84	1.9	0.98 (0.9-1.1)	6.8	41 (49)	22 (26)	9 (11)	10 (12)
Wide receiver	103	2.3	1.01 (0.9-1.1)	5.9	41 (40)	33 (32)	15 (15)	8 (8)
Tight end	62	2.7	1.21 (1.16-1.26)	6.9	17 (27)	29 (47)	8 (13)	6 (10)
Offensive line	108	1.6	0.88 (0.80-0.98)	6.4	32 (30)	14 (13)	14 (13)	5 (5)
Defense	358	2.2	1.19 (1.15-1.23)	6.3	143 (40)	137 (38)	30 (8)	24 (7)
Defensive line	116	1.7	0.95 (0.86-1.04)	5.4	47 (41)	45 (39)	8 (7)	6 (5)
Linebacker	103	2.3	1.05 (0.97-1.14)	6.4	48 (47)	37 (36)	8 (8)	6 (6)
Secondary	139	2.6	1.22 (1.18-1.27)	7.2	48 (35)	55 (40)	14 (10)	12 (9)
Punter/kicker	17	0.7	0.41 (0.28-0.61)	6.0	11 (65)	4 (24)	2 (12)	0

^aAE, athlete exposure; CI, confidence interval; Avg, average.

There was no significant difference between time lost for a specific injury that occurred in a game compared with practices, with the exception of concussions, where significantly more time was lost for concussions that occurred during practices.

Injuries by Position

The positions at highest risk for injury were tight end (2.7 injuries/1000 AE) and defensive secondary (2.6

injuries/1000 AE). These positions had a slightly increased risk of injury (1.21 for tight ends; 1.22 for secondary) compared with the team as a control. Quarterbacks, punters, and kickers had the lowest rate of injury (1.2 injuries/1000 AE for quarterbacks; 0.72 injuries/1000 AE for punters/kickers). Defensive players had a slightly higher rate of injury than offensive players (2.2 vs 2.0 injuries/1000 AE). The average of days missed for all injuries was highest for the defensive secondary (7.2 days lost/injury) and least for quarterbacks (5.3 days lost/ injury) (Table 5).

Hamstring injuries were most common in running backs, defensive backs/safeties, and wide receivers, accounting for 22%, 14%, and 12%, respectively, of all injuries in those groups. Knee sprains were most common in offensive linemen (19% of all injuries), followed by wide receivers (16%), tight ends (16%), and defensive backs/safeties (16%). Ankle sprains were most common in linebackers (12%) and defensive linemen (10%).

DISCUSSION

This study is the first study to our knowledge that examines injury rates during NFL training camps. Football remains one of the most popular sports in the United States, albeit with a very high rate of injury among the athletes. Preseason training camp is a critical period of time for athlete conditioning as well as player evaluation. However, it also places players at high risk of injury. The purpose of this study was to determine the trends in injuries that occur during training camp so future studies can focus on strategies to limit these injuries.

Previous studies have examined injury rates in middle school, high school, and collegiate football players.^{1,2,8,23} Early studies suggested that there are between 300 000 and 1.2 million injuries annually during the high school football season.^{17,18} Injury rates have been found to increase as the level of competition increased.^{1,8} Recently, Shankar et al²³ compared injury rates between high school and collegiate football players during 2 seasons. The injury rate in high school practices was 2.56 per 1000 AE and 5.77 per 1000 AE in college. In this study, the injury rate during professional football practice was 13.6 per 1000 AE, more than double that in college.²² Similarly, the injury rate in games also increases from high school, to college, to the professional level. The higher injury rate seen with higher levels of competition may be in part due to the fact that the players are bigger, faster, and more skilled, leading to higher forces during contact activities. However, the increase in the rate of muscular strains—the main injury incurred at all levels during practice—is unclear. One explanation may be the amount of training at each level, leading to overuse-type injuries in the professional athlete. College athletes are limited to 20 hours a week of training, whereas there are no limits on the amount of time a professional football player can spend training, especially during preseason camp. In addition, there may be age-related changes in the muscle-tendon junction that cause the older professional athlete to be at a higher risk of overuse-type injuries, especially after a decade or more of elite training and athletic performance.

Injury rates varied considerably during the 5 weeks of training camp. There were significantly more injuries during the first 2 weeks than during the last 3 weeks of training camp. In addition, the severity of injury—measured in time lost and in number of minor injuries—decreased as the training period progressed. Taken together, these data suggest that injuries are more frequent and more severe during the early period of training camp. Other sports have demonstrated similar injury patterns.¹³ Brooks et al⁴ evaluated training injuries in professional rugby players. They found that the incidence of training injury was significantly higher during

the preseason period than during the first and second parts of the league's season. In our study, the average injury in the early period of training camp resulted in more than 1 week of practice missed, or approximately 20% of the entire training camp. This amount of time lost represents a critical time lost for conditioning for the athlete, as well as evaluation of player personnel. Changes in the training protocols for the early training camp period may allow for a lower rate of injury, which could benefit both the player and coaching staff.

This study demonstrates that the risk of injury was significantly higher in preseason games than in practices. The rate of injury per 1000 AE during games was almost 4 times greater than in practice. The number of injuries resulting in an athlete being placed on the injured reserve or requiring surgery from a game was 13-fold higher than an injury from practice. Although the amount of time lost was not different between practices and games, this is likely due to the fact that once a player was placed on injured reserve, he was no longer counted as missing practices or games in the database. This is a limitation of the study, but the fact that a much higher proportion of players were placed on injured reserve from practice games confirms that more serious injuries occur in these preseason games. Further, the injury rate in this study was higher during the practice games than the injury rate during Division I college football games.² Preseason games clearly place players at risk for significant injury before the start of the regular season. At this time, the incidence of injury in regular season games has not been determined, and therefore it is not known how the rate of injuries in preseason games compares with that of regular season games.

The most common injury experienced during this study period was knee sprain. Knee injuries were the most common injury in practice and the second most common injury in games. This is consistent with previous studies, which found that the knee and ankle were the most commonly affected body parts injured in high school and college football players.²³ Most of the knee injuries were MCL injuries (72%), although there were 6 ACL ruptures that required reconstruction. The average time missed after a knee sprain was almost 9 days, the longest time lost for any specific injury. Conditioning and proprioceptive training offer an avenue that may lead to decreased knee injury rates. Balance training has significantly reduced ACL injuries in male soccer players.⁷ However, it was also associated with an increased risk of major knee injuries in female soccer players as well as overuse injuries in volleyball players in 1 study.¹⁴ More research into preventative training techniques to limit these injuries is needed.

Musculotendon strains were the most common type of injury during preseason practices. The rate of muscle strains did not change during the decade studied, accounting for between 41% and 52% of all injuries. Hamstring injuries were the most common muscle strain as well as the most severe, with an average of 8.3 days lost per event. Hamstring injuries are prevalent at all levels of football,²³ as well as being the most common injury in other contact sports, including Australian football.¹⁹ The cause of the high incidence of hamstring injuries in professional football players is likely multifactorial. As players age, they may be more susceptible

to muscle strains, making these more common in the professional athlete. Previous studies in Australian football have demonstrated that increased age (>25 years) and previous hamstring injury are independent factors that increase the risk of hamstring strains in their athlete population.^{11,12} There are age-related changes at the muscle-tendon junction that are potentially modifiable to reduce injury risk in older athletes and should be considered in the development of injury prevention programs for professional football players. Asklung et al³ found that an eccentric preseason hamstring program improved function and decreased injury rate in professional soccer players, indicating that the addition of specific preseason strength training for the hamstrings may be beneficial to elite professional athletes.

The rate of injury differed considerably by position in this study. Interestingly, tight ends and defensive secondary players had the highest overall rate of injury. The risk of injury at these positions was only mildly increased compared to other positions. These positions may have a higher rate of injury because they emphasize both speed and contact during training camp, whereas other positions focus more on either contact drills or speed drills. Not surprisingly, the positions that are protected from contact during training camp (quarterback, punters, and kickers) had the lowest rate of injury. Previous studies have shown that running backs and linebackers have the highest rate of injury.²³ We had anticipated seeing a difference in injury patterns based on the position played, but this was not clearly seen in this study. Knee sprains represented a higher percentage of injuries in offensive linemen, which is consistent with previous studies.^{2,8,23} Running backs also had a higher rate of hamstring injury compared to other positions, but overall, musculotendon strains occurred at similar rates when comparing contact position players (linemen and linebackers) and skill position players (running backs, wide receivers, defensive secondary). The overall rate of injury, particularly musculotendon strains, may be decreased by increasing precamp conditioning, possibly by adding an eccentric exercise regimen to the precamp and early training camp period.

There are several limitations to this study. First, this study did not differentiate between certain types of injuries within a specific body part. For example, burners were not consistently differentiated from cervical strains, and high and low ankle sprains were not differentiated. This study also did not delineate what type of practice (contact or noncontact) caused an injury. Albright et al² found that scrimmages and contact practices were responsible for a significantly greater risk of injury. Other contact sports, including rugby and Australian football, have been found to have an increased number of training injuries during the latter part of practices.^{4,19}

In conclusion, NFL players are at significant risk for injury during the training camp period, particularly during preseason games. Injuries incurred during this period result in a loss of conditioning time as well as time for evaluation by the coaching staff. Knowledge of injury trends during the training camp period is important to help identify treatment and prevention strategies. This could result in fewer injuries and decreased loss of time during this critical period of the NFL season.

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