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Injuries in Collegiate Wrestling

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ABSTRACT

We evaluated the data of the National Collegiate Athletic Association Injury Surveillance System on collegiate wrestling with a focus on musculoskeletal injuries. Over 800,000 athlete-exposures during an 11-year period compose these data. Findings particular to wrestling and a comparison with other collegiate sports are included. Collegiate wrestling had a relatively high rate of injury at 9.6 injuries per 1000 athlete-exposures. It was second to spring football in total injury rate. Most injuries in this study were not serious, with 6.3% resulting in surgery and 37.6% resulting in a week or more off from wrestling. There was only one catastrophic, nonfatal injury. The knee, shoulder, and ankle were the most commonly injured regions, and injuries to them were often the more serious. Sprains, strains, and contusions were the most common injury types. Takedowns and sparring were the most common activities at the time of injury. Mechanism of injury was evaluated; rotation about a planted foot and contact with environmental objects were identified as areas needing further attention. Illegal action accounted for only 4.6% of injuries in competition. Competition had a significantly higher injury rate than practice, but the injury profiles of these two areas showed both to be equally important. The preseason and regular season had higher injury rates than the postseason, but, again, the injury profiles of these periods were similar. Injury percentages were similar among the 10 weight classes.

Information regarding injuries in wrestling, particularly in recent years, is limited. More specifically, collegiate wrestling has not been extensively studied. There have been studies following individual collegiate teams for several seasons.[6,7] Others have reviewed injuries of age groups other than college, or injuries occurring during specific competitions or training camps.[1–4] There are no previous studies involving many institutions over a long period of time, which would decrease the chance that a single year with an unusually high number of injuries would influence the results. Previous authors have noted a high rate of injuries in wrestling,[1,2,6,9] although most are not serious.[3,4,6,9] A wide variety of injuries has been described.[1] To our knowledge, there has not been a comparison of injury rates in collegiate wrestling with other collegiate sports. The purpose of this surveillance study is to review the data compiled by the National Collegiate Athletic Association (NCAA) Injury Surveillance System. The primary focus is musculoskeletal injuries. Our underlying goal was to establish a better understanding of collegiate wrestling injuries so that directions for further research and strategies for injury prevention can be identified.

MATERIALS AND METHODS

We reviewed the NCAA Injury Surveillance System data on wrestling from 1985 through 1996. This system was developed in 1982 to provide data on injury trends in intercollegiate athletics. Participation is voluntary and data are collected annually from 15% to 20% of schools sponsoring a particular sport. Sampling of institutions is random except for the requirement of a minimum of 15% representation from each of the three divisions and from each of the four geographic regions included. A participating institution submits reports for all defined injuries that occur in a sport throughout a season. Data are recorded by certified and student athletic trainers using descriptive reports for each injury. The system does not identify every injury nationwide; rather, it provides a sampling representative of all NCAA institutions participating in a given sport.

An injury is defined as something that 1) occurs as a result of participation in an organized intercollegiate practice or competition, 2) requires medical attention by a

Conclusions drawn from or recommendations based on the data provided by the National Collegiate Athletic Association are those of the authors based on analysis/evaluations of the authors and do not represent the views of the officers, staff, or membership of the NCAA.

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team athletic trainer or physician, and 3) results in restriction of participation for 1 or more days beyond the day of injury. An athlete-exposure, the unit of risk in the NCAA Injury Surveillance System, is defined as one athlete participating in one practice or competition (with each wrestling match being a competition). Injury rates are injuries in a particular category divided by athlete-exposures in that category. Injury rates are expressed as the number of injuries per 1000 athlete-exposures. Statistical analyses were performed using the chi-square test. Statistical significance was set at $P = 0.05$.

The average number of wrestling teams studied each year was 45, representing 16% of all schools sponsoring the sport. The total number of athlete-exposures studied was 873,479 over the 11 seasons. The sampling of teams was performed as described above with regard to division (1, 2, 3) and geographic region (East, South, Midwest, West). Several items on which we report were tracked for only a portion of the study period. This is noted where necessary throughout the text.

A portion of this review compares wrestling with other sports followed by the NCAA Injury Surveillance System, with data collected in a similar fashion. (Note: some of this comparison of wrestling with other sports is based on information through the 1994 to 1995 season, so the numbers vary slightly from the wrestling data, which were recorded through 1996.)

RESULTS

The combined practice and competition injury rate for wrestling over the 11 seasons studied was 9.6 per 1000 athlete-exposures (a total of 8425 injuries). Wrestling was second to spring football for the highest total injury rate (Fig. 1). Among all reported wrestling injuries through 1996, 37.6% resulted in 7 or more days time loss. Wrestling was compared with other sports regarding this parameter (percentage of injuries resulting in 7 or more days time loss among all injuries in a particular sport) through the 1994 to 1995 season and was third (39%), behind spring football (43%) and women's gymnastics (40%). Among all reported wrestling injuries, 6.3% required surgery. In comparison with other sports regarding the percentage of injuries requiring surgery through the 1992 to 1993 season, wrestling was fifth (6.1%), behind women's gymnastics (8.9%), womens' basketball (8.7%), spring football (8.3%), and football (6.7%). (Wrestling was tied with mens' gymnastics.) With catastrophic injury defined as being life altering or causing permanent disability; there was one catastrophic, nonfatal injury (details not specified) in the 873,479 athlete-exposures.

Table 1 lists the top 10 most commonly injured body regions over the 11 seasons. During the study period, 42 different body parts were injured. For every season, the most commonly injured body part was the knee, with an average over the 11 seasons of 21% of all reported injuries. From 1989 through 1995 more detailed information was collected on knee injuries than on injuries to other body parts. Over these seasons, 30% of the knee injuries involved collateral ligaments; 15% a torn meniscus; 6% the patella, the patellar tendon, or both; 5% the ACL; and 1% the PCL. For every season, the shoulder was the second most commonly injured body part, averaging 14% of all injuries. For all but two seasons, the ankle was the third most commonly injured, averaging 9%. Further anatomic detail on the shoulder and ankle injuries was not analyzed.

Of all the injuries resulting in 7 or more days off, 30% involved the knee, 15% involved the shoulder, and 8% involved the ankle. An array of injuries was listed after these top three. Of all injuries resulting in surgery during the regular or postseason, 65% involved the knee, 9% involved the shoulder, and 4% each involved the ear and nose. Various other body parts each involved less than 2%

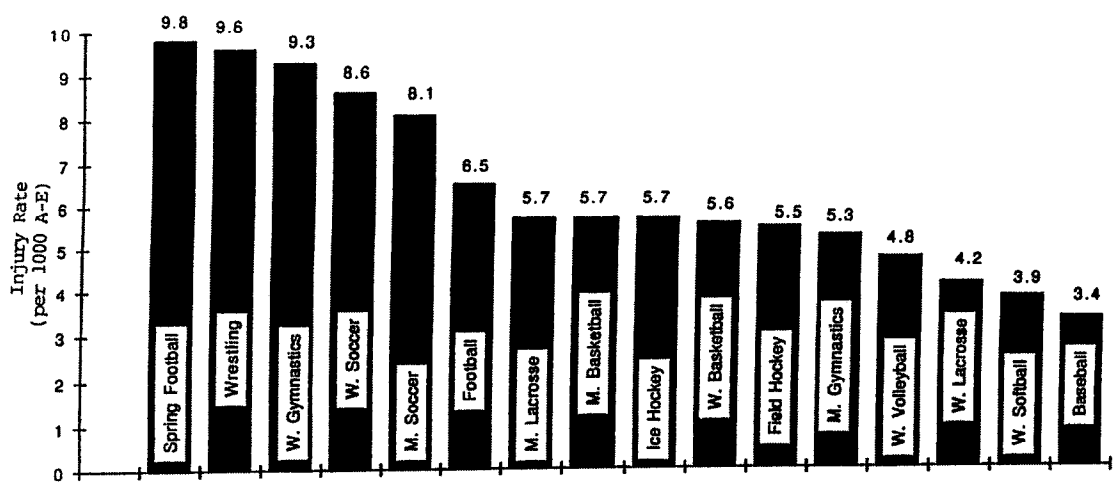

Figure 1. Total (practice and game) injury rate across all sports analyzed in the NCAA Injury Surveillance System through the 1995 to 1996 season. A-E, athlete-exposures. (Courtesy of the NCAA Injury Surveillance System.)

TABLE 1
Regions Most Commonly Injured

Body region	Percent of total injuries (all seasons)
Knee	21
Shoulder	14
Ankle	9
Neck	6
Face	5
Ribs	5
Elbow	5
Head	4
Lower back	4
Upper leg	2

TABLE 2
The Most Commonly Injured Regions: Practice Versus Competition

Body region	Percent of practice injuries	Percent of competition injuries
Knee	19.0	26.2
Shoulder	12.2	17.1
Ankle	8.8	8.8
Ribs	—	6.8
Face	6.5	
Neck	5.5	5.7

TABLE 3
Type of Injury: Practice Versus Competition

Injury type	Percent of practice injuries	Percent of competition injuries
Sprain	26.1	33.4
Infection	17.4	—
Strain	16.2	17.8
Contusion	6.4	6.8
Cartilage tear	5.0	6.5
Fracture	—	4.4

TABLE 4
Mechanism of Injury: Practice Versus Competition

Mechanism	Percent of practice injuries	Percent of competition injuries
Contact with other	53.6	64.4
Contact with mat	22.3	22.4
No contact (other)	16.3	7.8
No contact (rotation of planted foot)	4.0	3.9
Contact with environment (other than mat)	1.4	0.4

TABLE 5
The Most Commonly Injured Regions: Pre-, Regular, and Postseason by Percentage of Injuries

Body region	Preseason	Regular season	Postseason
Knee	19.1	22.2	24.7
Shoulder	12.7	13.5	14.4
Ankle	8.7	8.3	10.3
Face	6.8	5.5	—
Head	—	—	6.2
Neck	5.5	5.5	6.2

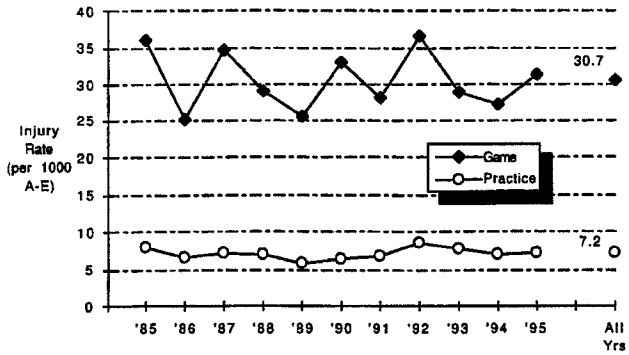

Figure 2. Wrestling injury data from practice and competition for all schools included in the survey. A-E, athlete-exposures. (Courtesy of the NCAA Injury Surveillance System.)

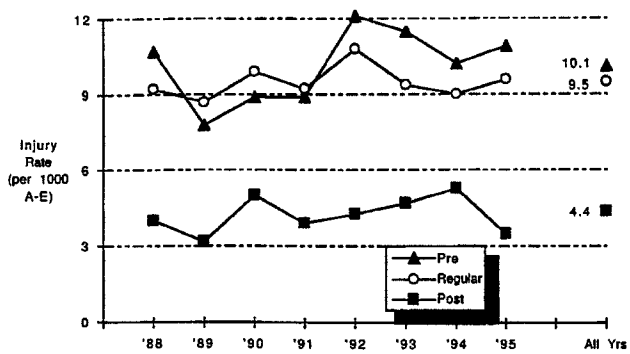

Figure 3. Total injury data broken down by preseason (before the first regular season game), regular season, and postseason (after the final regular-season game). A-E, athlete-exposures. (Courtesy of the NCAA Injury Surveillance System.)

of the injuries (1.2% of the injuries requiring surgery were ankle injuries). Specific details on the surgeries performed were not available.

For every season, sprain was the most common general type of injury, averaging 28% of all injuries over the study period. Strains were the second most common injury type in eight seasons, averaging 17%, with skin infection being the second most common "injury" in the other three seasons. Over the 11 seasons, contusions, infections, or strains were the third most common injury.

From 1990 through 1995, the activity at the time of injury was recorded. Averaging over these five seasons, 38% of injuries occurred during takedowns, 17% during sparring, 8% while riding, 6% during escapes, 3% during reversals, 3% with near falls, and the remainder occurred during various other activities. We do not know how much time was spent during these various activities, therefore injury rates were not calculated. Averaging all seasons, 57% of all injuries involved contact with another competitor, 22% involved contact with the playing surface, 14% involved no contact, 4% involved no apparent contact but did involve rotation about a planted foot, and roughly 1%

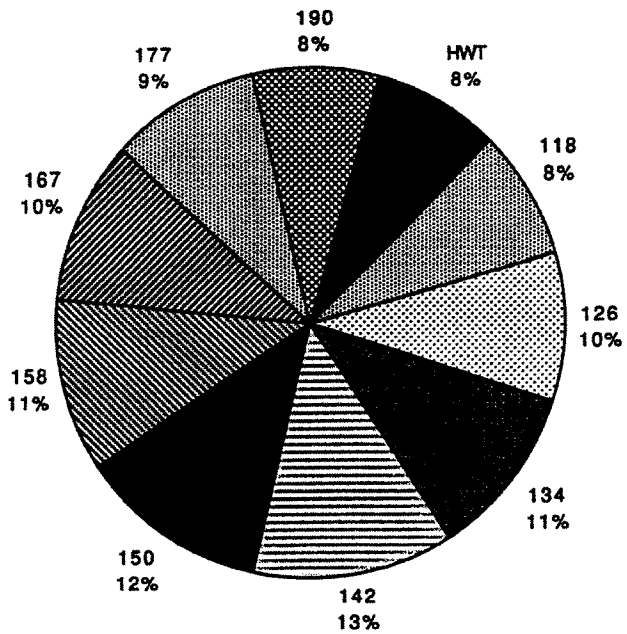

Figure 4. Percentage of all injuries reported, by weight class (pounds), for the 11 years in the survey. HWT, heavyweight. (Courtesy of the NCAA Injury Surveillance System.)

involved contact with something in the environment other than the playing surface. Of the competition injuries from 1991 through 1995, 4.6% were directly related to illegal action.

The injury rate for wrestling competition was 30.7 per 1000 athlete-exposures (2632 injuries) compared with 7.2 for practice (5663 injuries). Chi-square analysis found this to be a significant difference ($P < 0.0001$). The practice and competition injury rates were stable over the years (Fig. 2). Through the 1994 to 1995 season, wrestling ranked second to football for competition injury rate with 30.8 versus 36.2 per 1000 athlete-exposures. For injuries incurred in practice, wrestling was third behind spring football and women's gymnastics with rates of 9.2, 8.1, and 7.2 per 1000 athlete-exposures, respectively. The percentage of wrestling injuries requiring 7 or more days off was similar for competition (39.5%) and practice (37.5%). Among the injuries incurred in competition, 7.1% required surgery; among those incurred in practice, 6.8% required surgery. Table 2 shows the comparison of practice with competition with regard to body region injured. The knee, shoulder, and ankle were the most common for both, with similar percentages. Table 3 compares practice and competition for type of injury and shows that sprains, strains, and contusions were similarly common. Infection accounted for 17.4% of practice "injuries" but was not in the top five categories for competition. Also, fracture shows up for the first time as a relatively common injury type under competition injuries. Table 4 is a comparison for mechanism of injury. Injuries due to contact with the environment other than the mat accounted for 1.4% of practice injuries, compared with 0.4% of competition injuries. Otherwise, the percentages in each category for practice and competition are comparable with the figures for mechanism of all injuries.

TABLE 6
The Five Most Common Types of Injury During Each Phase of the Season

Injury type	Percentage of injuries
Preseason	
Sprain	24.3
Skin infection	18.4
Strain	16.7
Cartilage tear	6.1
Contusion	5.8
Regular season	
Sprain	29.4
Strain	16.5
Skin infection	13.1
Contusion	6.7
Cartilage tear	5.0
Postseason	
Sprain	33.0
Strain	18.6
Cartilage tear	8.2
Skin infection	8.2
Laceration	5.2

TABLE 7
Injuries by Weight Class[a]

Weight class (pounds)	Area injured		
	Knee (% of all knee injuries)	Shoulder (% of all shoulder injuries)	Ankle (% of all ankle injuries)
118	7.7	7.6	8.9
126	8.7	9.0	9.8
134	10.6	11.3	10.0
142	12.7	12.7	13.3
150	11.1	13.3	11.3
158	11.4	10.5	11.2
167	11.0	11.2	8.0
177	10.0	9.9	8.4
190	9.2	8.5	7.7
HWT[b]	7.7	6.1	11.5

[a] Comparison is based on percentages. The number of participants in each weight class may vary.
[b] Heavyweight.

Figure 3 compares the injury rates for the preseason, regular season, and postseason periods with an average of 10.1, 9.5, and 4.4 injuries per 1000 athlete-exposures, respectively. The difference between the postseason and the combined preseason and regular season was significant ($P < 0.0001$). Beginning in 1988, additional data were collected with which to compare these different times of the season. For preseason injuries, 6.6% required surgery during or after the season and 37.3% required 7 or more days off. For regular season injuries these percentages were 6.1% and 38.7%, respectively. For postseason injuries the percentages were 11.3% and 24.8%, respectively. Table 5 compares the three different time segments with regard to body region injured and shows that knee, shoulder, and ankle injuries were the top three for each. Table 6 compares these time segments for type of injury.

Comparison of the 10 different weight classes found a similar percentage of total injuries for each weight class (Fig. 4). The weight classes were then compared looking specifically at knee, shoulder, and ankle injuries to see if more of these injuries were occurring in particular weight classes (Table 7).

DISCUSSION

The Injury Surveillance System data find an overall incidence of 9.6 injuries per 1000 athlete-exposures for collegiate wrestlers. Previous authors comment on a high rate of injury in wrestling. Roy[6] follows a single division 1 collegiate team over three seasons and reports 276 total injuries. Estwanik et al.[1] studies the injuries at the 1976 freestyle and Greco-Roman Olympic trials (freestyle is the international wrestling style more similar to American collegiate wrestling). Of the freestyle competitors, 26.5% were injured, or an injury occurred in 1 of every 14 matches. It is difficult to compare our incidence data with other reports considering the differences in definitions of injury and the lack of true rates in previous reports. Our study agreed with these earlier reports in that the overall incidence of wrestling injuries was fairly high. The comparison with other NCAA sports adds perspective. Wrestling was second to spring football in total injury rate.

If a sport has a high rate of injury, the obvious next question is whether the injuries are serious. Previous authors have noted that most wrestling injuries are not serious. After reviewing injuries among preadolescent wrestlers, although he does not specifically define injury, Hartmann[3] concludes that most are trivial and that wrestling is a safe sport for preadolescent boys. In his initial attempt to classify wrestling injuries, Snook[9] believes that there is a low incidence of serious injuries. In the most comprehensive previous study of college wrestling, Roy[6] concludes that the majority of the injuries are not serious, with 9.8% meeting his definition of severe and 6.9% requiring more than 2 weeks off. However, specific definitions for his severe and very severe categories are not given.

Measuring severity is difficult given the lack of established definitions. We used both surgery and extent of time off as indicators of injury severity. Our findings agreed with those of previous authors in that most injuries were not serious. Only 6% of all injuries resulted in surgery and less than 40% required a week or more off. Again, the comparison with other sports adds perspective. For injuries requiring a week or more off, wrestling was third to spring football and women's gymnastics. Wrestling fell to fifth for percentage of injuries requiring surgery. (It is important to note that time lost for a particular injury may differ between sports.)

Although our focus was on musculoskeletal injuries, an important point to emphasize was the lack of catastrophic injuries in collegiate wrestling. Among 873,479 athlete-exposures there was only one reported catastrophic, nonfatal injury. The 12th annual report of the National Center for Catastrophic Sports Injury Research agrees with this finding.[5] The report is based on data from 1982 to 1994. Collegiate wrestling had one direct, catastrophic injury during this time period. It was nonfatal but resulted in some permanent disability (further details were not published). The report defines direct injury as "resulting directly from participation in the skills of the sport." Indirect injuries are those caused by systemic failure due to exertion or by a complication of a nonfatal injury. Collegiate wrestling had no indirect, catastrophic injury between 1982 and 1994. (Recently, wrestling has received much attention regarding three tragic deaths related to weight loss. All occurred after the period covered by our study. It is noteworthy that in the 11 seasons reviewed here, and in 24 years of personal [GJJ] involvement with the sport, such tragedies were unheard of. Certainly, much attention will need to be focused on possible explanations for this recent change.)

There have been previous attempts to identify common injuries among wrestlers.[2,6–8] Many of our findings agreed with these earlier reports. As noted by Estwanik et al.,[1] a wide spectrum of injuries are encountered. We found 42 different body parts listed with injuries over the course of the study period verifying that, in wrestling, just about any body part can be injured. We found the knee to be the most commonly injured body part among collegiate wrestlers. It was also the most common area of injury to require surgery or to necessitate extended time off. Most of the knee injuries were of the collateral ligaments, while injuries to the menisci and extensor mechanism were the second and third most common injuries. There were relatively few ACL and PCL injuries. The shoulder was consistently the second most common site of injury. It also was second to knees in injuries requiring extended time off or surgery. Interestingly, the ankle was the third most commonly injured part for all but 2 of the 11 seasons. This has not been the case in earlier reports. Although ankle injuries were the third most common to require extended time off, only 1% of ankle injuries required surgery. Identifying the most common injuries in a sport is an important early step in focusing further efforts. Based on this work, knee, shoulder, and ankle injuries all should receive further attention.

Not surprisingly, sprains, strains, and contusions were the most common general types of injuries. Infection was the second most common "injury" in three seasons. Skin infection in wrestling has received attention both in the literature as well as in efforts to control it. Although the focus of this report is musculoskeletal injuries, this finding in the Injury Surveillance System data should be pointed out as it suggests the persistence of infection as a pertinent issue.

The most common activities at the time of injury were takedowns and sparring. This is consistent with the 1982 report by Snook[7] and with both of the Estwanik et al. papers.[1,2] Most injuries involved contact between competitors or contact between a competitor and the mat surface. This was as expected in a contact, combative sport. Of particular interest were injuries due to rotation about a planted foot. At 4% of over 8000 injuries they comprised a significant number. This raises the question of whether shoes and mat surface play a role in knee and ankle

injuries as do cleats and turf in other sports. To our knowledge, this has not been studied and we plan to further analyze this issue. Also, 1% of injuries involved contact with objects other than the mat surface in the environment. Although specifics are not available, this raises the issue of proximity to the mat of tables, clocks, and nonpadded surfaces. Whether or not these involve severe injuries, there is a simple prevention strategy for this type of injury. Illegal action did not seem to be a major contributor to collegiate wrestling injuries. At 4.6% of competition injuries from 1991 to 1995 this comprised a total of only 60 injuries in 5 seasons. The referees, coaches, and athletes are all to be commended for this.

The question of whether most injuries occur during competition or practice has not been agreed on by all investigators. Snook[7] believes that injuries are more common in competition, while Estwanik et al.[2] report that injuries are more common in practice. Roy[6] also thinks that more injuries occur during practice. Our study found a significantly higher incidence rate for competition. The consistency of these rates over the years strengthens this finding and supports the methodology used for data collection. Initially, it seemed important to answer the question of whether practice or competition posed higher risk for injuries. However, our results pointed out that while the incidence of injury was higher in competition, there were actually more injuries in practice because more time was spent in practice. It is interesting that injuries incurred in competition did not seem to be more serious than those incurred in practice. The percentages of injuries requiring surgery or extended time off were similar for competition and practice. The lists of the body regions most commonly injured were also very similar for practice and competition. Sprains, strains, and contusions were similarly prevalent, as were cartilage tears. It is noteworthy that while infection accounted for 17.4% of practice "injuries," it was not among the top five injuries for competition. This suggests that infection-control efforts around competition are effective but that practice needs further attention. Also, fracture was in the top five injury types for competition, which differed from practice. Injury mechanisms appeared to be similar when comparing practice and competition. One difference was in the percentage of injuries due to contact with the environment other than the mat, and particular attention should be given to the practice environment regarding this type of injury. We found that the overall injury profile was similar when comparing practice with competition and that both areas deserve equal attention in future studies.

Another interesting finding was the difference in injury rates during different times of the season. Injury rates in the preseason and regular season were more than double that of the postseason. Explanations for this such as training effect, less "lopsided" competition, and participation predominantly of the best athletes in the postseason would be speculative. Our findings showed similar overall injury profiles during these different times of the season. Body regions injured and types of injuries were very similar. Injury severity in the preseason and regular season was essentially the same. In the postseason a higher percentage of injuries required surgery (11.3%), yet a lower percentage necessitated an extended time off (24.8%). Our findings did not lead to any clear explanations for injury rate differences in the different times of the season, so this question also warrants further attention.

No particular weight classes were more prone than others to injury in general. This finding was in agreement with Estwanik et al.[1] and Hartmann.[3] Another question was the prevalence of specific injuries among different weight classes. For example, did most shoulder injuries occur in particular weight classes? Although not statistically analyzed, our data did not show definite trends. In general, the middleweights tended to carry the higher percentages of injuries in all three areas (knee, shoulder, and ankle). One break from this trend was the higher percentage of ankle injuries among heavyweights, suggesting that these larger athletes may be more prone to ankle injuries.

CONCLUSION

Wrestling is unique among collegiate athletics. It is an ancient form of competition that is both combative and intellectual. These, and other aspects, are what captivate those who choose to participate. As expected in a physical, contact sport, the athletes are prone to occasional injury. It is in the interest of this great sport to establish a better understanding of the injuries involved so that, where possible, they might be prevented. This review of data collected by the NCAA Injury Surveillance System provides several insights. The overall injury rate was relatively high, but most injuries were not serious, and catastrophic injuries were exceedingly rare. While a wide variety of injuries were encountered, knee, shoulder, and ankle injuries were consistently the most common and the most serious and therefore should be the focus of further work. The question is raised of a potentially alterable relationship between rotation of a planted foot and wrestling injuries of the knee and ankle. Keeping nonpadded objects farther from the mat may be a simple and effective means of preventing some types of injuries. Regarding the question of whether practice or competition had a higher injury rate, we found the rate in competition to be significantly higher, but because of the distribution of time spent in these two areas and their very similar injury profiles we believe that practice and competition injuries deserve equal attention in future studies. In general, the preseason and regular season had higher injury rates than the postseason. Again, the injury profiles with regard to body region injured, injury type, and severity were similar during the three different segments of the season. Finally, comparison of the different weight classes found similar injury percentages.

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