Injury and Disability in Matched Men's and Women's Intercollegiate Sports

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Abstract: Eight matched men's and women's intercollegiate varsity teams were studied prospectively for one academic year to determine the incidence of athletic injury and resulting disability. Sports in which both men and women participated in a comparable manner were chosen: basketball, fencing, gymnastics, swimming, tennis, indoor track, outdoor track, and volleyball. Men (232) and women (150) were injured at comparable rates, 42 percent versus 39 percent. When adjusted for exposure time, seven of the eight sports continued to show similar injury rates. Women gymnasts, however, experienced .82 injuries per 100 person-hours of exposure as compared to .21 injuries for the men ($p = .0001$). Disability was greater in women gymnasts, 7.44 days per 100 person-hours versus 1.15 days for men ($p = .0004$). Percent of season lost to injury was also greater for women gymnasts. Types and sites of injury were similar for men and women, with sprains and strains accounting for over half of all injuries. We found no evidence for gender differences in matched sports except for gymnastics, in which technically diverse events may have accounted for the differences observed. (*Am J Public Health* 1990; 80:1459–1462).

Introduction

Women's participation in intercollegiate athletics has increased dramatically in recent years. Several studies comparing injury rates in men and women participating in similar sports have reported conflicting results.[1–3] Some studies have noted higher injury rates in female gymnasts and basketball players.[4–7] However, few studies have been conducted on mature men and women.[8–10]

In view of the conflicting results of previous studies and the paucity of information on mature athletes, the present study was undertaken to provide injury data on men and women engaged in similar sports while controlling for the length of time each athlete was exposed to injury. Earlier studies have rarely controlled for exposure time. If gender differences are observed, a larger study may be designed to investigate possible risk factors such as technical differences within a sport or biological differences associated with injury.

Methods

The study was conducted as a prospective cohort study for the period of one academic year at a large university. Eight matched men's and women's varsity sports were studied. These were sports in which both men and women participated in a comparable manner and included basketball, fencing, gymnastics, swimming, tennis, indoor track, outdoor track, and volleyball.

One of the authors (A.M.R.) visited each team weekly to record the appropriate injury information for the week. Injury data came from the medical records kept by the team physicians and by certified and student athletic trainers.

An athletic trainer or student trainer was present at each team practice and competition and was responsible for collecting the injury and disability data. Injuries not attributable to the team sport, as well as all illnesses, were excluded from the study.

We defined an injury as a traumatic medical problem due to sports participation and resulting in loss of time from practice or competition. When an injury occurred during practice or competition and the athlete was unable to complete the day's activity, one-half day of disability was assigned. One whole day of disability was assigned for each full day of practice or competition lost. On weekends, teams usually had only one day off. For example, if an athlete was injured on Saturday, had no scheduled practice on Sunday, and returned to practice on Monday, half of Sunday was assigned as injury time off. Disability days were calculated for each athlete.

We studied each team from the first official day of practice until the last day of regular competition or practice. Hours of practice and competition were estimated by either direct observation or interviews with coaches and athletes, or a combination of both methods. This provided indices independent of differences in exposure time. Exposure time was calculated for each athlete and for each sport by subtracting disability days as well as other absences from the total time available for practice and competition.

To compare injuries between men and women, we utilized the following indices: 1) injuries per 100 persons; 2) injuries per 100 person-hours of exposure; 3) disability days per 100 person-hours of exposure; 4) percent of season lost to injury; and 5) percent of persons injured. These indices were computed for each athlete and each team. Because injuries were not normally distributed and, more than likely, not independent, the nonparametric Wilcoxon Rank Sum statistic,[11] corrected for ties, was employed to test gender differences within each sport and for all sports after assigning an injury rate to each athlete. This procedure was used for two indices: injuries per 100 person-hours of exposure, and percent of season lost to injury. The Mantel-Haenszel statistic[12] provided a test of difference in the proportion of men and women injured over all sports together. The relative risk of injury and its 95% confidence interval was estimated for males using the direct precision-based method.[13]

If the true proportions of male and female athletes who are injured are in the range of 40 percent to 60 percent, the present study sample has approximately an 80 percent chance of detecting a 15 percent difference when alpha is at .05.

Types of injury and anatomical sites were also determined. No practicable statistical methods of analyses were available to evaluate gender differences for these parameters.

Results

The study cohort was composed of 232 men and 150 women. Table 1 shows the frequency and percent injured for

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TABLE 1—Injuries among Male and Female Athletes in Eight Matched Intercollegiate Sports during One Year at a Large University

Sport	Gender	Persons on Team	Persons Injured (%)	Number of Injuries	Injuries per 100 Persons
Basketball	M	12	10 (83)	18	150
	F	14	11 (79)	19	136
Fencing	M	18	5 (28)	5	28
	F	6	3 (50)	3	50
Gymnastics	M	24	23 (96)	52	217
	F	11	11 (100)	30	273
Swimming	M	36	14 (39)	21	58
	F	21	8 (38)	8	38
Tennis	M	12	5 (42)	6	50
	F	11	3 (27)	4	36
Track, Indoor	M	57	21 (37)	28	49
	F	37	12 (32)	16	43
Track, Outdoor	M	56	9 (16)	11	20
	F	37	4 (11)	4	11
Volleyball	M	17	11 (65)	13	76
	F	13	6 (46)	7	54
All Sports	M	232	98 (42)*	154	66
	F	150	58 (39)	91	61

*Relative risk = 1.25 (CI 0.88, 1.43).

each of the eight matched sports. While the percentage of athletes injured varied considerably between sports, within sports there appear to be only small and inconsistent gender differences. For all sports combined, where 42 percent of the men and 39 percent of the women were injured, the Mantel-Haenszel χ^2 was 0.53 ($p \approx .50$). The relative risk, adjusted for between sport differences, was 1.25 with a 95% confidence interval of 0.88 to 1.43.

The rate of injury expressed as injuries per 100 persons was similar for all sports combined, 66 injuries per 100 persons for men, and 61 per 100 persons for women. Both men and women participating in gymnastics appear to have higher rates of injury than athletes in the other sports. All but one of the 35 gymnasts reported at least one disabling injury during the season. Women gymnasts were injured at a somewhat higher rate than men—273 versus 217 per 100 persons, respectively. When the incidence of injuries is expressed in terms of exposure time, women gymnasts sustained 0.82 injuries per 100 person-hours of exposure, while men incurred only 0.21 injuries (Table 2). This difference was significant by the Wilcoxon Rank Sum Test ($p = .0001$). There were no gender differences observed for the seven other sports nor for all sports combined.

Table 2 also summarizes disability days for men and women by sport. Women gymnasts had the highest rate of disability, 7.44 days per 100 person-hours of exposure, while men gymnasts had only 1.15 disability days, a sixfold difference ($p = .0004$). We were unable to detect gender differences in any of the remaining seven sports and, more importantly, when all eight sports were combined. For all sports, both men and women missed 1.4 days for every 100 hours of exposure, a period approximated by five to six weeks of practice and competition.

The types and sites of injury occurring during the period of study appear to be similar for both men and women. Strains and sprains were clearly the most common types of injury (Figure 1), accounting for over half of all injuries for both men and women.

The most frequent site of injury was foot and ankle (Figure 2). There appears to be little difference between sexes with respect to site. However, on closer inspection, injuries to the upper extremity (shoulder, upper arm, hand, wrist, elbow, and forearm) occurred more frequently in men (27 percent of injuries) than in women (13 percent of injuries).

Discussion

We relied on the medical records as kept by the team physicians and athletic trainers. The data were reviewed and accumulated once each week by one of the authors. We assumed that the reporting of injuries would be equally reliable across all sports and gender.

The present study involved 382 men and women over a period of one year at a single university. Thus, the question of repeatability of the findings from year to year, as well as the generalizability of the findings from one setting to another, may be questioned. While the total number of athletes studied was fairly large, the number of men and

TABLE 2—Injury and Disability Rates among Male and Female Athletes in Eight Matched Intercollegiate Sports during One Year at a Large University

Sport	Gender	Mean Hours of Exposure*	Injuries per 100 Person-Hours	(p)**	Disability Days	Disability Days per 100 Person-Hours	(p)**
Basketball	M	337	0.45	(.90)	65.5	1.62	(.48)
	F	283	0.48		69.0	1.74	
Fencing	M	278	0.10	(.27)	21.5	0.43	(.47)
	F	273	0.18		3.5	0.21	
Gymnastics	M	1020	0.21	(.0001)	281.5	1.15	(.0004)
	F	365	0.82		274.0	7.44	
Swimming	M	469	0.12	(.67)	241.5	1.43	(.77)
	F	488	0.08		63.5	0.62	
Tennis	M	305	0.16	(.37)	88.5	2.42	(.37)
	F	375	0.10		23.5	0.57	
Track, Indoor	M	266	0.18	(.44)	326.0	2.15	(.33)
	F	281	0.15		51.0	0.49	
Track, Outdoor	M	151	0.13	(.56)	143.5	1.70	(.52)
	F	92	0.12		71.5	2.11	
Volleyball	M	408	0.19	(.93)	52.0	0.75	(.48)
	F	353	0.15		22.5	0.49	
All Sports	M	397	0.18	p = .99	152.5	1.44	p = .49
	F	305	0.21		72.3	1.38	

*adjusted for missed practice and competition
**probability of difference between groups by Wilcoxon Rank Sum test

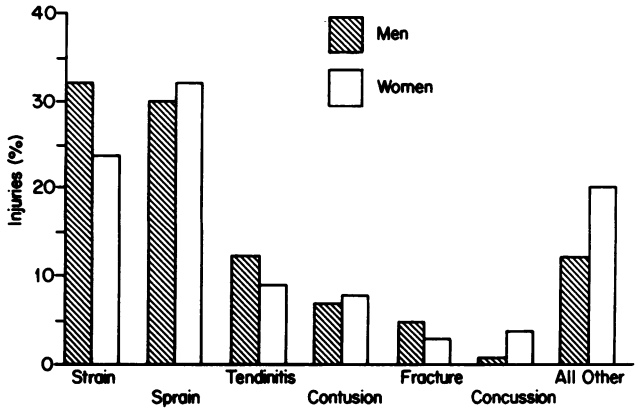

FIGURE 1—Percent of Injuries by Type among Male and Female Athletes in Eight Matched Intercollegiate Sports during One Year at a Large University

women in each paired sport was relatively small, resulting in low statistical power for detecting sport-specific gender differences. While gender differences in gymnastics were sufficiently large to overcome this problem, there may be differences in other sports that we were unable to detect.

Our estimates of exposure time for each athlete are crude, but should be useful when comparing gender differences for a single sport. For example, in basketball, men and women play the game in a similar manner and probably have comparable periods of activity and inactivity. To the extent that this is true, any gender difference in observed rate will be free of bias from exposure difference in a given sport.

We expected modest differences in exposure times between women and men in the same sport. However, we did not anticipate the size of the differences observed. For the 16 teams, exposure times ranged from 92 hours for women's outdoor track to 1,020 hours for men's gymnastics. It is clear from Table 2 that within-sport and between-sport comparisons of injury must take these exposure differences into account. Gymnastics reflects the greatest exposure disparity between women and men, 365 hours and 1,020 hours, respectively. Yet, women report a higher incidence of injuries per 100 persons.

We found little difference between men and women in terms of injury or disability in the eight sports except for gymnastics. Other investigators[2,10,14] as well, have reported differences in injury rates and types of injury in male and female gymnasts, with females showing somewhat higher rates. The differences that we observed are largely a result of expressing injuries in terms of exposure time. Only small differences between the sexes were observed when injuries were expressed per 100 persons or as percent of persons injured (Table 1).

When we expressed disability as the percent of season lost for each athlete, the median for women gymnasts, 8.21 percent, was significantly higher than the median for men, 3.15 percent ($p < .01$). No other team lost as high a percentage of their season due to disability. Ten of the 14 teams had medians at zero percent.

It is generally accepted that men gymnasts use predominantly upper body musculature and women use predominantly lower body musculature. This is consistent with the upper extremity injury difference noted earlier. The injury and disability differences that have been reported in this paper and elsewhere may be more a consequence of the different types of events and apparatus than of gender. Women gymnasts participate in four events and men in six. Only two of the events utilize the same apparatus: floor exercise and vault.

It is interesting to note that, while women and men gymnasts comprised only 9 percent of the athletes followed during the year of study, they accounted for almost 34 percent of all injuries. The apparent excess of injuries in gymnasts may be a result of the special requirements of the sport. Injuries that might be regarded as inconsequential and not reported by athletes in other sports such as football may impair the performance of the gymnast.

The main finding of this paper suggests that, when men and women compete in sports that are technically similar, the

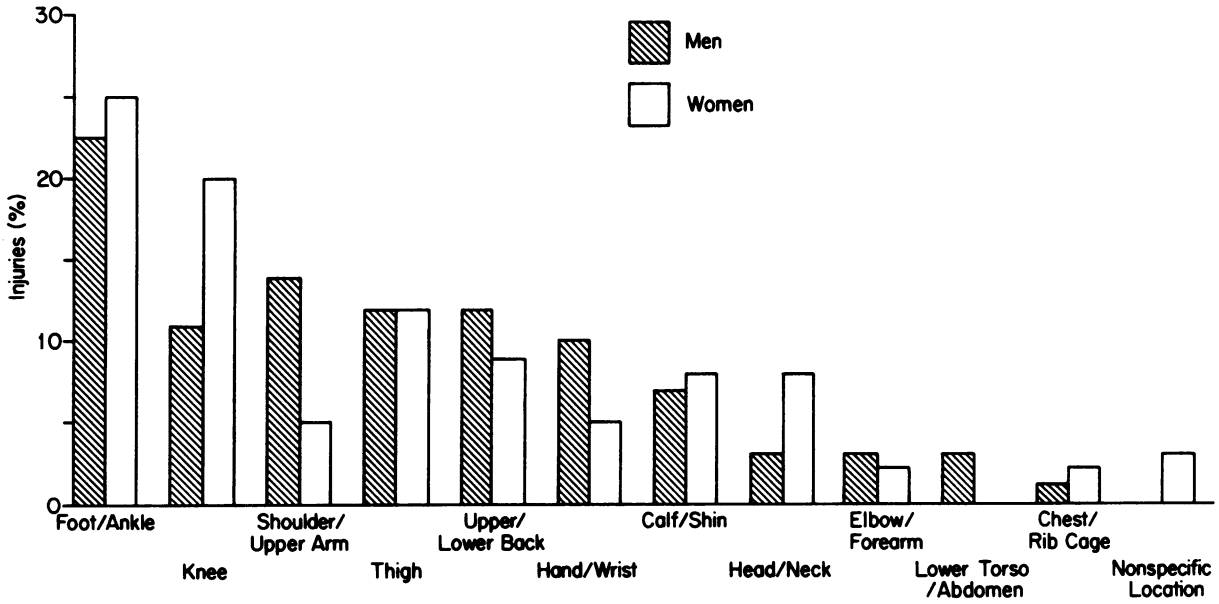

FIGURE 2—Percent of Injuries by Site among Male and Female Athletes in Eight Matched Intercollegiate Sports during One Year at a Large University

rates of injury are approximately equal. When they compete in sports that are technically different, there is little reason to expect injury rates to be the same. This may account for our single positive finding—that men and women gymnasts differed in injury rates.

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National Conference on Cancer Nursing: Call For Abstracts

Nursing professionals are invited to submit abstracts for poster presentations for the American Cancer Society's Sixth National Conference on Cancer Nursing. The conference, "From Primary to Tertiary Care: Cancer Across the Life Span," will be held July 25–27 in Seattle, Washington.

Within the theme, abstract topics may be related to clinical practice, education, research, and nursing administration. The deadline for abstract submission is February 1. For additional information, contact: Terri Ades, RN, Coordinator for Nursing Programs, ACS National Office, 1599 Clifton Rd, NE, Atlanta, GA 30329; (404) 329-7655.

This conference is the sixth in a series of national nursing conferences which are held every four years, and whose purpose is to improve the quality of cancer care provided to individuals and their families. The conference program is directed at nurse generalists, primary care nurses, oncology nurses, and other members of the health profession whose practice is devoted to providing care to individuals and their families throughout the life span. The conference is sponsored by the American Cancer Society, in cooperation with the American Nurses' Association Council on Primary Health Care Nurse Practitioners, Association of Pediatric Oncology Nurses, and the Oncology Nursing Society.