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#### Take home message

There is a relatively high risk of sustaining an injury during the cross country phase of eventing. This can be reduced by using PAS015 helmets and body/shoulder protectors to the prEN 13158 standard.

## The prevalence of chronic knee injury in triathletes

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#### Abstract

**Objectives**—To add to the area of triathlon research by providing much needed prevalence data on knee injury in triathletes.

**Method**—An incidental “in field” sampling technique was used to interview 58 triathletes aged between 15 and 55 years about knee injury during a triathlon event. The sample comprised 46 men and 12 women.

**Results**—Most knee injuries occurred during the running event (72%) and affected the lateral side of the knee (38%). In all, 78% of the sample sought treatment from a healthcare professional.

**Conclusion**—The study has provided much needed prevalence data on chronic knee injury in triathletes. (*Br J Sports Med* 1999;33:214–216)

Keywords: triathlon; knee; Q angle

Triathlon began in Honolulu in 1978 and involves three events, running, cycling, and swimming. According to Williams *et al.*,<sup>1</sup> despite ever increasing interest in the sport, research in this area has lagged far behind that into other sports. The amount of literature available detailing aspects of injury and training regimes is small. Studies have focused on incidence of injury, types of injury suffered, and physiological response to swimming, cycling, and running.<sup>1–7</sup>

In a study of 72 triathletes by Wilk *et al.*,<sup>8</sup> three quarters sustained triathlon related musculoskeletal injuries during training as the result of overuse.

Collins *et al.*<sup>9</sup> surveyed 600 finishers in the Seafair Triathlon in 1986 with a 45% return rate. They reported that 49% of the respondents suffered a training related injury which caused them to stop training for at least one day. Some 70% of the injuries were related to running, and the knee, shoulder, and ankle were the most vulnerable. The investigators noted that higher training mileage for swimming, cycling, and running did not lead to a significantly higher incidence of injury.

A study by Korkia *et al.*<sup>10</sup> also found that the injury incidence was unrelated to the mean amount of weekly training, competition, intensity, or frequency of training in 155 British triathletes over an eight week period. At least one injury was reported by 58 (37%) of the participants. The most affected areas for these triathletes were the ankle/foot, thigh, knee, lower leg, and back. Most (84%) of these injuries were minor, and 83% of the respondents did not have to miss a planned competition.

Ultraendurance triathletes who competed in the 1986 Hawaii Iron Man Triathlon were studied by O'Toole *et al.*<sup>11</sup> It was found that 91% of participants had sustained at least one soft tissue injury during the preceding year, and 84% of participants reported knee/thigh injuries.

Cipriani *et al.*<sup>12</sup> surveyed 118 triathletes and found that knee injuries were the most common.

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Table 1 Location of knee injury in relation to triathlon stage

Area of knee affected	Run	Cycle	Run and cycle
Lateral	33.3	5.5	0
Medial	16.6	5.5	5.5
Anterior	11.1	5.5	0
Anterior/lateral	11.1	0	0
Medial/lateral	0	5.5	0
Posterior	0	0	0

Values are percentages.

Only 42% of the triathletes sought medical treatment, and 43% had to stop training.

Epidemiology studies noted that most triathlon related injuries occur during run training.<sup>8 10 11 13</sup>

## Method

### SUBJECTS

An incidental "in field" sampling technique was used to interview 58 triathletes aged between 15 and 55 years during a triathlon event. The sample comprised 46 men and 12 women.

### PROCEDURE

A structured questionnaire to be administered by an interviewer was designed to assess injuries to the knee sustained during triathlons. The 27 closed ended questions sought to (a) show the prevalence of knee injury within a sample group of triathletes, (b) identify the most common location of knee injury, and (c) determine from which healthcare professionals triathletes sought treatment. Before inclusion in the survey each subject had to meet certain inclusion/exclusion criteria. The inclusion criteria were: aged between 15 and 55; actively training/racing in triathlon for at least one year; participating in all three disciplines; when injury occurred, it was sustained between 1994 and 1997; injury was sustained through training/racing in a triathlon related sport. The exclusion criteria were: previous surgery to the knee; participation in another sport; suffering any debilitating disease. All questions were administered by one of the authors.

### DEFINITION OF INJURY

Injury was defined as any musculoskeletal ailment that caused the athlete to reduce, or refrain from, training for at least two days during the period 1994–1997.

### DATA ANALYSIS

To facilitate comparisons, the sample was divided into an injured and non-injured group which were compared using descriptive methods.

## Results

The triathletes sought treatment as follows: 27% from a physiotherapist; 11% from a general practitioner; 17% from a podiatrist; 6% from a chiropractor/physiotherapist; 17% from a general practitioner/chiropractor; 22% did not seek treatment.

The average age was 31 years; 79% were men and 21% women. They could be broken down into age groups as follows: aged 15–20, three;

Table 2 A breakdown of injured and non-injured triathletes

	No of triathletes	No of injured	No of non-injured
Athletic status			
Novice	7	1	6
Club	17	7	10
Age group	26	9	17
Elite	7	3	4
Do not compete	1	0	1
Duration of participation (years)			
>1	13	3	10
2–5	20	6	16
6–8	16	7	9
9–10	6	2	4
11+	3	2	1
Running surface			
Off road	4	1	3
Road	19	5	14
Grass	6	4	2
Treadmill	1	0	1
Mixed	28	10	18

Table 3 Formal diagnosis of knee injury

Formal diagnosis	Number of cases
Idiopathic	4
Poor patellae tracking	4
Iliotibial band friction syndrome	2
Abnormal pronation	4
Chondromalacia patellae	3
Osgood-Schlatters disease	1

aged 21–25, five; aged 26–30, 23; aged 31–35, 12; aged 36–40, six; aged 41–45, five; aged 46–50, three; aged 51–55, one.

In all, 34% (20/58) of all the athletes interviewed claimed to have suffered a knee injury between 1994 and 1997.

Table 1 shows the prevalence of knee injury, and the area, in relation to the sport. No knee injuries were reported to have occurred during the swimming stage. Cycling produced knee injuries in 22% (4/18); the lateral, medial, and anterior aspects of the knee were affected. Some 65% (13/20) reported an injury to the knee during the running stage; most of these occurred on the lateral side of the knee. A further 6% stated that injuries had occurred to their knees through a combination of running and cycling.

Table 2 is a summary of injured and non-injured triathletes.

A previous formal diagnosis of knee injury was made in 18 cases (table 3).

## Discussion

A comparison between male and female athletes did not show any large differences. The predominance of male triathletes compares with other studies.<sup>11</sup>

The average age of the triathletes in the study was 31 years, which is comparable with subjects in a study by Bailey *et al.*<sup>7</sup> but slightly lower than in a study by Massimino *et al.*<sup>6</sup> most triathletes in our study being in the 25–30 years bracket (39%) and the 30–35 years group (21%).

In all, 78% of the sample sought treatment in this study, compared with only 51% in a study by Korkia *et al.*<sup>8</sup> and 42% in one by Cipriani *et al.*<sup>12</sup> In both the latter studies treatment was sought primarily from a physiotherapist. However, it should be noted that the time lapse

between injury and the athlete seeking medical attention was not looked at in our study.

Knee injuries sustained during running were the highest at 72% compared with 22% incurred while cycling. These results are comparable with those of Massimino *et al*<sup>6</sup> who found that 58% of knee injuries were caused through running and 20% by cycling. Cipriani *et al.*<sup>12</sup> also found a high incidence of knee injury.

Diagnostic tests were not attempted in this study. Diagnosis was based on what the subject recalled as the diagnosis.

This study found that lateral knee pain had the highest prevalence. This is different from previous studies conducted on runners, in which anterior knee pain was the most common finding.<sup>14-15</sup> Most injuries were sustained through running and affected the lateral side of the knee. Despite the fact that many authors related pain in this area to iliotibial band friction syndrome during long distance running,<sup>16-19</sup> only two triathletes in our study had been diagnosed with this condition.

The highest number of injuries was observed in athletes who ran on a mixture of terrains (50%; 10/20). The group who trained solely on roads or tarmac surfaces accounted for 25% of the injured athletes. The fact that a large number of athletes remained uninjured despite training only on roads indicates that training on hard surfaces does not always predispose the triathlete to injury.

This study has highlighted the need for further research within the area of multidisciplinary events, in particular the relation between intrinsic and extrinsic factors that predispose to injury.

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#### Take home message

Prevalence data for knee injury in triathletes are provided. Most injuries occurred in the running event and affected the lateral side of the knee.