Track and Field Injuries

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Abstract

Objective: A review of the existing literature on injuries to youth (≤18 years old) in track and field or athletics. Data sources: Searches of the Medline and SPORT Discus databases for English language articles through the end of 2003, using the search terms (adolescent or youth) and (track or field or running) and injuries. Main results: Only nine prospective or retrospective studies were found dealing with track and field injuries in children and that stated injury rates or provided enough information to allow the estimation of injury rates. Differences in study design and inconsistencies in the definition of a reportable injury provided major hindrances to making comparisons or combining data across studies. Among the few conclusions that can be drawn are that the lower extremities account for the majority of injuries, and muscle strains and ligament sprains are the predominant types of injury. While a majority of injuries may occur during training, since there is much more exposure during training than during competitions, the risk of injury is about four times higher during competitions. Conclusions: Informed decisions with regard to preventing injuries in youth track and field are dependent upon the quality of the basic epidemiological data available, and at this time such data are, for the most part, nonexistent. Because of the large numbers of participants and the large number and variety of activities involved in track and field, adequately designed epidemiological research is difficult, but opportunities for research in this sport are available for anyone willing to take on the challenge.

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Introduction

Running, jumping and throwing are basic sport skills that provide the foundation for most other sports, but they are the focus of the sport of athletics or track and field. The running events vary in distance from short sprints (50, 60, and 100 m) to distance races (1,500, 5,000, and 10,000 m), as well as races involving hurdles (110 m hurdles, 400 m hurdles, and steeplechase).
The field events consist of throwing events (shot put, discus throw, javelin throw, and hammer throw), horizontal jumps (long jump and triple jump), and vertical jumps (high jump and pole vault). Training and competing in running events involves long periods of repetitive stress on the musculoskeletal system, with the feet striking the ground 1,000 to 1,500 times per mile with forces two to three times body weight [1, 2]. As a result, the majority of running injuries are attributable to overuse of that system. Field events, on the other hand, involve generation of maximum force in a short period of time, and many of the injuries sustained in these events are the result of the high stresses generated by maximal muscle contractions, although there are many gradual onset, repetitive stress injuries as well.

Based on participation data from the National Federation of State High School Associations [3], track and field is the third most popular high school sport in terms of the number of participants, exceeded only by football and basketball. A total of 913,629 high school students participated in the sport during the 2002–03 school year (498,027 boys and 415,602 girls). In addition, 32,850 children aged 14 and younger participated in USA Track & Field’s (USATF) Youth and Junior Olympic Programs in 2003 (16,500 boys and 16,350 girls) [4]. These total 946,479 youth participants in track and field (514,527 boys and 431,952 girls). Assuming there are additional individuals not accounted for in these sources who participate through middle school or AAU programs, over one million children participated in track and field in the USA in 2003.

This chapter reviews existing literature on injuries to children (≤18 years old) participating in track and field. The literature review began with searches of the Medline and SPORT Discus databases for English language articles using the search terms (adolescent or youth) and (track or field or running) and injuries. The search covered the literature through the end of 2003. In addition, personal resources of the author were utilized. Most of the literature for this sport deals with older individuals. Much of what is available dealing with children’s track and field injuries tends to be case reports, case series and opinion pieces, which do not allow analyses of injury rates or etiological factors. This issue has been noted previously in reviews of running injuries [5] and field event injuries [6] of older athletes. The number of prospective and retrospective studies is small, and studies providing data on the number of exposures to injury for the calculation of rates are rarer still. Differences in study design and inconsistencies in definition of a reportable injury provide major hindrances to making comparisons or combining data across studies. In addition, most studies do not differentiate between running athletes and field athletes. All these limitations should be kept in mind when reading this review.
Incidence of Injury

Only nine prospective or retrospective studies were found dealing with track and field injuries in children and that either stated an injury rate or provided enough information to allow some estimation of an injury rate (table 1) [7–15]. The injury rate presented in table 1 (injuries per 100 participants per year) is a minimally useful rate that allows some gross comparisons between studies. Data on exposure to risk of injury were essentially nonexistent in all but one of these studies [7], so calculation of injury rates per 1,000 exposures or 100 h of participation was not possible except in that one study. Rates per 100 per year were given in three of the studies [7–9], but sufficient information regarding numbers of participants and injuries was provided in the others to allow calculation of these rates. In five of the studies there was sufficient information to also allow a breakdown by sex. Three of the papers covered multiple sports [9–11], one included older athletes [12], one covered wheelchair athletes [11], and one covered only medial tibial stress syndrome (MTSS) in young runners [13]. Keep in mind when reviewing these data that no two studies used the same definition of a reportable injury. This fact alone makes any conclusions drawn from comparisons of these papers highly speculative.

Only two papers [8, 11] gave a breakdown of injury occurrences by the type of event, allowing a distinction between track injuries and field injuries. While presenting no specific data, Garrick and Requa [14] mention that in their sample ‘about 4 out of every 5 injuries occurred during a track event as opposed to a field event’, indicating that approximately 80% of injuries occur in running events and 20% in field events. Watson and DiMartino [8] found 82% of the injuries that occurred during participation in a track or field activity were in running events and 18% in field events. They also reported that 20% of the total number of injuries reported occurred in other activities before, during or after practice, not directly related to either running or field event activity. Taking this into account, about 65% of reported injuries in their study occurred during running activity, 15% during field event activity, and 20% during other activities.

D'Souza’s study [12] provided enough information to calculate that about 70% of the injuries reported in his study were to running event participants and about 30% to field event participants. While these figures indicate that the preponderance of reported injuries in these studies was to runners, only one of the studies provided data on the numbers of track athletes and field athletes to allow estimation of real rates of injury to these two major categories of participants. In other words, we do not have any idea whether the larger percentage of injuries reported for the track athletes is because there are many more of them than there are field event athletes in the samples, or because runners are
### Table 1. A comparison of injury rates in track and field in adolescents

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Method</th>
<th>Duration</th>
<th>Number of participants</th>
<th>Injury definition</th>
<th>Number of injuries</th>
<th>Rate IR/100/yr</th>
<th>Rate IR/1,000 athlete-exposures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orava and Saarela [15]</td>
<td>P</td>
<td>I/MR</td>
<td>3 years</td>
<td>48 (26 M, 22 F)</td>
<td>Any treatment</td>
<td>71*</td>
<td>49.3* (53.8 M, 43.9 F)*</td>
<td></td>
</tr>
<tr>
<td>Zaricznyj et al. [9]</td>
<td>P</td>
<td>MR</td>
<td>1 year</td>
<td>289</td>
<td>Any treatment</td>
<td>50</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>Requa and Garrick [14]</td>
<td>P</td>
<td>Q</td>
<td>2 years</td>
<td>516 (308 M, 208 F)</td>
<td>≥1 day</td>
<td>174</td>
<td>16.9* (16.4 M, 17.5 F)*</td>
<td></td>
</tr>
<tr>
<td>Watson and DiMartino [8]</td>
<td>P</td>
<td>I/Q</td>
<td>1 season (77 days)</td>
<td>234 (156 M, 78 F)</td>
<td>≥2 days</td>
<td>41</td>
<td>17.5</td>
<td></td>
</tr>
<tr>
<td>Mueller et al. [7]</td>
<td>P</td>
<td>Q (weekly reports)</td>
<td>3 years</td>
<td>53,700 (29,700 M, 24,000 F)</td>
<td>≥1 day, plus any medical treatment</td>
<td>1,659</td>
<td>3.1* (2.4 M, 3.9 F)</td>
<td>1.2* (1.0 M, 1.5 F)</td>
</tr>
<tr>
<td>Bennett et al. [13]</td>
<td>P/CC</td>
<td>I/ME</td>
<td>1 season (8 weeks)</td>
<td>125 (57 M, 68 F)</td>
<td>Symptoms of MTSS ‘any physical damage’</td>
<td>15</td>
<td>12.0* (3.5 M, 19.1 F)*</td>
<td></td>
</tr>
<tr>
<td>Backx et al. [10]</td>
<td>R</td>
<td>I/Q</td>
<td>7 months</td>
<td>54 (25 M, 29 F)</td>
<td>≥7 days</td>
<td>16*</td>
<td>29.5*</td>
<td></td>
</tr>
<tr>
<td>D’Souza [12]</td>
<td>R</td>
<td>Q</td>
<td>1 year</td>
<td>147 (all ages) (96 M, 51 F) (number of participants &lt;18 not stated)</td>
<td>≥7 days</td>
<td>?</td>
<td>51.3 (=% injured in &lt;18 group)</td>
<td></td>
</tr>
</tbody>
</table>

*Calculated from data in the article.

P = Prospective; R = retrospective; CC = case-control; I = interview; Q = questionnaire; MR = medical reports; ME = medical exam.
at much higher risk of injury than field event athletes, or a combination of these factors. Recording and reporting this information would be complicated by the fact that many participate in both running and field events. D’Souza [12] did report a breakdown of his study sample by the type of event, which allowed a calculation of an estimate of 63 injuries per 100 track event athletes per year and 56 injuries per 100 field event athletes per year. Unfortunately these data included participants older than 18. Hence, we still have no solid information on the separate risks for younger track athletes and field athletes.

Injury Characteristics

Injury Onset

 Only one study [15] differentiated between acute or sudden onset injuries and gradual onset injuries. Of the 71 recorded injuries among 48 athletes over a 3-year period, 19 (26.8%; 13.2/100 participants/year) were acute injuries and 51 (73.2%; 36.1/100 participants/year) were ‘exertional injuries’ or gradual onset injuries.

Injury Location

 Five of the studies (all of the purely prospective studies) provided information on the body part injured, and reported the distribution in percent of total injuries, or provided enough information to allow percentages to be calculated. These data are summarized in table 2 [7–9, 14, 15]. Given the nature of this sport, with heavy use of the legs in running, jumping and throwing activities, it is not surprising that the great majority of injuries are reported in the lower extremities. In all the studies, the lower extremities accounted for 64–87% of the reported injuries. Although there is no way to confirm it from the data presented in these studies, it is a reasonable presumption that the preponderance of the upper extremity injuries occur in field event athletes, primarily throwers. It is fairly consistent across all the studies that the highest percentages of injuries occur in the upper leg, knee, lower leg and ankle.

Situational

 Three of the studies [8, 12, 14] mention that between 75 and 98% of the injuries reported occurred in training sessions. The only study to provide specific data on injuries in training and in competition was the study by Mueller et al. [7]. They report an injury rate of 1.7/100 athletes in competition and 1.4/100 athletes for training sessions. Based on athlete-exposures in competition and training (an athlete-exposure is defined as one athlete participating in one training session or one competition where he or she is exposed to the
possibility of being injured), they report an injury rate of 2.93/1,000 athlete-exposures in competition and 0.72/1,000 athlete-exposures in training. This illustrates why reporting injury ‘rates’ in percentages or per 100 participants per year can very often be misleading: a true picture of risk can be gained only when exposure data are part of the equation [16]. The reported percentages indicate that many more injuries occur during training, which is true in most any sport simply because there are many more training sessions than competitions. The rate per 100 athletes indicates a slightly higher injury rate in competitions, but the real risk cannot be appreciated unless the rate is reported in relation to the number of exposures in competition and in training sessions. In this case the much more accurate injury rates per 1,000 athlete-exposures indicate that an

Table 2. A percent comparison of injury location in youth track and field

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N =</td>
<td>48</td>
<td>289</td>
<td>516</td>
<td>234</td>
</tr>
<tr>
<td>Head</td>
<td>–</td>
<td>6.0</td>
<td>1.9</td>
<td>–</td>
<td>0.2</td>
</tr>
<tr>
<td>Spine/Trunk</td>
<td>18.3</td>
<td>6.0</td>
<td>5.5</td>
<td>12.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Neck</td>
<td>–</td>
<td>2.0</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Back/Spine</td>
<td>18.3</td>
<td>4.0</td>
<td>5.5</td>
<td>12.1</td>
<td>2.9</td>
</tr>
<tr>
<td>Internal</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>0.2</td>
</tr>
<tr>
<td>Upper extremity</td>
<td>1.4</td>
<td>24.0</td>
<td>4.9</td>
<td>2.4</td>
<td>7.0</td>
</tr>
<tr>
<td>Shoulder</td>
<td>–</td>
<td>4.0</td>
<td>–</td>
<td>–</td>
<td>1.8</td>
</tr>
<tr>
<td>Elbow</td>
<td>1.4</td>
<td>6.0</td>
<td>3.7</td>
<td>2.4</td>
<td>1.7</td>
</tr>
<tr>
<td>Wrist</td>
<td>–</td>
<td>8.0</td>
<td>–</td>
<td>–</td>
<td>1.7</td>
</tr>
<tr>
<td>Hand</td>
<td>–</td>
<td>4.0</td>
<td>1.2</td>
<td>–</td>
<td>1.0</td>
</tr>
<tr>
<td>Fingers</td>
<td>–</td>
<td>2.0</td>
<td>–</td>
<td>–</td>
<td>0.8</td>
</tr>
<tr>
<td>Lower extremity</td>
<td>78.9</td>
<td>64.0</td>
<td>87.4</td>
<td>80.3</td>
<td>77.0</td>
</tr>
<tr>
<td>Pelvis/Hip/Groin</td>
<td>4.2</td>
<td>10.0</td>
<td>–</td>
<td>12.1</td>
<td>10.4</td>
</tr>
<tr>
<td>Upper leg</td>
<td>12.7</td>
<td>–</td>
<td>28.8</td>
<td>7.3</td>
<td>20.8</td>
</tr>
<tr>
<td>Knee</td>
<td>11.3</td>
<td>24.0</td>
<td>12.6</td>
<td>2.4</td>
<td>15.0</td>
</tr>
<tr>
<td>Patella</td>
<td>2.8</td>
<td>–</td>
<td>–</td>
<td>14.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Lower leg</td>
<td>19.7</td>
<td>8.0</td>
<td>35.8</td>
<td>21.9</td>
<td>12.6</td>
</tr>
<tr>
<td>Achilles tendon</td>
<td>5.6</td>
<td>–</td>
<td>–</td>
<td>2.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Ankle</td>
<td>11.3</td>
<td>14.0</td>
<td>10.2</td>
<td>17.1</td>
<td>11.8</td>
</tr>
<tr>
<td>Foot</td>
<td>11.3</td>
<td>8.0</td>
<td>–</td>
<td>2.4</td>
<td>2.3</td>
</tr>
<tr>
<td>Toes</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>2.3</td>
</tr>
<tr>
<td>Other</td>
<td>1.4</td>
<td>–</td>
<td>–</td>
<td>4.9</td>
<td>13.9</td>
</tr>
</tbody>
</table>

*Calculated from data in the article.
athlete is 4.1 times more at risk, or more likely to incur an injury, in competition than during a training session. This is a common finding across all sports, where data based on exposure show a higher injury rate in competitions, ranging from two to nine times greater than in training [16].

Injury Severity

Injury Type

Four of the prospective studies [7, 8, 14, 15] provided data that allowed calculation of a percentage breakdown of the types of injuries incurred by young track and field athletes. A summary of these data is presented in table 3. Muscle strains appear to be a predominant type of injury across all the studies. Inflammation also is a major type of injury in three of the studies, but apparently was not a category used by Mueller et al. [7] in their data collection forms. Ligament sprains also are a common type of injury across all the studies.

Catastrophic Injury

None of the studies mentioned so far reported any catastrophic injuries; i.e., injuries resulting in death or permanent disability. However, data on these severe injuries are available from the National Center for Catastrophic Sport Injury Research [17]. They report injuries of three types: fatal; nonfatal (permanent severe functional disability); and serious (no permanent disability, but a severe injury; an example would be a fractured cervical vertebra with no paralysis or transient paralysis with eventual complete recovery). The injuries are categorized as direct (resulting directly from participation in the sport), and indirect (resulting from a systemic failure as a result of exertion while participating in a sport or by a complication secondary to a nonfatal injury). These data are collected from across the USA via news and wire service reports and from a network of individuals who monitor and report any such injuries in their area.

Twenty years of high school data for track and field (1983–2002) indicate a total of 54 direct injuries: 20 fatal injuries (1/year), 14 nonfatal injuries (0.7/year) and 20 serious injuries (1/year). During this period there were also 27 indirect fatalities (1.35/year). These injuries are predominantly to male participants, with males recording 0.19 direct fatalities per 100,000 participants versus 0.01 for females, 0.13 nonfatal injuries per 100,000 for males versus 0.01 for females, and 0.15 serious injuries per 100,000 for males versus 0.05 for females. Indirect injuries show the same pattern, with 0.24 indirect fatalities per 100,000 for males versus 0.05 for females.

Pole vaulting was the activity responsible for the majority of these injuries, with 17 fatalities, 8 nonfatal and 6 serious injuries over the last 20 years. All of
### Table 3. A percent comparison of injury types in youth track and field

<table>
<thead>
<tr>
<th>Study (all prospective)</th>
<th>Number of injuries/ number of participant-seasons</th>
<th>Contusion</th>
<th>Dislocation</th>
<th>Fracture</th>
<th>Inflammation</th>
<th>Laceration</th>
<th>Sprain</th>
<th>Strain</th>
<th>Stress</th>
<th>Tear</th>
<th>Tendonitis</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orava and Saarela [15]*</td>
<td>71/144</td>
<td>2.8</td>
<td>–</td>
<td>–</td>
<td>39.4</td>
<td>–</td>
<td>12.7</td>
<td>16.9</td>
<td>1.4</td>
<td>1.4</td>
<td>12.7</td>
<td>12.7</td>
</tr>
<tr>
<td>Requa and Garrick [14]*</td>
<td>174/1,032</td>
<td>1.9</td>
<td>–</td>
<td>3.0</td>
<td>17.6</td>
<td>1.9</td>
<td>15.5</td>
<td>45.1</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>14.6</td>
</tr>
<tr>
<td>Watson and DiMartino [8]*</td>
<td>41/234</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>36.4</td>
<td>2.4</td>
<td>17.1</td>
<td>24.3</td>
<td>–</td>
<td>–</td>
<td>14.6</td>
<td>4.9</td>
</tr>
<tr>
<td>Mueller et al. [7]*</td>
<td>1,659/53,700</td>
<td>4.0</td>
<td>1.6</td>
<td>3.9</td>
<td>–</td>
<td>1.4</td>
<td>20.2</td>
<td>48.8</td>
<td>1.6</td>
<td>–</td>
<td>–</td>
<td>18.3</td>
</tr>
</tbody>
</table>

*Calculated from data in the article.
these 31 injuries involved the athlete bouncing out of or landing off the landing pit. The much higher rate of direct injuries to males noted above can be largely explained by the fact that females did not participate in pole vaulting until very recently. There also have been 20 direct injuries involving athletes being struck by a thrown discus, shot or javelin.

**Time Loss**

Only two studies [7, 14] provided any useful information on time loss for track and field injuries. Requa and Garrick [14] reported that boys and girls had a similar pattern, with 14 and 19% of injuries with greater than 10 days lost, respectively, and 30% and 40% of injuries with greater than 5 days lost, respectively. The more recent and much larger study by Mueller et al. [7] showed a different pattern, with 50% of injuries to boys lasting one week or longer and only 33% of injuries to girls lasting one week or longer. It is difficult to make comparisons with these studies because they used different breakdowns of the number of days lost.

**Injury Risk Factors**

Only two studies presented data that could be utilized in this section. Mueller et al. [7] tabulated data on year in school and years of experience that indicated a trend toward fewer injuries with age and experience. But without any data presented on the numbers of participants at each level, it is not possible to come to any conclusions about this issue. The study by Bennett et al. [13] investigated a number of potential factors for predicting the occurrence of MTSS in high school runners. They concluded that sex (female) and a ‘pronatory foot’ (larger values for the navicular drop test) are predictive of MTSS. They did not feel their sample was large enough to establish a specific threshold for the navicular drop test.

Five of the studies (table 1) provided enough data to calculate injury rates per 100 participants by sex. The results show no definable trend. Three of the studies show girls with a higher injury rate, and two show boys with the higher rate. Combining the data from the five studies gives an injury rate of 3.0/100 participants for the boys and 4.4/100 participants for the girls, but this result should not be considered definitive because the size of the database for the Mueller et al. [7] study overwhelms all the other studies, and without exposure data the results can be very misleading, as illustrated earlier. The most dependable piece of data is in the right column of table 1, where the Mueller et al. [7] study provides the only data available involving exposures. It shows an injury rate of 1.0/1,000 athlete-exposures for boys and 1.5/1,000 athlete-exposures for girls.
Suggestions for Injury Prevention

Because there are so few data currently available on the epidemiology of youth track and field injuries, there is little solid information upon which to base any suggestions for injury prevention. When discussing youth sports injuries, common subjects of concern for growing athletes are the risks of epiphyseal and apophyseal injuries and how to prevent them. These have been studied more thoroughly in a few other youth sports (for instance, see the chapter on Gymnastics in this book), and have been mentioned in reviews of adult track and field injuries [5, 6]. While the data regarding the risks for these types of injuries from other youth sports may be generalizable to youth track and field, there still are no well-designed, true epidemiological studies of these issues available for this sport. A good number of well-designed, large-scale basic epidemiological studies involving the collection of exposure data are needed for this sport (or any sport) to develop sound judgments as to the etiological factors involved in specific injuries. Knowledge of the etiological factors is needed to develop reasonable preventive measures. Then further epidemiological studies are needed to monitor the impact of the preventive measures. With the exception of the recent Mueller et al. [7] study, nothing of this nature has been accomplished for this sport at the very beginning of this cycle, let alone at any of the other stages.

While there currently is no sound scientific basis for making suggestions to reduce injuries in youth track and field, one ‘common sense’ suggestion can be made with regard to preventing the types of Catastrophic Injuries mentioned above. Over the past 20 years, nearly all these types of injuries have occurred in the pole vault and the throwing events (see Catastrophic Injury above). Recently, advances have been made with regard to rules and requirements at all levels of competition for the size and characteristics of the pole vault landing pit, which should help reduce the risk involved with that event. Beyond that, and also with regard to the throwing events, coaches and competition administrators should ensure that they have an adequate number of well-trained officials to monitor these events during competitions. Unfortunately, this sport requires a large number of officials for a competition. A high school dual meet needs at least 25–30 officials to provide adequate coverage. A large multiday championship meet can use up to 150 officials. Compare this with the very small numbers of officials needed for a football, basketball or baseball game.

Out of necessity, track and field officials for the most part are unpaid, and most often at the high school and junior high school level they are parents and spectators helping out. The national governing body for track and field, USATF, operates a national training and certification program for officials, the only program of its kind in the country for this sport. Safety, particularly in the field...
events, is a major point of emphasis in the USATF training program. Coaches and school administrators need only contact the officials certification chair for the local USATF association (through www.usatf.org) to request help from a few trained officials, who can help reduce the risks for these events. Most USATF association officials groups also can provide brief training programs for local parent and volunteer groups in how to properly and safely officiate a meet. When coaches and athletes regularly experience a safely run competition venue during competitions, they will more likely transfer those safe practices to the training setting as well. In addition to using adequately trained officials for competitions, schools and clubs should use coaches who have successfully completed a training program specific to track and field. For example, in the USA the USATF Coaching Education Level I program, or the American Sport Education Program available through the National Federation of State High School Associations are available.

**Suggestions for Further Research**

Future epidemiological research in youth track and field injuries is wide open, with much to be accomplished. As noted previously, there are very few studies currently available in the literature for the youth level in this sport, and most available studies tend to be on older athletes. There is not enough information regarding even the first stage of the epidemiology-epidemiology cycle that is necessary for beginning the attempt to reduce injuries in youth track and field. There is a need for a number of large-scale epidemiological studies of high school, middle school and club teams, but at this stage even smaller studies at the local level can be of value, if properly designed and carried out. While studies designed to address a specific research question may be appropriate, particularly for smaller studies, at this stage there is a great need for the larger, basic study of the overall epidemiology of injuries in this sport.

Such studies must utilize a common definition of a reportable injury [16]. As seen in table 1, none of the nine studies selected for this review used exactly the same definition of an injury, making it difficult to compare data across the studies. Currently the most commonly used (and recommended) definition of a reportable injury in sport injury epidemiology is: an injury incurred during participation in the sport, requiring medical attention at some level (e.g., coach, school nurse, trainer, and physician), and keeping the athlete from normal full participation for the remainder of that competition/training session or for one or more days following the injury. Many studies also will include any head injury that results in evaluation for a possible concussion, whether or not time
loss is involved. The notion of time loss keeps the data recording system from being inundated with minor injuries that do not interfere with normal participation. Using definitions involving longer time loss periods (e.g., 2 days, 1 week) are not recommended because they may miss many of the more subtle injuries and will make the study more difficult to compare with other studies, both in this sport and across other sports, which do use the recommended definition of a reportable injury.

The population of athletes used in a study should be clearly defined, and as representative as possible. The numbers of males and females must be known and reported, as well as other characteristics of the participants, such as age, grade in school, and event(s) they are participating in, at a minimum. If they are of interest, other characteristics such as race/ethnicity, years of experience in the sport, or previous injury history should be collected at the beginning of the study and reported as well.

The data should be collected by a person with medical knowledge (e.g., certified athletic trainer, school nurse, and team physician). This individual should be present at all training sessions and competitions. Of great importance is the collection of exposure data, the major weakness of nearly all previous studies in this sport. Data must be collected and reported on the number of athletes participating in each training session and competition (not all athletes are necessarily at every training session, and not all athletes who train with a team or club are necessarily involved in a particular competition). This should be done on a standard form designed to fit the needs of a particular study. Injury data also should be reported on a standard form. This should include information such as characteristics of the injured individual, date and time of injury, competition or training session, body part injured, type of injury, circumstances of the injury, event, and severity (amount of time loss). Data forms should be submitted on a regular basis (e.g., weekly) to a central collection point, logged in and reviewed for completeness and consistency. The person completing the data forms should be contacted if there are missing forms, incomplete forms or inconsistencies in the reported data (e.g., a fractured lower leg that kept an athlete out for only 2 days should be followed up for clarification).

Utilizing the injury data and the exposure data, results should be reported as injury rates per 1,000 athlete-exposures. As noted previously, reporting percentages of injuries or injuries per 100 participants is not sufficient for the purpose of providing the information needed to explore etiological factors or for making comparisons with other studies or other sports. Reporting rates as injuries per 1,000 athlete-exposures is the recommended standard minimum reporting procedure. Ideally, collecting exposure data also in terms of hours of participation to allow reporting of injury rates per 100 or 1,000 h of exposure...
would be preferable, and may be possible in smaller studies. However, it is
difficult to do this in large-scale studies, so rate per 1,000 athlete-exposures is
recommended.

In addition to the medically trained persons responsible for on-site data
collection, the research team for epidemiological studies of this nature should
include a sports medicine physician, and a computer-knowledgeable data
manager familiar with medical terminology and the sport involved, who prior
to data entry can log in and screen the data forms for completeness and consist-
ency as they are received. It also is preferable to have an epidemiologist and/or
biostatistician available for consultation, particularly one with experience in
injury epidemiology. It is possible that one individual can cover more than one
of these responsibilities, particularly for smaller-scale projects. Usually, the
larger the project, the more people will have to be involved.

Informed decisions about preventing injuries in youth track and field are
dependent upon the quality of the basic epidemiological data available, and at
this time such data are for the most part nonexistent for this sport. Because of
the large numbers of participants and the large number and variety of activities
involved in track and field, adequately designed epidemiological research is dif-
ficult. But the future is wide open for anyone willing to take on the challenge of
doing epidemiological research in youth track and field.

References

2 Subotnik SI: The biomechanics of running: Implications for the prevention of foot injuries. Sports
4 USATF 2004: Personal communication from Andy Martin, USATF national office, on
5 Knutzen K, Hart L: Running; in Caine D, Caine C, Lindner K (eds): Epidemiology of Sports
6 Alexander MJL: Field events; in Caine D, Caine C, Lindner K (eds): Epidemiology of Sports
8 Watson MD, DiMartino PP: Incidence of injuries in high school track and field athletes and its
9 Zaricznyj B, Shattuck LJM, Mast TA, Robertson RV, D’Elia G: Sports-related injuries in school-aged
10 Backx FIG, Beijer HJM, Bol E, Erich WBM: Injuries in high-risk persons and high-risk sports.

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