

**Sports Safety**  
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**Background**

Every day, millions of children and young adults participate in sports activities. They can range from track and field to football, swimming to soccer, and gymnastics to ice hockey. Involvement in these athletic endeavors helps a child improve their physical fitness, their coordination, and it teaches them to learn about teamwork. However, with such vast numbers of involvement, parents and caregivers should recognize the potential injuries that their youth may incur due to participating. Like other causes of injury to children, many sports injuries are preventable; they are not “accidents.” By recognizing injury patterns and by understanding the risks of each particular sport, improvements in rules and equipment and better preparation by the player could make a child safer when participating.

**Surveillance**

Compared with other areas of injury control, sports-related injuries pose particular problems. First, the injuries are difficult to track and reporting of these injuries may lack accuracy. Data surrounding a sports injury event can be elicited from emergency department charts, private pediatrician offices, or any medical record. However, only a minority of the total number of injuries may be treated in such a setting. The best studies of sports-related injuries come from data collected by athletic trainers, school nurses, and team physicians.<sup>1</sup> Yet again, this data tends to only reflect injuries that occur during competition in an organized sport at an isolated site. It would not account for the children that play sports recreationally during recess or after school and the magnitude of the problem may be missed if only one team or school is collecting the data. Second, a standard method for reporting and classifying sports injuries does not exist. Most sports injuries are documented by the body part injured or the amount of time a player missed practice or a game. Thus, every abrasion or laceration may not be reported as an injury that occurred during a sporting event. By reporting just the body part injured or the time missed from participating, important information such as the mechanism of injury or the equipment or lack of equipment involved may be absent from the report. By lacking such information, future preventative steps cannot be designed.

**Magnitude of the Problem**

Although tracking injuries may be difficult, there is some literature as to the magnitude of the sports injury problem. According to the National Electronic Injury Surveillance System of the US Consumer Product Safety Commission, more than 3.5 million sports-related injuries, for children less than 15 years of age, are treated in hospitals and physician's offices each year.<sup>2</sup> This accounts for more than one-quarter of all emergency department injuries for children.<sup>3</sup> For children involved in an organized sport, the majority of injuries that are reported (70-80%) are minor, resulting in less than one week of practice missed.<sup>6</sup> Sixty percent of these injuries tend to occur in practice since there are more children participating at this time than the limited number exposed during game

competition. A significant number of these injuries still require medical attention with approximately 770,000 requiring a physician visit and roughly 90,000 needing hospitalization each year.<sup>4</sup> As a result, sports injuries have been shown to cause an estimated health care cost (indirect and direct) of 1.3 billion dollars.<sup>5</sup>

### **Injury Mechanisms**

Before a child participates in any athletic competition, parents must understand that there is always a risk of injury. In general, children less than 10 years of age are injured more commonly during individual recreational activities rather than organized sporting competition. These injuries may occur as a child collides or falls while riding a bicycle, sledding, or skating. Usually these injuries occur within the first week of the activity, before the child fully can grasp the skills required.<sup>6</sup> The older, pubertal child, is more likely to be injured during organized sporting activities, when weights are greater and the collisions are more severe.<sup>7</sup> Following simple laws of physics, if velocities and weights increase, the collision or stress endured at the encounter will be greater. The majority of athletic encounters match children by age during organized competition; except for the rare occasion when children are matched by weight as in wrestling, for example. Since children can grow at different rates, similarly aged children can have significant differences in height and weight, increasing one's risk of being injured. This may play a role in deciding which organized sport best suits your child. Also, in this decision process, there is some literature to suggest that certain sports can be considered more risky for injury than others.

As mentioned earlier, most children less than 10 years of age sustain an injury during an individual recreational activity. Gotsch and her colleagues, concurred with this finding as they reviewed non-fatal injured children presenting to their Emergency Department. Their results showed that common mechanisms of injury within this age range included: playground, bicycle, scooter, and trampoline injuries.<sup>8</sup> For sporting activities involving the older aged children, several studies have compared different sports to determine injury numbers and the types of injuries seen. Garrick in 1978, and later McLain in 1989, analyzed injuries to interscholastic high school athletes and both found similar results despite being performed 11 years apart and in different areas of the United States.<sup>9,10</sup> Football, wrestling, track and field, basketball, and soccer participation resulted in the most common sports causing injury for males, while softball, gymnastics, track and field, basketball, and volleyball produced the most injuries for females. In these studies, injuries were defined as a sports-related medical problem that required removal from participation. Gotsch and Taylor, on the other hand, reviewed sports-related injuries that resulted in an Emergency Department visit.<sup>8,11</sup> In these reviews, recreational and organized sports were grouped together. Gotsch showed that football, basketball, and cycling were amongst the more common mechanisms for causing injury for males and basketball for females. Taylor grouped both females and males together in her study and showed that football, basketball, gym games, and baseball were the most likely sports mechanisms to cause injury. Thus, from these studies, the common sports that cause injury to children are evident. In every study, football, wrestling, and gymnastics were mechanisms that caused a high frequency and severity of injuries. However, the sport that

causes the most injuries may vary depending on the definition utilized or the database analyzed.

### **Types of Injuries**

After understanding the common mechanisms that may result in a pediatric sports injury, it is important to grasp what types of injuries these children may sustain. In general, injuries among young athletes can fall into two categories: acute injuries and overuse injuries. Both of these types of injuries usually involve muscles and bones. In the acute setting, the most common injuries seen are strains, sprains, fractures, or contusions.<sup>11</sup> These injuries may result from a collision, a sudden twist, or a fall onto a particular body part. The overuse injuries tend to occur due to repetitive, small injuries to an immature and developing body. Any sport in which repeat motions occur, such as pitching a baseball, running cross country, or swinging a tennis racquet, overuse injuries should be a concern. In the past, these overuse injuries tended to only occur in the older athlete. Today, however, children are getting involved in competitive, organized sports at a younger age and on some occasions their dedication to excellence has them over-extending their body's limits. The common overuse injuries that may be seen include: tendonitis, stress fractures, bursitis, and strains.

The body part that gets injured may vary from sport to sport as different sports may emphasize different body parts during activity. For example, lower extremity injuries may be seen more often in soccer, cross country, basketball, and field hockey, whereas, upper extremity injuries may occur from swimming, tennis, or baseball pitching. Since gymnasts participate in different events and all body parts are stressed during competition, upper and lower extremity injuries tend to be equally distributed.<sup>6</sup> Injuries may also result from the type of equipment used or the ball involved in the activity. Eye injuries are more of concern in sports where a projectile is involved, such as baseball or racquetball. The age of the child can also determine the site most commonly injured within a particular sport. Younger athletes tend to fall on an outstretched arm, while older competitors often injure their lower extremity. On some occasions, there is even a difference amongst sexes as to the susceptibility of an injury within a particular sport. For example, females tend to have more knee injuries in basketball than their male counterparts. In general, males often sustain more shoulder injuries from organized, sport competition, while females are usually more susceptible to knee and ankle injuries and overuse injuries.<sup>12, 13</sup>

Since most sports only place a child at risk for a minor injury, parents may wish to learn more about sports that could potentially cause a "catastrophic injury" to their child. Catastrophic injuries can be defined as an injury that "results in permanent, severe neurologic disability (eg. spinal cord injury, cerebral injury)."<sup>1</sup> These injuries can further be classified as either a direct or an indirect catastrophic injury. Direct injuries result from trauma that occurred from actively participating in the sport (eg. tackling in football or colliding heads in basketball), whereas indirect injuries usually result from overexertion while participating (eg. sudden cardiac death or dehydration). High school and college sports with the most physical contact, such as football and ice hockey, have

been shown to cause the most direct catastrophic injuries.<sup>1</sup> While lacrosse basketball, and ice hockey have been reported to cause the majority of indirect catastrophic injuries.<sup>6</sup>

### **Injury Prevention**

As better surveillance systems are utilized to track new and old injuries from sports and research is completed to determine the epidemiology of these injuries, effective preventative strategies can be implemented (See Table 1: Parent Education Pamphlet for general preventative strategies). Of course, to discuss all injuries due to sports and their preventative strategies is beyond the scope of this paper. However, an overview of general prevention techniques will be addressed. These interventions can often be placed within one of three categories: equipment/field modifications, rule changes/coaching, and better preparation by the individual participant.

#### **Field/Equipment Changes**

Countless changes in equipment and playing fields have reduced injuries to young and older athletes. Equipment changes/innovations often address particular trends in injuries to athletes within individual sports. For example, young hockey players sustaining eye/facial injuries in Canada began to wear face masks and helmets to prevent these traumatic events. After this requirement was established, Pashby found a significant decrease in facial injuries.<sup>14</sup> Traumatic leg injuries have been shown to be more evident in soccer players who have inadequate or no shin protection.<sup>15</sup> Changes in the field can also have an impact in reducing injuries. By anchoring soccer goals, fewer young soccer players have been crushed by a movable/falling goal.<sup>16</sup> Field modifications to decrease the number of potholes, grates, and rocks from the playing surface, and removing objects around the perimeter of the field during play can also help to reduce injuries to the competitors.

#### **Rule Changes/Coaching**

By changing rules within an individual sport to protect young athletes, by officials enforcing these rules, and by coaches teaching their players the appropriate way to play, young athletes can be safer to enjoy the sport in which they participate. One of the most successful rule alterations that resulted in a reduction in cervical spine injuries was the outlawing of “spearing” by football players. Spearing is the act of making an initial contact with the helmet when tackling an opponent. Studies after this rule was enacted around 1976, showed there to be a significant reduction in the number of quadriplegic events to these young athletes.<sup>17</sup> Officials play an important role to enforce the rules that have been established. If penalties were not issued for inappropriate play, the injurious behavior would likely continue. Because stiff penalties were issued to football players for “spearing,” this form of tackling has decreased significantly over time. Coaches, as well, need to teach their players the rules of the game. Not only will it allow them to participate effectively, but it can also make them safer as they play and learn to develop their skills.

## **Individual Preparation**

Before youth sign up to play a particular sport, the parents and the child should do their research to learn more about the activity. Finding out some of the common injuries associated with the game, what equipment is recommended to compete, and who will be supervising the games as they play are important pieces of information needed. After the sport of choice is decided and it has been researched, the child should undergo a pre-participation physical evaluation. This early physical exam by a medical professional should assess a child's general health and fitness status. It can also act to learn the young athlete's goals for participating and it ensures that the parent/child understands the risks of the game. After the appropriate equipment has been purchased and the child has been medically cleared to play, the athlete must get in the appropriate physical condition in order to compete. The athlete cannot expect practices alone to prepare them appropriately to play, some individual preparation should be done. This conditioning should be adequate for the level of play by the child. Over-conditioning can cause problems and overuse injuries as well. Also, warm-ups and stretching prior to conditioning and practices are essential. Adequate hydration is also important prior to and during competition, especially during summer sporting events. Finally, if a child does sustain an injury during play, the injury should be adequately rehabilitated and the player should be evaluated and cleared by medical personnel prior to returning to play. Of course, the extent of the injury would determine the level of rehabilitation and the needs for seeking a medical evaluation.

## **Common Injuries and Preventative Strategies Associated with Popular Sports (Adapted from Barfield & Gross)<sup>18</sup>**

### **Football**

#### **Common Injuries**

- Head injuries
- Neck injuries/Stingers
- Low back stress fractures
- Contusions
- Dehydration/Heat-related illnesses

#### **Prevention Strategies**

- Teach proper tackling
- Use proper protective equipment (helmets, face masks, etc)
- Ensure proper hydration and take frequent water breaks
- Remove helmet frequently

### **Soccer**

#### **Common Injuries**

- Head contusions/concussions
- Tibial shaft fractures
- Ankle sprains

#### **Prevention Strategies**

- Teach proper heading techniques and avoid excessive heading
- Use shin guards
- Stretch ankles specifically prior to play

## **Baseball/Softball**

### **Common Injuries**

- Throat injuries (catchers)
- Head & eye injuries
- Rotator cuff injury / tendonitis
- Medial epicondylitis
- Ankle injuries

### **Prevention Strategies**

- Wear proper protective equipment (helmets, throat guards, etc)
- Limit number of throws and teach proper pitching techniques
- Initiate proper shoulder strengthening (especially in off-season)

## **Basketball**

### **Common Injuries**

- Head injuries
- Patellar tendonitis
- Ankle injuries

### **Prevention Strategies**

- Require stretching, strengthening, & conditioning exercises
- Brace or tape ankles when appropriate
- Avoid significant contact during play

## **Gymnastics**

### **Common Injuries**

- Flexion & hyperextension thoracic / lumbar vertebral injuries
- Wrist and forearm sprains/tendonitis
- Shoulder instability
- Anorexia Nervosa & delayed puberty

### **Prevention Strategies**

- Exercises and strengthening for trunk and abdomen to maintain neutral positioning of the spine & rotator cuff for shoulder
- Wrist bracing and tape when appropriate
- Limit weight bearing on the upper extremities
- Limit extreme and repetitive shoulder use
- Monitor weights and exercise routine

## **Wrestling**

### **Common Injuries**

- Shoulder dislocations, AC joint and sternoclavicular strains
- Knee injuries
- Skin infections from mat (impetigo, tinea corporis)
- Auricular hematomas & resultant deformity (cauliflower ears)

### **Prevention Strategies**

- Preseason strengthening of shoulder & knees
- Avoid quick stops in dangerous positions
- Ensure mats are cleaned daily with antiseptic solution
- Teach athletes to check skin for lesions and prior to play
- Use proper protective equipment always (snug head gear with ear protection)

## Summary

Participation in youth sports helps children with their coordination, physical skills, and it teaches them about competition and team play. In general, youth sports are relatively safe. Injuries become more of a concern as a child grows and gets older. Sports that have been shown to cause significant injuries at the high school and collegiate level are football, wrestling, and gymnastics. Prior to competition, youth athletes and their families should: research the particular sport to determine if the sport is appropriate for their child; purchase the appropriate equipment to play; and receive a pre-participation physical evaluation. Remember that all sports can place your child at risk for an injury and by preplanning and adequate training your child can be safe and healthy. Finally, the most important detail is to make sure that your child is learning and having fun in their chosen sport.

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