

# An Injury Prevention Curriculum for Coaches



*Keeping Kids in the Game for Life*

Developed by:  
William Oates, PT, Director of the Sports Medicine and Rehabilitation Department  
at Nathan Littauer Hospital  
Casey Barlow

Contributions from:  
Cheryl McGrattan  
Victor Batista  
STOP Sports Injuries Campaign Steering Committee

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LITTAUER**

*Hospital & Nursing Home*





# Introduction

There is a growing epidemic of preventable youth sports injuries that are dismantling kids' athletic hopes and dreams at an early age. The mission of the STOP Sports Injuries campaign is simple: Keeping kids out of the operating room and in the game for life. Created by Nathan Littauer Hospital (Gloversville, NY) in partnership with the STOP Sports Injuries campaign, this curriculum serves to help all coaches and parents learn about preventing overuse and traumatic injuries in youth athletics.

We hope by completing the training provided in this curriculum, you will:

- Learn the basics of athletic overuse and traumatic injury prevention and identification
- Organize other trainings for coaches and parents in your area
- Have open dialogue with parents and coaches on the problem of sports injuries
- Spread awareness of the national STOP Sports Injuries campaign

For more information on the campaign and preventing youth sports injuries, please visit [www.STOPSportsInjuries.org](http://www.STOPSportsInjuries.org) and [www.nlh.org](http://www.nlh.org).

## *About STOP Sports Injuries*

The American Orthopaedic Society for Sports Medicine (AOSSM) initiated the STOP Sports Injuries campaign in 2010 to prevent overuse and trauma injuries among young athletes. Founding partner organizations include the American Academy of Orthopaedic Surgeons, American Academy of Pediatrics, American Medical Society for Sports Medicine, National Athletic Trainers' Association, National Strength and Conditioning Association, Pediatric Orthopaedic Society of North America, Sports Physical Therapy Section, and SAFE Kids USA. Today, more than 250 other local and national organizations have taken the pledge to prevent youth sports injuries.

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# Preseason Conditioning and Proper Warm-up

## The Importance of Preseason Training

Training in the months prior to the start of a sports season is critical to an athlete's success, no matter how old or how advanced the athlete. In addition to the physical advantages an athlete will gain, a successful preseason strength and conditioning program prevents short- and long-term injury. A study on preventing adolescent sport injuries, based on a review of 154 clinical papers, concluded that preseason conditioning and education are vital in preventing injuries in youth athletes.<sup>1</sup>

Coaches of all youth sports at all levels must educate players on proper off-season training and preparation for the season, emphasizing the need for effective training regimens. However, maintaining a balance between work and rest is crucial throughout the year, as coaches cannot risk over-training their young athletes, which may have a detrimental effect on an athlete's performance and health.

Athletes who neglect off-season training put tremendous strain on their bodies once practices have commenced, making injuries such as tendonitis and muscle strains, as well as heat-related illnesses, very common. Many injuries occurring during the first weeks of practice stem from inadequate preseason preparation.



## Preparing Athletes for Success

Off-season and in-season training vary from sport to sport and through various levels. While the human body is tremendously resilient, pushing a body—especially one that is young and not fully developed—beyond what it can handle can have significant short- and long-term consequences. To avoid over-training young athletes, follow the simple 10 percent rule: Do not increase weight, training activity, mileage or pace by more than 10 percent a week.<sup>2</sup> This prevents stressing the body beyond capacity by allowing it to rest, rebuild, and recover. In fact, increasing training intensity too quickly can actually lead to a decrease in aerobic capacity.

When designing an off-season training regimen, the ultimate goal is preventing injury and bringing athletes to peak performance levels. While different sports and ages require different approaches, the central idea is making improvements gradually, remembering the 10 percent rule. As a general guideline, it should take an athlete six to eight weeks of training to safely reach optimal performance for an upcoming season.

For all sports, focus on improving core stability and balance first. A sound core and optimal balance is crucial to controlling and stabilizing the limbs. An example of this would be growing a strong trunk to support the limbs of a tree.

Next, focus on improving overall cardiovascular fitness and endurance, focusing on long duration and low intensity workouts. Even if the sport is primarily anaerobic, an athlete with a strong cardiovascular status will advance faster when training for aerobic/high-explosion activities. Remember, in youth and high school athletics we are training the total athlete, not just athletes for an individual sport. Coaches should have a strong understanding of what is and is not needed for training healthy athletes.





*A Coaches Dozen: Twelve FUNdamental principles for building young and healthy athletes.<sup>3</sup>*

1. Remember: young athletes are not mini-adults
2. Value preparatory conditioning
3. Avoid sport specialization before adolescence and preferably not before late high school
4. Enhance physical literacy, such as fundamental skills
5. Realize it's better to under-train than over-train
6. Focus on positive feedback
7. Maximize recovery: stretch, cool down, hydrate, eat a nutritious diet, and relax
8. Remind athletes that it is not what you take, it is what you do
9. Get connected: listen to the athlete
10. Make a long-term commitment to safe practices
11. Maintain open communication: there are no secrets
12. Never stop learning

Sports are meant to be fun while facilitating the social development of our youth. Over-training can burn children out quickly, stripping them of the enjoyment associated with sports for years to come. Coaches and parents should attempt to instill that winning is not everything and instead inspire the enjoyment of physical activity and the camaraderie associated with being part of a team.

## Warming Up for Play

The years of watching players lying down and counting off their static stretches before practice are over. More and more teams around the country are correctly introducing dynamic warm-ups to their pre-practice and pre-game routines. Recent studies conclude that static stretching (stretching that is held for ten or more seconds) does not reduce the risk of injury.<sup>4</sup> Furthermore, studies conclude that static stretching prior to competition actually decreases athletic performance in highly explosive movements such as sprinting and jumping.<sup>5 6</sup> This has led teams of all levels to incorporate dynamic stretching and plyometric activity into their warm-up routine.



Dynamic stretches facilitate movements similar to those during play and target muscle groups as they relate to specific sport movements. In addition to raising muscular tissue temperature in the body and increasing blood flow, dynamic stretching activates the nervous system, preparing the body for movements performed during play.<sup>7</sup> Plyometrics is a system of exercise in which the muscles are rapidly and repeatedly stretched and contracted for optimal function.

Common dynamic and plyometric exercises include the following:

- Warm-up: 1/2-speed jog, 3/4-speed jog, backwards jog and karaoke
- Mild jog with high knees, skipping, butt kicks, and reaching to toes
- Lunges with twist and walking quad stretch
- Crawling calf stretch
- Simulating 3/4-speed sport-specific activities (plyometrics), such as bounding, hopping, and diagonal cutting

Coaches must constantly adapt and research dynamic warm-up routines that will be most effective for their athletes and sports.

## Cooling down

Coaches and athletes often sacrifice cooling down properly after practices and games. Taking an extra 15 minutes after play to statically stretch will speed the recovery process, lengthen muscles, and improve muscular range of motion.<sup>8</sup> As dynamic stretches are beneficial prior to play, static stretching is effective for cooling down properly.

Athletes also should continue to drink plenty of fluids after play. Drinking water or other sports drinks 20 minutes after physical activity will help the body recover and recharge, as well as avoid potential heat illness.

Coaches should emphasize the importance of warming up and cooling down properly. Warming up effectively will not only prevent injury, but also dramatically improve performance during play, while static stretching after play has been proven to be highly beneficial in helping muscle recovery. By following these practices, coaches will greatly reduce injury, increase performance, and keep our children in the game for life.



# Overuse Injuries

## How are Overuse Injuries Different than Other Injuries?

When athletes sustain a concussion or break a wrist, they have suffered an acute injury. An acute injury usually results from a singular event such as a hit or fall. By contrast, an overuse injury develops slowly over time due to repetitive stress on tendons, muscles, bones or joints. This is a key concept that must be understood by coaches, parents and players: overuse injuries develop over time.

Overuse injuries are difficult to diagnose because the pains caused by repetitive microtrauma often go unreported or are overlooked by the athlete during the initial progression of the injury. Many athletes ignore minor aches and pains because they are subtle and minimally affect function in the initial stages. Teaching athletes to recognize and report any small aches or pains is the first step in reversing and preventing the development of an injury. Particularly in young athletes, an undiagnosed injury often leads to a more severe injury down the road.

To better understand this concept, consider a 14-year-old female volleyball player. She is in her second year of playing volleyball at high school and plays for a club team during the off-season. She jumps anywhere from 25 to 100 times per practice, five times a week during her high school season, and two times a week during her club season. She begins to notice soreness in her shins after practice but thinks nothing of it because it's not affecting her play.

This volleyball player is suffering from an overuse injury commonly known as shin splints. Her shin splints are in the initial stages, resulting from repetitive small tears in her shin muscles. If she continues to ignore the injury, the damage to her shins will increase, eventually restricting her movements and physical capabilities, if not benching her completely.





Overuse injuries are a rapidly growing concern among youth athletes. Every year 3.5 million children under the age of 14 are treated for sports injuries, and among middle school and high school athletes half of them are overuse injuries.<sup>9</sup> Unfortunately, the rate of overuse injuries is climbing while the average age of children afflicted with overuse injuries is decreasing. In the past 10 years, there has been a fivefold increase in the number of severe elbow and shoulder injuries in youth baseball and softball players alone.<sup>10</sup> This is a growing epidemic that cannot be ignored.

## The Problem is Not in the Body, It's in the Head

The rise of overuse injuries in the youth sports community is often a direct result of early sport specialization. Kids are specializing in sports—playing only one sport year-round—at an earlier age. Specialization usually stems from high expectations with competition. However, as we will learn, the physical and mental consequences of sport specialization greatly outweigh any reward.

In recent years, top professional athletes have dominated the sporting world. We constantly watch highlight videos and listen to remarkable success stories, but what we don't hear about are the 70 percent of kids who drop out of youth sports by age 13 due to pressure from adults, coaches and parents.<sup>11</sup> These children will be deprived of enjoyment and health simply due to the excessive demands of our sporting community.

Youth sports are supposed to facilitate sportsmanship and fun. Children are not mini-adults. They are not developed enough physically or mentally to begin specializing in sports. Our youth sporting community needs to readdress the role of sports in our children's lives and realize that fun, learning and camaraderie are more important than fashioning the 13-year-old professional athlete. We all must realize that the one individual who specialized and went on to professional stardom in athletics is a “one-in-a-million” child, not the norm. As such, everyone involved in youth athletics needs to be mindful of realistic expectations and goals.



## Physical Dangers of Overuse Injuries

Unlike many acute injuries, overuse injuries are highly preventable if coaches, parents and players make a commitment to educating themselves on prevention. Overuse injuries result mainly from training errors and/or excessive training. Quick jumps in intensity, duration or frequency of practices and training are common training errors that result in overuse injuries.<sup>12</sup> These risks are especially relevant at the start of a season, among athletes who have not gradually or adequately prepared themselves for the upcoming season. Athletes who try to start off where they finished the previous season often develop overuse injuries during the first weeks back.

In all of youth sports, poor mechanics is still the number one cause for overuse injuries. Improper technique can put unsafe torque and pressure on tendons, bones and joints. Done repeatedly, improper technique will lead to a variety of overuse injuries that will only get worse until the form is corrected or a severe injury is sustained. This is why good and knowledgeable coaches are so important to young athletes.

While coaching and parenting youth athletes, it is crucial to understand that children, even in high school, are physically much less mature than adults. Over-exercising children before they have reached skeletal maturity can have severe long-term consequences. Intense forces or high volume muscle contractions on an immature skeleton can result in severe injury, such as an avulsion fracture of a growth plate.<sup>13 14</sup> Growth plate injuries will not only sideline an athlete, but also can have lifelong consequences on their growth. Untreated injuries can cause permanent damage and stunt physical maturity.

## Overall Prevention

Building a solid foundation of strength is highly recommended for all sports and activities. Do not sacrifice overall fitness for sport-specific strength, especially before the body is fully developed. Focus on training the total athlete gradually with adequate resting time. Competing in several sports throughout the year will prevent sport-specific repetitive stress as long as there is adequate rest between seasons.



The American Academy of Pediatrics Council on Sports Medicine and Fitness recommends that children play only one sporting activity to a maximum of five days a week, with a minimum of one day off per week. Giving children an additional two to three months off per year from a particular sport will allow the body to heal and recharge the mind. The council also recommends playing multiple sports, especially before puberty. Children who play multiple sports have fewer injuries and continue to play longer and at higher levels than children who specialize in one sport before puberty.<sup>15</sup>

As your children mature, educate yourself on preventing overuse injuries common in their sports. The STOP Sports Injuries campaign offers injury prevention resources for specific sports, which are great references for helping youth athletes play sports in safer and smarter ways. The following summary of common upper and lower body overuse injuries seen in many sports explains how to recognize, treat and prevent them.

## Common Upper Body Overuse Injuries

### *Shoulder*

Some of the most common overuse injuries are seen in players' shoulders. One of the most common overuse injuries in the shoulder is called Little League Shoulder (overuse injury to the proximal humeral physis). Swimming, baseball, tennis, softball and volleyball are just some of the sports that result in frequent overuse injuries. Many injuries in the shoulder stem from muscular imbalances in the shoulder, rotator cuff, and upper back. These muscles stabilize the shoulder joint and are directly involved in the eccentric (muscle lengthening) and concentric (muscle firing) movements of the arm and shoulder (e.g., throwing a baseball or spiking a volleyball).

In most athletes, the muscles in the front of the arm and shoulder are stronger than those in the back of the joint, which are responsible for slowing the forward motion of the arm after a pitch or swing. The four rotator cuff muscles are strained from too much force or overuse in one direction. Shoulder aches and pains during or after exercise should not be ignored. Rest, proper diagnosis, and rehabilitation are always best, but in general, using light weights to gradually strengthen and balance muscles in the upper body will help the shoulder recover.





### *Elbow*

Elbow injuries are typically seen in baseball and tennis players because of repetitive throwing or swinging motions. The problem arises from the inflammation and deterioration of ligaments and tendons in the elbow. This can lead to pain, tenderness, stress fractures, Ulnar Collateral Ligament (UCL) injuries, or permanent growth plate damage.

“Little League elbow” (overuse injury to the medial epicondyle apophysis) is an injury to the elbow that is caused by frequent forces (such as pitching) that overload the area. A common case involves a youth baseball pitcher who is throwing in too many innings, throwing inappropriate pitches for his/her age, or trying to throw too hard. It is important for athletes, parents, and coaches to know the signs of fatigue, such as consistently elevating pitches, changing the arm angle, missing locations more frequently, decreased velocity, and using the lower body less during the activity. This common injury has led youth organizations to impose maximum pitch counts and required rest periods for youth pitchers in order to protect them from injury. Such guidelines as implemented by Little League Baseball are listed below.

#### *Maximum Pitch Counts*

Age	Maximum Pitch Count
7-8	50
9-10	75
11-12	85
13-16	95
17-18	105

#### *Rest Periods Required*

Ages 7-16	Ages 17-18	Rest days
61+	76+	3 full days
41-60	51-75	2 full days
21-40	26-50	1 full day
1-20	1-25	None



*It is also important to follow these recommendations:*

- Rotate playing other positions besides pitcher
- Avoid pitching on multiple teams with overlapping seasons
- Do not pitch with any elbow or shoulder pain
- Never use a radar gun, as it encourages over-throwing
- Emphasize control, accuracy, and good mechanics
- Do not rotate between pitcher-catcher or catcher-pitcher in the same game

Master the fastball and change-up first before even considering breaking pitches, which torque the arm far more severely.<sup>16</sup> A general rule is not to throw breaking pitches until the player shaves. In other words, the pitcher has gone through puberty and his/her bones, cartilage and growth plates have matured.

Pitchers, tennis players, and javelin throwers often experience UCL injuries. This ligament is often stressed by repeated use, causing progressive deterioration or even a complete rupture. If unaddressed, this injury can progress and ultimately require the commonly known Tommy John surgery, a procedure where the UCL is replaced with a graft from another part of the body. The average recovery time for this procedure is 12 to 18 months. Athletes should be aware of the potential long-term consequences resulting from this type of injury at a young age, such as chronic pain, joint instability, and loss of function.

Although many overuse injuries can affect the upper body, shoulder and elbow injuries are the most common. Regardless of the injury, it is absolutely vital to stop and reverse the progression of overuse injuries. Work with a physical therapist or athletic trainer to increase flexibility, as well as strengthen and balance the core and other relevant muscles *before* injuries occur. Additionally, emphasize the importance of proper technique, using the entire kinetic chain and muscles involved in a particular movement for optimal safety and performance.



## Common Lower Body Injuries

### *Knee/ACL*

Athletes in all different sports are susceptible to overuse injuries in the knee, primarily due to repetitive movements such as jumping, cutting, and sudden starts and stops. The factors that seem to make females more likely to injure their Anterior Cruciate Ligament (ACLs) are not fully understood. Current research suggests that specific differences in movement patterns may be one of the culprits, but additional studies are needed. Common overuse injuries to the knee include patellar tendonitis and overuse damage to the tendon tissue.

Athletes also commonly sustain ACL injuries, a ligament that provides support to the knee. ACL injuries are commonly associated with a single event or “blow out.” Approximately 60% of these injuries occur from cutting with non-contact.

Strong hip abductors keep the legs stable and pelvis level when landing, preventing the knee from abnormal torque or twisting. Imbalances in abductor strength or the quad/hamstring ratio, which should be 2 to 1, will add further stress on the knee during jumping movements. It is commonly believed that strengthening the quadriceps prevents ACL injuries, and while this is partially true, athletes should not sacrifice strengthening the lower body as a whole.

Patellar tendonitis, like all overuse injuries, develops over time and arises from the inflammation of the patellar tendon that connects the kneecap to the shinbone. This tendon provides strength when the knee is straightened out during the jumping process. Often referred to as “jumper’s knee,” athletes will feel an ache below the kneecap after activity during the early stages of progression. Pain will continue to increase as the injury progresses. Patellar tendonitis can be treated to a certain degree with rest and ice and by developing effective flexibility in the quadriceps, lower leg, and hamstring muscles. Many athletes wear braces or supports called infrapatellar straps to support the tendon and improve stability.





A child's body cannot take the stress that an adult's body can. Stressing a premature bone, tendon, or ligament will often lead to short- and long-term injury, affecting an athlete's performance later in life and possibly impairing growth.

### *Shins*

A very common overuse injury affecting players of all sports is shin splints. Shin splints result from inflammation of the tissues surrounding the tibia. This is caused by a number of factors such as a rapid increase in training, poor flexibility, or repetitive contact (jumping or running) on hard surfaces. In the early stages, athletes will notice mild tenderness around their shins, especially when the foot is bent downwards. If not addressed, athletes will further damage the area, creating discomfort eventually to a point where movement is greatly hindered. The treatment for this condition is a combination of rest, ice, and massage as well as proper flexibility/strength training.

If an athlete recognizes any early signs, consult an athletic trainer to treat, recover, and prevent reoccurrence. Shin splints can easily recur if not adequately cared for, and as with all injuries, coaches should emphasize the importance of resting the body and taking gradual and thorough measures to prevent further injury.

### *Achilles Tendon*

Achilles tendonitis is caused by repeated micro-tears to the Achilles tendon, leading to damage and loss of healthy tissue. Achilles tendonitis can progress either rapidly over a couple of days or gradually over several months. Athletes will often feel a gradual onset of pain before, during, and after exercise. The tendon and calf will often feel stiff and be sensitive to stretching when the foot is pointed upwards.

Athletes who try to reach high levels of performance too quickly, typically at the beginning of the season, are susceptible to Achilles tendonitis. Athletes with weak calves or other muscular strength and flexibility imbalances are at risk for a number of injuries as well as Achilles tendonitis.



Similar to all overuse injuries, rest and ice are essential in preventing further progression of Achilles tendonitis. Additionally, heel inserts or pads prevent the strain put on the Achilles tendon during everyday activities, but this is only for short-term use when the tendon is recovering. Consultation with a physical therapist or athletic trainer is necessary in order to recover, strengthen, and increase flexibility, as well as to assess the athlete for unique needs based on the structure of their foot.

### *Hip/Thigh*

Hip injuries are common in all sports, but are commonly seen in sports with repetitive, high intensity hip movements, such as track and gymnastics.

Snapping hip syndrome is an overuse injury that occurs after large amounts of training and practice in a single sport, which leads to strength and flexibility imbalances. Tendons may audibly and painfully snap over the bones around the hip joint when the hip is raised upwards to the chest and back down. This condition has many variations depending on the muscles involved and underlying hip ailments.

A more serious overuse injury seen in athletes is a femoral neck stress fracture, which affects the top part of the thighbone. This stress fracture develops over time in athletes who have poor running mechanics, increase their training too quickly, lack of proper nutrition, or excessively train throughout the year.

Athletes developing a femoral neck stress fracture often have gradually intensifying groin pain during everyday activities. This pain will begin to focus onto a specific point as it develops. If diagnosed early enough by a doctor, athletes can reverse the progression with rest and physical therapy. In later development of the injury, an athlete will often be put on crutches for a period of time or even require surgery.

Once again, as with any injury, proper diagnosis and rest is the crucial first step in the recovery process. Strengthening the core and pelvis gradually and preventing other muscular imbalances is highly efficient in preventing overuse injuries at the hip.



### *Lower Abdomen*

Athletes may develop a weakening of the muscles or tendons of the lower abdominal wall, particularly in the region where the wall is quite thin, that results in a condition called sports hernia. While an inguinal hernia has a palpable hernia, that is not the case with this injury. The symptoms include pain in the lower abdomen, often radiating into the groin or testicles (in a male). These symptoms are exacerbated with stressful activities such as those related to sports (e.g., running, cutting and bending) as well as coughing or sneezing. This injury is most common in athletes such as hockey players who are forced to maintain a forward lean, but it is also prevalent in high-stress sports such as soccer and football. While conservative treatments such as rest, ice, and physical therapy may be used, unfortunately, surgery is often required to correct the problem.

## Spotting an Overuse Injury and Recovering From It

Many overuse injuries are easily recognizable by pain or a decrease in ability/loss of function. Make sure athletes report any discomfort or pain when warming up, playing, or resting after activity. Even if the pain is not affecting their performance now, ignoring pain will lead to further injury. Remember that it's better to miss one practice or game than the season. Athletes may also feel grabbing, snapping, or popping, which is often an indicator of a developing overuse injury. Use the following system as a general guideline for classifying, grading the development, and assessing the progress of an overuse injury.

### *Classification of Tendonitis/Overuse Injuries*

- Stage 1: Pain after activity, no functional impairment
- Stage 2: Pain during and after activity with minimal functional impairment
- Stage 3: Pain during and after activity that persists throughout the day, significant functional impairment
- Stage 4: Significant functional impairment with all daily activities





Athletes will notice the beginning stages of tendonitis and most overuse injuries. It cannot be stressed enough how important it is to teach players that playing through any amount of pain will only cause further injury and likely longer periods of time away from their sport. Furthermore, it is the coach's and parent's job to know what activities and what amount of exercise puts their child at risk. Taking the necessary precautions will not only keep athletes healthy, but also increase their performance and enjoyment for years to come.

When an athlete, coach or parent suspects injury, have it assessed and diagnosed by a healthcare professional, being sure to follow the recommendations of that person for optimal outcomes. To initially reverse and prevent, overuse injury progression, follow the R-I-C-E method (rest, ice, compression and elevation). This will help muscles, ligaments, and tendons recover after play.

## Advantages to Sport Diversification

Recent research has shown there is a clear advantage to early sport diversification,<sup>17</sup> with one study concluding: "Athletic performance at one age in childhood does not accurately predict performance at a later age."<sup>18</sup> A young athlete's performance when they are young is not an accurate predictor of performance later in life. What is certain is that over-training young athletes, especially in a specific sport, will likely lead to injury and may permanently compromise an athlete's performance and/or long-term health. It is often recommended that sport specialization should be discouraged until the athlete is a senior in high school.

It is vital to the future of youth sports that we, as a culture, understand the consequences of early specialization in children. Overuse injuries, surgeries, and permanent damage are all common physical consequences of over-training and sport specialization. Mentally, children will become less motivated and "burnt out," stripping them of the benefits of youth sports.

Educated, multi-sport athletes are diversified in their athletic skills and strengths. This is the total athlete. Sport diversification builds a well-rounded athlete, physically, socially, and mentally. Enjoyment should be the priority in youth sports. By understanding these concepts, we can preserve the "youth" in youth sports.



# Concussions

## Introduction

### *What is a Concussion?*

The U.S. Centers for Disease Control and Prevention (CDC) defines a concussion as a brain injury induced by traumatic biomechanical forces secondary to direct or indirect forces to the head,<sup>19</sup> which force the soft tissues of the brain into the skull. A direct force means that the skull comes in contact with another surface, such as the ground or another player, whereas indirect force involves no impact, but is caused by the sudden deceleration of the body, such as a car accident or other whiplash-like motions of the head. Also known as a mild traumatic brain injury (MTBI), concussions can occur with or without a loss of consciousness and range in severity. Regardless of the severity, every impact to the head is serious and demands thorough evaluation and adequate recovery time.

A recent study analyzing the amount and severity of hits to the head in three NCAA Division I football teams found that over the course of a season, each team, in practice alone, averaged 2,500 significant blows to the head, 300 of which were in the concussive range.<sup>20</sup> The study used the Head Impact Telemetry System, placing accelerometers in players' helmets to measure the impact on the skull. This is an astonishing number of concussive and sub-concussive blows for an individual team, considering that game competition is not included in these statistics. Numbers like this strongly demonstrate how prevalent this issue has become in the sporting world.

The CDC estimates that anywhere from 1.6 million to 3.8 million sports and recreation-related concussions occur each year in the United States, most of which go untreated by medical professionals. A person who sustains a TBI, or someone who sustains several MTBIs, is at high risk for lifelong physical, cognitive, and psychological impairment.<sup>21</sup> Athletes who are not properly evaluated by medical professionals, or those who do not give themselves ample recovery time, are even more susceptible to further injury such as second impact syndrome, chronic traumatic encephalopathy, and dementia pugilistica.



### *Second Impact Syndrome*

Second impact syndrome results when the brain suffers from a second concussion while still recovering from one prior. If a second concussion occurs while the brain is still recovering, more fluid rushes to the area, putting increased pressure on the skull. This can immediately cause permanent damage and death. This severe outcome can happen if a player returns to play that day or even weeks later if the brain has not fully recovered.

### *Chronic Traumatic Encephalopathy*

There is growing evidence and research suggesting that players who sustain repeated concussions suffer far greater long-term consequences. Chronic traumatic encephalopathy (CTE), evidenced by neurofibrillary tangles in the brain's cortex, is becoming a growing concern in sports, particularly in football. CTE is a progressive disease that can cause depression, memory loss, and premature Alzheimer's disease-like dementia. There is mounting evidence linking CTE to several deaths of former NFL players who have received countless concussive and sub-concussive blows.<sup>22</sup>

### *Dementia Pugilistica*

Another neurodegenerative disease that is increasingly common among athletes is dementia pugilistica (DP). DP, also known as chronic boxer's encephalopathy or boxer's dementia, is similar to CTE in that it develops progressively over time. People suffering from DP may have declining mental ability, speech problems, lack of coordination, tremors, and Parkinson's Disease.<sup>23</sup>

The brain is a highly complex organ and should be considered the most fragile part of the body, and therefore requires an appropriate amount of caution after suffering an injury. Rushing athletes who are suspected of having a concussion back to play without professional evaluation is not only negligent, but also can result in serious, permanent brain damage. To preserve the health and safety of our athletes, we must educate ourselves on how to better prevent and respond to concussions.





## Prevention

Coaches and parents must teach proper technique, such as hitting the core of a player with your head up in football or rolling out correctly while diving for a volleyball. More importantly, coaches and parents must encourage players to follow rules and safety precautions strictly. Ensure that safety equipment fits properly, has been maintained and is worn consistently.

Furthermore, coaches, parents and athletes must take the initiative to instill the importance of sportsmanship in our sporting community. Sports are not the ruthless games they are sometimes portrayed to be. Athletes at elite levels are more often not those who hit harder, but rather those who hit smarter. Playing smarter with self-discipline and control will reduce injuries and advance athletes to higher levels. If a concussion does occur, the athlete *should not* return to play until cleared by a medical professional.

## Proper Diagnosis and Evaluation

Many teams and schools are now conducting computer-based neuro-psychological assessments prior to the start of a sports season. These tests measure an athlete's cognitive ability and set a baseline for testing brain function. For example, some test questions may include how quickly a player can do simple math or the ability to recall a list of objects in order.<sup>24 25</sup> Later in the season, these same neuropsychological tests can be an effective follow-up tool for assessing a player's condition. For a post injury neuro-psychological test to be informative, it is imperative to have a comparative pre-injury assessment at the beginning of the season.

Every mind is wired differently and, therefore, the presence or absence of concussion symptoms varies greatly from athlete to athlete. For this reason, great time and care must be taken when evaluating the severity of an athlete's concussion, especially because symptoms are often subtle.

Coaches, parents, and players can prevent further injury by educating themselves on what to look for in an athlete suspected of having a concussion.



The signs and symptoms typically fall into four categories; physical, cognitive, emotional, and sleep. Some symptoms may appear immediately, while others may develop over days and even weeks. These symptoms may be subtle and be difficult to fully recognize.

The most common signs and symptoms of a concussion include:

#### ***SIGNS/SYMPTOMS***

Appears dazed/stunned	Headache
Confusion	Nausea
Moves clumsily	Balance problems/dizziness
Answers questions slowly	Double/blurry vision
Personality/behavior changes	Feeling sluggish
Forgets events before/after the hit	Sensitivity to noise or light
Forgets plays	Feeling groggy, sluggish or foggy
Unsure of game, score, or opponent	Concentration/memory problem
Loses consciousness	Confusion

When an athlete reports these signs and symptoms, it is a good indication that the player has suffered a concussion. Remember that players will often avoid reporting symptoms because they wish to keep playing. This is why it is of vital importance to educate players on the consequences of playing through a concussion; the short- and long-term consequences are simply too great. No matter how minor the symptoms seem to be, do not let the athlete return to play. New laws are prohibiting the return of an athlete to practice or competition without the approval of a medical professional.<sup>26</sup>

If a medical professional is present, have them evaluate the athlete thoroughly and objectively with use of neurological baseline tests, cognitive ability, physical and symptomatic signs, motor function or coordination, emotional response, and other diagnostic tools. An athletic trainer is often the healthcare person present on the sidelines during sporting competitions. They are there so that a skilled professional is present to make the difficult decision on behalf of the athlete.



In the absence of a medical professional, several resources provide free onsite concussion evaluation tools. An effective concussion evaluation tool will include a signs and symptoms checklist, a memory assessment, a cognitive assessment, and neurological screening for eye movement, pupils, speech, etc. The Sport Concussion Assessment Tool (SCAT-2)<sup>27</sup> is a user-friendly and thorough onsite evaluation tool. It is strongly recommended that coaches become familiar with this tool and possibly receive training from a professional, such as an athletic trainer, to develop a comfort level and familiarity with the exam. Many people recommend simulating a concussive event examination to prepare for the real thing.

*The following may be used as a general guide for safe and effective responses:*

### ABCs

A=airway      B=breathing      C=circulation

- **Check** the scene first for safety and then the athlete.
- **Call** 911 or other emergency number as necessary.
- **Care** for the injured athlete until medical personnel arrive.
- **When in doubt, sit them out.**

Regardless of whether symptoms subside or not, it is always recommended that an athlete suspected of sustaining a concussion be taken to a hospital or healthcare professional for a full evaluation.

## Ensuring Adequate Recovery Time

Athletes recovering from a concussion are at high risk for further or even permanent damage. As discussed earlier, second impact syndrome, CTE, and PD can be life-threatening and inflict serious short- and long-term injury. To prevent further injury, a medical professional must provide approval before an athlete can return to play.





Returning to play must be done in gradual steps. Complete physical and mental rest is needed until the player is asymptomatic, keeping in mind that athletes may show no signs at rest, but are unable to mimic sports activities without the return of symptoms. While physical rest is vital, mental rest, or a quiet mind, facilitates a more rapid recovery process. Therefore, the injured athlete should avoid activities such as texting, playing video games, and doing homework.

The following is a recommended progression chart for clearance to return to sport. The athlete should be symptom-free for 24 hours at each level before advancing to the next step, and if any symptoms occur at a particular level, the athlete should return to the previous one. This should be coordinated by a physician or certified athletic trainer.

1. No activity with complete physical and mental rest
2. Return to mental activity
3. Light aerobic exercise, staying at less than 70 percent of maximum heart rate
4. Sport-specific exercise drills
5. Non-contact training drills at normal intensity
6. Full-speed, contact practice
7. Return to play

An athlete who has sustained even a mild concussion should be cleared by a medical professional in writing before returning to play.



# Heat Illness

There are many important differences between an adult and a young athlete. Physiologically, children conduct more heat from the surrounding environment than adults do because of a greater ratio of surface area to body mass. In addition, children generate more metabolic heat per weight than adults, but are less capable of releasing heat because of a lower sweating capacity.<sup>28</sup> For these reasons, children are more susceptible to heat illnesses in sports.

Heat stroke, a heat illness related to the body's inability to regulate temperature, has become the third-leading cause of death in youth athletes.<sup>29</sup> As coaches, parents and players, we need to educate ourselves to prevent this from occurring, as it is largely preventable with appropriate precautions and response.

## Preventing Heat Illnesses

### *Knowing the Danger Zone*

An important part of coaching is understanding the conditions that present a greater risk to the young men and women in your care. As a general guideline, temperatures ranging from 65 degrees to 72 degrees Fahrenheit present a moderate risk, temperatures of 74 degrees to 82 degrees present a high risk, and temperatures above 82 degrees present an extremely high risk to athletes.<sup>30</sup> In addition, an increase in humidity greatly increases the chance for heat illness.

In high-risk conditions, coaches are encouraged to conduct shorter practice sessions. Wearing less padding and equipment is also an important consideration based on weather. A 10-day period of lighter practices is recommended, especially in warm weather climates, for athletes to become properly acclimated. Coaches should continuously observe athletes for any heat illness symptoms and should not hesitate to take an athlete aside and evaluate their condition. During conditioning drills, a buddy system may be helpful so that teammates may monitor tolerance.



Coaches should also be aware of high-risk candidates for heat illness, which include athletes who have a history of a heat illness-related event; are overweight/obese; have a history of diabetes, renal or heart difficulties; have had a recent bout of flu or upper respiratory infection; have anorexia or bulimia; or have a poor baseline fitness level. Some athletes intentionally make themselves far more prone to heat illness, such as wrestlers who are trying to “make weight.”

Heat illness can be managed through proper hydration before, during, and after practice. Heat illnesses stem from the loss of fluids and electrolytes during sweating. Replacing them on a consistent basis is one of the most effective ways to remain hydrated. It is recommended that coaches eliminate voluntary hydration by athletes and instead enforce hydration beyond thirst levels on a routine basis (e.g., every half hour).

An estimated 70 percent of high school athletes show up for practices inadequately hydrated. The STOP Sports Injuries campaign recommends the following guidelines for keeping athletes hydrated.<sup>33</sup>

- Stay hydrated throughout the week, especially on practice and game days
- Drink 16 ounces of water or sports drink one hour before warming up for play
- Continue with 4–8 ounces of fluid every 15–20 minutes of play
- Consume food or drink with a moderate amount of sodium (salt) prior to competition or training
- For games and practices lasting longer than one hour or for multiple practices in one day, replacement fluids should contain sodium, potassium, and carbohydrates
- Weighing yourself before and after sporting events is a good way of judging how much fluid is lost while exercising. If more than 2 percent of body weight is lost during play, the athlete may be compromising performance and should increase fluid intake. If the athlete is gaining weight, fluid intake should be lowered





- Try to keep urine at a lemonade coloration or clearer
- Practice at cooler times of day (i.e., early morning, later afternoon)
- Discourage athletes from wearing layered or rubberized clothing that prevents the body from cooling down efficiently
- Remember that every athlete's body is different; what works for one athlete may not work for another

Proper training in the months leading up to practice is another effective way to acclimate the body to warm temperatures. Athletes often do not adequately prepare for the upcoming season, and therefore shock their bodies once training begins. Athletes must gradually condition themselves for competition in extreme temperatures.

In addition, parents, players and coaches must monitor other player's mental and physical condition to detect early signs of heat illness. Always be aware of the limitations caused by warm weather.

### *Recognizing Heat Illnesses*

Common heat-related illnesses include the following:

- **Heat Cramps:** Cramps caused by the depletion of salt and water in the body due to profuse sweating
- **Heat Exhaustion:** The result of either water or salt depletion in the body due to profuse sweating during prolonged exercise, commonly causing athletes to feel weak, dizzy, nauseous and confused or to have headaches
- **Heat Syncope:** A precursor to heat stroke, caused by prolonged exercise in the heat, which can also occur after physical activity has stopped—usually within the first week of acclimating to exercise in the heat. Symptoms include weakness, fatigue, tunnel vision, and fainting
- **Heat Stroke:** The most severe heat illness is caused by the body's failure to cool itself down. It can occur suddenly with few preceding symptoms, causing unconsciousness, coma, or death



### *Cold-Related Illnesses*

Cold weather, as well as heat, can lead to dehydration. Recent studies suggest that cold weather decreases the thirst sensation in athletes. Athletes competing in colder weather do not feel the desire to hydrate nearly as much, but they exert similar effort and lose fluids and electrolytes at a similar rate as they would in warmer temperatures. Athletes competing in cold weather need to take the same precautions for staying hydrated.

### *Responding to Heat Illness and Dehydration*

When heat illness and/or dehydration is suspected, immediately remove the child from play. It is recommended to have a plan in case of emergency, including how to contact medical professionals (i.e., phone numbers, contact names) and possible treatment options (e.g., ice packs, spray bottles and towels) readily available. Take these recommended steps when assessing an athlete with heat illness and dehydration symptoms.<sup>32</sup>

- Get the athlete to a cool and shaded area
- Have the athlete drink water or a sports drink
- Elevate the athlete's legs slightly
- Do not return the athlete to any physical activity
- If symptoms are severe or if the child is unconscious, call 9-1-1 and seek immediate medical aid. Keep the athlete cool using cold water immersion, a cold water spray, cold towels placed over the entire body or ice packs
- Inform the parent (or guardian) of the athlete for continued, effective monitoring if they are not present during an event

The tables on the following pages summarize additional actions to take and be aware of when responding to heat illness and dehydration issues.



*Comparison of Heat Illness Characteristics in Youth with those of Adults<sup>31</sup>*

Characteristic	Typical for a Child vs. Adult
Sweating threshold	Higher
Sweating rate per m2 skin	Much lower
Exercise tolerance	Shorter
Acclimation to heat	Slower
Core temperature increases with dehydration	Faster

*Symptoms of Dehydration per Percent Body Weight Lost<sup>32</sup>*

% Body Weight Lost	Symptoms
0.5	Thirst
2.0	Increased thirst, discomfort and poor appetite
3.0	Dry mouth and decreased urine output
4.0	Flushed skin and impatience
5.0	Poor concentration
6.0	Decreased temperature regulation
8.0	Dizziness, labored breathing and confusion
10.0	Poor balance, delirium and swollen tongue
11.0	Kidney failure and circulatory insufficiency





*Dehydration Symptom/Treatment Chart<sup>33</sup>*

Symptoms	Disorder	Treatment
Thirst, nausea, chills, clammy skin, muscle pain/spasms	Heat cramps	4-8 oz of cold water every 15 minutes; shade and remove excess/wet clothing
Decreased sweating, dizzy, headache, short of breath, rapid pulse, decreased saliva and increased fatigue	Heat exhaustion	Stop all exercise, ice bag to top of head and 16 oz of cold water for every pound lost
Decreased sweating, decreased urine, dry and hot skin, swollen tongue, hallucination, rapid pulse unsteady gait, fainting, hypotensive, loss of consciousness, shock	Heat stroke	Emergency medical treatment, ice bath or shower and elevate the feet

Coaches, parents and players must not underestimate the seriousness of heat illnesses. These illnesses can happen suddenly with little warning and can have severe consequences. Through gradual acclimation to warm weather, proper hydration and continually educating ourselves on heat illnesses, we can help young athletes play safe in the heat.

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[www.STOPSportsinjuries.org](http://www.STOPSportsinjuries.org)



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