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Burnout in Young Athletes: How to Keep the Fun in Sports

By: Joel S. Brenner, MD, MPH, FAAP & Drew Watson, MD, MS, FAAP

Does your child dream of becoming the next Olympic star or pro athlete? While we all want to support our children's goals, the American Academy of Pediatrics (AAP) encourages (/English/news/Pages/AAP-calls-out-causes-of-injury-overtraining-and-burnout-in-youth-sports.aspx) a commonsense approach when it comes to sports training. Here's why.

The benefits of organized sports

These days, it's less common to see kids outside playing pick-up games or racing each other to see who's the fastest. Open, free play (/English/family-life/power-of-play/Pages/the-power-of-play-how-fun-and-games-help-children-thrive.aspx) seems to be less popular as young kids choose a single sport or activity and play it all year round.

Organized sports can be great for kids. They can help them develop physical skills and get regular **exercise (/English/healthy-living/fitness/StopWatch-Tool/Pages/default.aspx)** that supports healthy growth and well-being. Participating in sports can also help them make friends, learn how to be part of a team and play fair, improve **self-esteem (/English/ages-stages/gradeschool/Pages/Helping-Your-Child-Develop-A-Healthy-Sense-of-Self-Esteem.aspx)** and have fun. **But studies show that nearly 70% of kids across the U.S. drop their favorite sport before age 13.**

When kids drop out of sports

This is a warning sign that far too many young people are experiencing burnout, which can cause them to turn away from the activities they once loved. Burnout also interferes with a budding habit of physical activity and the lifelong physical and mental health benefits it provides. Read on to learn more about burnout and how to keep the fun in sports.

How and why do young athletes burn out?

Burnout is when kids no longer feel a sense of fun and accomplishment when playing or practicing. It can happen with sports specialization (https://publications.aap.org/pediatrics/article/138/3/e20162148/52612/Sports-Specialization-and-Intensive-Training-in?autologincheck=redirected), which is when a child focuses on only one sport or activity, usually year-round.

Single-minded, non-stop focus on just one activity—whether it's baseball, swimming, football, dance, gymnastics, hockey, lacrosse or any other choice—can cause kids to lose interest and enthusiasm.

What sports burnout may feel like to your child

Overtraining and burnout can leave a young athlete feeling physically or mentally exhausted. They may believe that ...izing (and winning) in the sport is what coaches, parents and families want and need them to do. In the worst ...ons, kids may assume this sport is their only chance for success in life.

How can I encourage a healthy approach to sports?

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We encourage families to take a positive attitude toward sports that focuses on fun, teamwork and regular exercise. This way, sports can become part of a balanced lifestyle that keeps kids active and healthy into adulthood.

8 tips for healthy youth sports participation:

- **Wait to start organized sports until about age 6**, when kids are fully ready. Younger kids should enjoy free play every day to help bones, muscles and balance develop and give them a chance to exercise social skills, too—all without pressure to perform.
- **Encourage your child to play a variety of sports**. Studies show that kids thrive when they try out many different activities before puberty. They also are less likely to lose interest or drop out when they engage in more than one sport.
- **Focus on fun.** Did you know that kids say fun is the #1 reason they want to play sports? Give them the freedom to choose activities they truly enjoy. Avoid too much emphasis on outcomes or performance, especially in younger children.
- **Set training limits**. A good general rule is that kids should not train more hours each week than their age. AAP experts advise parents and families to plan for 1 to 2 days of rest every week with at least 2-3 months off during the year. The time off can be divided into 1-month increments.
- **Consider what's driving your child.** Are they thinking about success in college? Or becoming wealthy, famous athletes later in life? These are exciting dreams, but parents and caregivers should present a balanced view. Remind your child that only 3% to 11% of high-school athletes go on to compete in college, and only 1% receive athletic scholarships. The percentage of college athletes who go on to professional careers is even smaller. (Fewer than 2% of NCAA student athletes play professionally after they leave school.)
- **Keep an eye on your child's health**. Growing athletes need plenty of sleep (/English/healthy-living/sleep/Pages/default.aspx) and good nutrition (/English/healthy-living/nutrition/Pages/default.aspx) to recover from the stress that training puts on their bodies. Be sure your child gets plenty of foods high in iron, calcium and vitamin D. Female athletes should watch for issues caused by overtraining, like missed periods. And because many sports stress the value of maintaining a certain weight or body type, always watch for signs of disordered eating (/English/health-issues/conditions/emotional-problems/Pages/Treating-Eating-Disorders.aspx) in your child.
- **Watch for signs of abuse (/English/healthy-living/sports/Pages/Preventing-Abuse-in-Youth-Sports-and-Organized-Activities.aspx)**. If anything makes you uneasy about your child's relationship with coaches and other adults in an athletic program, take action. If you see or hear something that suggests abuse, or your child complains of mistreatment, speak up immediately. Your child's doctor can help you map out a plan to advocate for your child.
- **Set a positive example.** If kids see you working out or playing sports 7 days a week, even when you're feeling tired or suffering from pain, they may try to do the same. After all, kids pick up cues about what parents expect. If you practice healthy self-care, they will too.

  Your attitude about your child's athletic performance matters, too. Look for ways to appreciate everything they do, not just what they accomplish on the court, playing field or gym. Knowing you love them unconditionally fosters the confidence they need to enjoy sports to the fullest.

More information

- Preventing Overuse Injuries In Young Athletes: AAP Policy Explained (/English/health-issues/injuries-mergencies/sports-injuries/Pages/Preventing-Overuse-Injuries.aspx)
  AP Calls Out Causes of Overuse Injuries & Burnout in Youth Sports (/English/news/Pages/AAP-calls-out-auses-of-injury-overtraining-and-burnout-in-youth-sports.aspx)

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- 3 Mental Skills Children Need for Sports (/English/healthy-living/sports/Pages/Mental-Skills-Needed-for-Sports.aspx)
- Mental Health in Teen Athletes (/English/healthy-living/sports/Pages/mental-health-in-teen-athletes.aspx)
- Sports Physicals: When, Where, Who Should Do It? (/English/healthy-living/sports/Pages/Sports-Physical-PPE.aspx)

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CLINICAL REPORT Guidance for the Clinician in Rendering Pediatric Care

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Overuse Injuries, Overtraining, and Burnout in Young Athletes

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Sports participation can have tremendous physical and mental health benefits for children. Properly implemented progressive training programs can yield a broad range of beneficial physiologic adaptations, but imbalances of training load and recovery can have important negative consequences. Overuse injuries, for example, can result from repetitive stress without sufficient recovery that leads to accumulated musculoskeletal damage. In addition, extended periods of increased training loads that exceed the intervening recovery can have systemic consequences such as overtraining syndrome, which results in decreased performance, increased injury and illness risk, and derangement of endocrine, neurologic, cardiovascular, and psychological systems. Burnout represents one of the primary reasons for attrition in youth sports. Broadly defined as physical or mental exhaustion and a reduced sense of accomplishment that leads to devaluation of sport, burnout represents a direct threat to the goal of lifelong physical activity and the wide-ranging health benefits that it provides. This clinical report is intended to provide pediatricians with information regarding the risk factors, diagnosis, management, and prevention of these conditions to assist in the identification of at-risk children, the treatment of young athletes, and the guidance of families in the promotion of safe and healthy sport participation.

INTRODUCTION

Youth sport participation represents the primary route to physical activity in American children and has the potential to be a powerful pathway to a wide range of physical and psychosocial benefits. In addition, it represents an important avenue for the promotion of lifelong physical activity that stands to promote adult physical and mental health. Unfortunately, although over 60 million children and adolescents currently participate in organized sports, attrition rates remain staggeringly high, with 70% of youth athletes choosing to discontinue participation in organized sports by 13 years of age.[1] Discontinuation of sports during childhood plays a role in the more

abstract

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than 75% of adolescents in the United States who fail to meet physical activity recommendations.[2]

Injury and burnout have been suggested as two of the primary causes for attrition from sports.[3] Since the prior American Academy of Pediatrics (AAP) clinical report on overuse injury, overtraining, and burnout in youth sports was published in 2007, considerable evidence has emerged to better define how excessive training volumes can lead to overuse injury, overtraining, impaired well-being, and decreased quality of life. In addition, the youth sport environments and practices that lead to increased perceived pressure, a loss of enjoyment, burnout, and attrition from sport have been explored considerably.

The professionalization of youth sports is widely considered responsible for the high volumes of training and the pressure to specialize in a single sport that may lead to overuse injury, overtraining, and burnout in youth athletes. In addition, the pressure to succeed at a young age, as well as the perception that this is the most efficacious route to future athletic success, further leads to high volumes of training and loss of enjoyment in sport, both of which can contribute to widespread burnout and attrition among youth athletes.

The types and mechanisms of overuse injuries that can result from certain sport environments represent important information to the pediatrician caring for youth athletes. In addition, understanding the psychosocial impacts of injury, overtraining, and attrition from sports is vital to properly help counsel young athletes and promote lifelong physical activity practices that can impact physical and mental health into adulthood. Providing this information to the AAP membership and readership through this updated clinical report can also help. In doing so, this clinical report aligns with the mission of the AAP.

This clinical report replaces a previous AAP clinical report titled "Overuse Injuries, Overtraining, and Burnout in Child and Adolescent Athletes," and is complementary to the AAP clinical reports "Sports Specialization and Intensive Training in Young Athletes" and "Organized Sports for Children, Preadolescents, and Adolescents." This report reviews overuse injuries, including risk factors and prevention strategies, consequences of overtraining, and special considerations such as endurance events and the multisport athlete. It provides an overview of potential risk factors for burnout and attrition from sports and offers guidance for pediatricians to help young athletes (both children and adolescents) and their families. In addition, sport governing bodies should adopt the sport participation practices that will most benefit young athletes in their pursuit of physical activity and long-term athlete development. In some areas of interest, however, there is still limited scientific evidence available. Therefore, some of the recommendations provided are based on committee opinion and/or expertise.

OVERUSE INJURIES

An overuse injury results from cumulative microtrauma to bone, muscle, and/or tendon as a function of repetitive stress with insufficient recovery. Overuse injuries may follow a typical clinical progression in which the pain associated with the damaged structure occurs after activity, then during activity without limitation, during activity with limitation, and ultimately at rest. Among young athletes, overuse injuries most commonly involve the lower leg; female athletes, endurance sport athletes, and athletes with a prior injury appear to be at increased risk.[4,5] A list of common overuse injuries is shown in Table 1. Although most overuse injuries in adolescents last less than 3 weeks, the duration of these injuries is highly variable, ranging from less than 1 week to season-ending.[4]

Children and adolescents may be at an increased risk for overuse injuries compared with adults. Growing bones in children are less tolerant of stress than those of adults and may be more susceptible to the development of stress injuries.[6] In addition, apophyses and epiphyses in children may be particularly vulnerable before skeletal maturity. For example, an imbalance of stress and recovery at the insertion of the patellar tendon among young athletes can result in proximal tibial apophysitis, also known as Osgood-Schlatter disease. In a young gymnast, repeated axial loading and dorsiflexion can lead to distal radial epiphysiolysis, or "gymnast's wrist."[7] In some instances, overuse injuries may present primarily with dysfunction, making athletes and families less likely to seek care. For example, a young baseball player may primarily notice worsening pitch velocity and accuracy as early signs of proximal humeral epiphysiolysis, or "little league shoulder," an overuse injury caused by torsional and distraction forces across the physis from excessive overhead throwing.[8]

Risk Factors for Overuse Injuries

Specialization in a specific sport may also predispose to the development of overuse injuries. Although there is only minimal sport-specific research, evidence suggests that specialized athletes may be at an increased risk of overuse injuries in general.[9,10] Specifically, specialization in sports with considerable biomechanical repetition (eg, pitching, running) may result in sufficient repetitive stress of certain structures that exceeds the healing capacity of the tissue, resulting in injury.[11,12] It remains unclear, however, whether the relationship between specialization and overuse injury in young athletes is independent of training load. Further sport-specific and sex-specific research is needed to determine whether the same relationship exists within other more biomechanically diverse activities to properly guide decision-making for young athletes and families.

Although excessive loading of musculoskeletal structures with insufficient recovery can lead to overuse injury, properly managed chronic training loads can elicit physiologic

TABLE 1 Common Overuse Injuries in Young Athletes	
Injury	**Common Locations**
Apophysitis	Calcaneus (Sever's disease), tibial tuberosity (Osgood-Schlatter disease), medial epicondyle
Bone stress injury (stress reaction, stress fracture)	Tibia, metatarsals, lumbar spine
Tendinopathy	Patellar tendon (jumper's knee)
Epiphysiolysis	Proximal humerus (little league shoulder), distal radius (gymnast's wrist)
Patellofemoral pain syndrome	Anterior knee
Osteochrondritis dessicans or Panner's disease	Capitellum

adaptations that are protective against injury.[13,14] The mechanisms that underlie this protective effect are poorly defined in children but may be attributable to increased levels of cardiovascular fitness, muscular power, and myotendinous adaptations that lead to increased durability.[13] On the other hand, acute increases in training load relative to the chronic load (or habitual physical activity) can overwhelm these mechanisms and increase the risk for injury.[15,16] The proper combination of training load and rest to promote adaptation without increased injury risk in a young athlete is likely a function of a number of factors, including physical maturity, fitness level, biomechanics, sport environment, and others. In an attempt to capture this risk on an individual level, the monitoring of an acute on chronic workload ratio (ACWR) has been suggested as a method to identify individuals at risk, and even to guide return to sport after injury.[17] Although there is a wide range of techniques and resources available to measure external training load (eg, running distance via GPS) and internal training load (heart rate measurements or session-rating of perceived exertion), ACWR has been conventionally defined as the total training load from the prior week divided by the rolling average of the prior 4 weeks, with a ratio of 1.5 associated with an increased injury risk.[13,14,16] The majority of this research has been conducted in adults, however, and there is ongoing debate about the optimal method for determining ACWR and the threshold that is associated with increased injury risk.[18] Further research is needed among youth athletes to identify the proper measurement and implementation of acute and chronic workloads within sport- and sex-specific contexts to reduce injury risk.

In addition, factors such as nutrition, anatomy, technique, age, BMI, sleep, and prior injury can have a significant influence on the risk of overuse injury. Insufficient caloric intake (relative energy deficiency) and/or low vitamin D levels may predispose to bony stress injuries.[19,20] Improper technique, higher BMI, and certain anatomic factors may increase the stress associated with training load, potentially overwhelming the capacity for healing between bouts of stress. Young athletes with less experience and lower levels of fitness may be increasingly susceptible to overuse injuries, particularly at the start of a training period. Poor technique or improper biomechanics may lead to disproportionate loading of certain structures, and increased or earlier fatigue may also predispose to the development of overuse injuries. Prior injury has also been consistently identified as a risk factor for subsequent injury, likely because of improper mechanics that preceded or resulted from the prior injury and/or detraining effects from prolonged recovery.[5] Finally, emerging research suggests that psychosocial factors may also influence the balance between stress and recovery.[21,22] For example, athletes with reduced sleep, higher levels of athletic identity (the degree to which an individual identifies with the athlete role), perceived life stress, and perfectionist concerns have been found to be associated with an increased risk of overuse injury.[21,23] Although the specific underlying mechanism is unclear, it has been suggested that sources of increased psychological stress may undermine recovery, potentially contributing to the accumulation of physical stress that results in overuse injuries.[22] In support of this, early research suggests that behavioral interventions, such as mindfulness and stress management, can reduce the risk of injury and facilitate return to sport after injury.[24–27]

Prevention of Overuse Injuries

Prevention of overuse injuries involves identifying and addressing the factors that lead to an imbalance between stress and recovery. For example, although the tolerable training load for any individual athlete will be influenced by a number of factors including experience, age, physical maturity, and prior injury, it is commonly recommended that training loads (running mileage, for example) should be advanced by no more than 10% to 20% per week. Certain sports, such as baseball, have developed age-based pitching guidelines to limit repetitive stress. In addition, although there are no available data regarding their influence on overuse injury, youth athlete developmental models have been developed to promote age-appropriate training and facilitate healthy, long-term development.[28] Identifying the underlying mechanical factors that led to (or resulted from) a prior injury through individualized rehabilitation can increase load tolerance and reduce the risk of subsequent injury. However, risk reduction should also prioritize the factors that influence recovery and the balance between stress and recovery. Optimizing nutrition, hydration, and sleep can facilitate physiologic adaptation between training sessions. Similarly, improving psychosocial factors may also

improve the adaptive response to training and reduce the risk of overuse injury.

OVERTRAINING

Overtraining, or overtraining syndrome, refers to the constellation of symptoms resulting from chronic excessive exercise with insufficient recovery to facilitate physiologic adaptation.[29] As training loads are increased, athletes will experience a temporary period of fatigue and reduced performance afterward, referred to as overreaching. Although significant increases in acute training loads can have short-term negative effects on well-being,[30] with sufficient rest between bouts of physical stress, this functional overreaching results in physiologic adaptation, or "supercompensation," and is typically accompanied by improvements in performance.[31] If training loads are in excess of the intervening recovery for a sufficient period of time, however, an athlete can progress to nonfunctional overreaching and ultimately overtraining, in which performance subsequently decreases. Although functional overreaching is considered part of the adaptive process that promotes beneficial adaptation, nonfunctional overreaching and overtraining represent progressing degrees of dysfunction associated with a prolonged imbalance of training stimulus and recovery that can only be remedied through prolonged periods of rest. Although the underlying etiology remains poorly defined, the characteristic symptoms of nonfunctional overreaching and overtraining syndrome are representative of the disturbances across a range of systems, including endocrine, neurologic, cardiovascular, and psychological.[31] In addition to an otherwise unexplained decrease in performance, these manifestations can include fatigue, sleep disturbances, mood changes, and increased risks of illness and injury.[32] Specifically, in the absence of another explanation, overtraining syndrome is defined as an accumulation of stress (from training and/or other sources) resulting in a persistent performance decrease with or without other physiologic or psychologic symptoms that requires weeks or months of rest to restore.[29] Although it may overlap in symptoms, overtraining as a consequence of a prolonged imbalance of stress and recovery is distinct from relative energy deficiency in sport (RED-S). A similar syndrome of reduced performance and impairments across various physiologic systems, RED-S is specifically attributable to chronic low energy availability attributable to insufficient caloric intake to meet an athlete's energy expenditure. Nonetheless, overtraining and RED-S may be present concomitantly, and screening for disordered eating[33] and recognition of signs of RED-S (eg, menstrual cycle disruption) may help identify and address the role of chronic low energy availability.[34]

The incidence of overtraining syndrome is not well-defined, although prior reports suggest that the career rate of overtraining syndrome in young athletes by the time they reach adulthood may be as high as 35%.[31,35] Clinically defined as a decrease in performance accompanied by persistent fatigue and alterations in mood, the true diagnosis of overtraining syndrome remains one of exclusion, requiring the elimination of other potential causes (anemia, infection, endocrine disorders, mental illness, etc).[29] Although several biomarkers and psychomotor tests have been suggested,[36–38] there are currently no diagnostic tests that have demonstrated sufficient sensitivity and specificity to be used clinically in the diagnosis of overtraining syndrome in youth athletes. If other conditions have been excluded and overtraining is suspected, the only treatment is a reduction in training and facilitation of recovery through optimized nutrition, increased sleep, and stress reduction. Subsequent improvement in symptoms and athletic performance confirms the diagnosis but may take up to several months depending on the degree and duration of the maladaptation at the time of intervention.

Risk Factors for Overtraining

Although the basic underlying imbalance of stress and recovery can negatively affect any young athlete, certain populations may be at increased risk. Endurance athletes appear to be at increased risk of overtraining syndrome, as repeated prolonged bouts of exercise may outpace the intervening recovery and performance decreases may be misidentified as poor fitness, resulting in increased training and compounding the imbalance. Female youth athletes, individual sport athletes, and elite-level athletes may also be at an increased risk.[35,39] Repeated high-volume events, such as weekend tournaments consisting of multiple full-length games, may also result in higher levels of accumulated stress that can overwhelm the intervening recovery. Year-round participation in sports may also increase the risk of overtraining in young athletes, as breaks from participation can allow for recovery before the next season. Although sport specialization has been associated with higher levels of stress among young athletes,[40] it is unknown whether this represents a risk factor for the development of overtraining syndrome independent of training load. The impacts of sport specialization and multisport participation are discussed more fully in the AAP clinical report on sport specialization and intensive training.[1] On the other hand, simultaneous participation on multiple teams may lead to excessive levels of physical stress. Young athletes should participate in no more than 1 sport per day and ensure at least 1 day of rest per week from all organized sports activities. Specifically, athletes who participate in multiple sports or cross-training should ensure that this does not result in overlapping schedules that prevent rest days. In addition, young athletes should also have 2 to 3 months off from each sport per year. Opportunities for recreational, child-driven games or free play can be a way to promote physical activity, social development, and neuromuscular development in a low-stress environment during these periods.

Finally, it is vitally important to recognize that the stress that leads to overtraining syndrome can be aggregated from multiple sources, including training load, sleep impairments, environmental stress, academic difficulties, social problems, financial stress, family dynamics, etc. Consequently, children with greater levels of stress from other sources may be more vulnerable than others to the development of overtraining during periods of increased training. Similarly, insufficient sleep can undermine recovery between bouts of exercise, potentially increasing the risk of overtraining. The extent to which social determinants of health influence burnout and overuse injury risk is unknown.[41] Nonetheless, these outcomes could potentially be influenced by factors such as financial stress, reduced organized sports opportunities, and reduced access to health care providers within athletic settings such certified athletic trainers. The influence of social factors on injury and burnout risk represents an important area of future research. Families and pediatric health care providers should be mindful of the interactive and additive nature of these different stress sources when working with young athletes. Early identification of sleep or mood disturbances that are associated with increases in training may allow for early intervention and sufficient rest to avoid progression to overtraining.[42]

ENDURANCE EVENTS

Participation in longer endurance events (eg, marathons, triathlons, ultramarathons) has been increasing among both adults and children in recent years. Although aerobic activity has broad and well-defined physical and mental health benefits, opinions regarding youth participation in longer endurance events has been conflicting.[43–45] Recent evidence suggests that children and adolescents may be able to safely participate in marathons, however. In a study of 310 children participating in a single marathon over 26 years, only 4 minor race-day medical encounters were identified.[46] Despite not being statistically significant, this number represented a lower risk among children than adults. In a recent study of data collected on 1927 youth participants in a 28-week marathon training program, 18% reported an injury, with an average of 4.8 days of time loss. Notably, 99% of the individuals who started the marathon were able to complete it.[47] Similarly, with the increased popularity of ultramarathon events (running events longer than 26.2 miles), participation among children has increased as well.[48] Currently, there is no information available regarding the injury risks associated with ultramarathon distance running in children. Nonetheless, in addition to factors such as distance, elevation, terrain, and environmental dangers, age has been suggested as an important risk factor in ultramarathon events as well, with children younger than 12 years deemed high risk and those 12 to 15 years of age considered medium risk.[48]

Currently, although individual events may have specific policies regarding youth in prolonged endurance events, there is insufficient evidence to support a specific minimum age requirement for participation. Rather, the risk of participation in prolonged endurance events for any individual child is likely a combination of physical maturity, emotional maturity, fitness level, prior training, motivation, and preexisting health concerns. Instead of abiding by a specific chronologic age cut-off for participation, providers should facilitate shared decision-making with families that incorporates (1) a preparticipation evaluation; (2) identification and management of relevant health concerns; (3) identification of proper, intrinsic motivations for participation; (4) development of appropriate training plans that facilitate physiologic adaptation through the gradual progression of training loads and increasing competition distances; (5) prospective monitoring of both physical and psychosocial well-being; (6) presentation of the potential risks associated with participation; (7) discussion of the fact that early participation in prolonged endurance events does not predict long-term success or even long-term participation in similar events; and (8) scheduled follow-up to monitor progress and re-evaluate these factors over time.

The consequences of long-term participation in prolonged endurance events and children are also poorly defined.[48,49] For example, although children can exhibit cardiovascular adaptations to endurance training that are similar to adults, it is unknown whether this encumbers any long-term risk of pathologic remodeling or arrhythmia.[49] Higher running volume and longer participation may be associated with reduced bone mineral density in male and female runners, respectively, but it is unclear whether this contributes to long-term fracture risk or bone health. The positive and negative outcomes associated with long-term childhood participation in endurance events remains a vitally important area of future research.

Nonetheless, current evidence and recommendations suggest that children and adolescents should be allowed to participate in endurance events, such as marathons, provided that they are intrinsically motivated, follow an appropriate, supervised training program, and maintain normal growth.[49] Along with the recommendations above to ensure 1 day of rest per week and 2 to 3 months off from participation in any specific sport, a proper plan should include a gradual increase in running volume. Although evidence is limited, it is widely recommended that children delay specialization in endurance sports to reduce the risk of injury, facilitate broad neuromuscular training, and reduce the risk of attrition. In addition, children should be carefully monitored by family members, coaches, health care providers, and the individual athlete for any signs of emerging overuse injury, overtraining, or burnout. Of note, endurance sports represent a very accessible and inexpensive form of physical activity that have been successfully introduced and conducted among traditionally underserved children and communities. Introducing children to properly designed and monitored

endurance training plans may represent a scalable means to help improve access to organized sports for a broad population of young athletes.

WEEKEND TOURNAMENTS

Intensive weekend tournaments that include multiple games per day for several days are common in a number of youth sports in the United States. These may include up to 4 or 5 games in a single day, with very large acute training loads and no opportunity for adequate recovery in between. These spikes in training load are associated with significant impairments in well-being and sleep,[30] as well as the requisite environmental exposure for outdoor activities. Although specific evidence in youth athletes is not available, prolonged environmental exposure can lead to an increased risk of heat-related illness, and the accumulated fatigue may increase the risk for injury and illness. When several of these events are included in a single season, young athletes may be at an increased risk of burnout because of a lack of free time and opportunities to pursue other activities.

BURNOUT AND ATTRITION FROM SPORT

Burnout in sport was initially defined in 1986 focusing on stress and its effect on athletes leading them to stop participating in a sport they previously enjoyed.[50] Raedeke and Smith subsequently proposed a definition that includes: (1) emotional and/or physical exhaustion; (2) reduced sense of accomplishment; and (3) devaluation of sport.[51] Burnout is part of a spectrum that includes overreaching and overtraining syndrome.[52] As above, overreaching and overtraining exist on a continuum of decreased performance attributable to intense training without sufficient recovery that is accompanied by psychological and neuroendocrinologic symptoms.[29] To improve diagnostic accuracy and allow for more research, the Athlete Burnout Questionnaire (ABQ) was developed.[51] Unfortunately, most of the published research has only been performed in adults. The true prevalence of burnout in young athletes is unknown. However, 1 Swedish study estimated up to 9% of elite adolescent athletes met the definition.[53] Two studies showed that athletes who specialized early were more likely to cease participation because of burnout.[54,55]

Signs, Symptoms, and Diagnosis

Athletes with burnout can present with a variety of different signs and symptoms, which may be unique to each particular athlete (Table 2). Often the symptoms are not specific to burnout, however. A holistic approach utilizing the history, physical examination, and limited testing may facilitate the recognition and diagnosis of burnout. It is important for the pediatrician to investigate the athlete's motivation in participating in their sport.[56] Athletes with decreased performance despite adequate recovery, nutrition, and hydration may require further evaluation for burnout.[52,57]

TABLE 2 Burnout Symptoms

Fatigue
Depressive symptoms (eg, depressed mood, loss of interest in activities)
Loss of interest or motivation
Sleep disturbances
Irritability
Anxiety symptoms (eg, excessive worry, agitations)
Lack of concentration
Unexplained musculoskeletal complaints
Weight changes
Decreased academic or athletic performance
Decreased enjoyment in sports

To accurately diagnose burnout, it is important that the pediatrician rule out other organic causes that can present similarly. Depending on the overall clinical presentation, minimal laboratory studies could be considered to exclude other conditions that may present with similar signs and symptoms, such as anemia, infection, systemic inflammatory disease, mental health conditions, or endocrinologic disease (eg, diabetes mellitus, hypothyroidism). These could include a complete blood cell count, comprehensive metabolic panel, creatine kinase, erythrocyte sedimentation rate, C-reactive protein, iron studies, thyroid studies, and Epstein-Barr virus and cytomegalovirus titers.[52] Screening tools for other psychological diagnoses such as depression and anxiety should be used (ie, PHQ-9, GAD-7, Profile of Mood States, ABQ).

Potential Risk Factors or Populations at Risk

Training volume and overscheduling are 2 potential risk factors for burnout. It has become more common to see young athletes participate on multiple teams at the same time and training year-round. This training may be specialized or multisport, but both can take away free play time or time to engage in other nonsport-related activities.

Pressure instilled by parents, guardians, coaches, or peers are additional risk factors. The parental relationship can be a very positive influence on the developing athlete when it is supportive. However, when athletes perceive that parents measure success by performance, rates of burnout are higher.[58–60] Burnout rates are lower if success is defined by meeting intrinsic goals.[58–60] Coaches who are controlling, foster perfectionism, and encourage extrinsic motivation for participation are associated with a higher likelihood of burnout.[61] In addition, athletes who have a negative perception of their relationship with their coach are at risk for burnout.[62] Higher rates of burnout are also seen when peers focus on performance as opposed to effort or there is high intrateam conflict.[63] Focusing on long-term development and communication is protective against burnout.[64]

Athletic competition and training always incorporate physical and psychological stress. Stress that is handled

TABLE 3 Risk and Protective Factors for Burnout	
Risk Factors	**Preventive and Protective Factors**
Pressure or extrinsic motivation	Intrinsic motivation
Perceived stress	Supportive parental relationship
Prioritizing short-term goals	Long-term athlete development models
Perfectionism	Higher levels of autonomy, optimism, and mental toughness
Focus on performance outcomes from peers, coaches, or parents	Prioritization of effort and intrinsic goals over extrinsic goals
Overscheduling and high chronic training loads	Adequate rest and breaks from participation
High chronic training loads	
Intrateam conflict	

in a healthy way can lead to success and enjoyment. If stress becomes unhealthy, it can be a primary cause of burnout.[50] Perfectionism has also been associated with burnout in young athletes.[60,65] Higher levels of hope, dispositional optimism, and mental toughness have shown to be protective factors.[66–68]

Young people who primarily identify themselves as an athlete or who feel like they have limited control over their sports decisions are at higher risk for developing burnout.[69,70] Additional studies in self-determination have shown that athletes who have a sense of autonomy have lower rates of burnout.[71] Fear of failure has recently been shown to be a risk factor. Athletes who worry about being able to accomplish a preset goal may feel embarrassed at not reaching their goal or disappointing coaches, parents, or teammates.[72] A list of risk factors and protective factors for burnout are shown in Table 3.

Sport Attrition and Causes of Sport Discontinuation

Attrition occurs when an athlete no longer wants to participate in a sport and decides to drop out. Burnout is one cause of attrition from sport, but most dropout is attributable to other reasons such as loss of interest in their sport, lack of available time, interest in other activities, lack of playing time, little skill improvement, lack of fun, or injury.[52,73,74]

RECOMMENDATIONS FOR PREVENTION AND TREATMENT

1. Promote the conduction of preparticipation examinations within the medical home to afford a more comprehensive approach to young athlete care that can incorporate guidance regarding overuse injuries, overtraining, and burnout.
2. Encourage athletic autonomy and intrinsic motivation, measure success on participation and effort, and foster positive experiences with parents, coaches, and peers, all of which can help prevent burnout.[75]
3. Promote skill development and being well-rounded in physical activities while avoiding overtraining and overscheduling.
4. Encourage the athlete, parent, and coach to modify the causative factors and involve mental health professional professionals, if needed.
5. Encourage mindfulness tools.[76]
6. Keep workouts interesting, with age-appropriate games and training, to keep practice fun.
7. Take adequate time off from organized or structured sports participation on a weekly and yearly basis.
8. Focus on wellness and teaching athletes to listen to their bodies.
9. Encourage further research to determine whether social determinants of health, including access to health care, and access to a variety of sports experiences influence the risk of developing overuse injuries, overtraining, or burnout.

GUIDANCE FOR THE CLINICIAN

1. Information regarding the risks of overuse injuries, overtraining, and burnout can be included as part of the preparticipation examination and well-child visits for young athletes and potentially distributed among community organizations (eg, schools, clubs). Similarly, counseling and consideration of overtraining and burnout should be considered in young athletes who present with overuse injuries, mental health concerns, or other nonspecific complaints (eg, poor sleep, fatigue, mood changes). Clinicians should be familiar with published Mental Health Competencies for Pediatric Practice from the AAP (https://doi.org/10.1542/peds.2019-2757).
2. Encourage athletes to strive to have at least 1 to 2 days off per week from competition and sport-specific training to allow them to recover both physically and psychologically.
3. Encourage the athlete to participate on only 1 team during a season and to take at least 2 to 3 months away from any specific sport during the year. These breaks may be divided into 1-month increments. The athlete should focus on other activities or free play during this time. If the athlete plays on more than 1 team, then they should not occur on the same day and the participation time should be incorporated into the aforementioned guidelines.
4. Emphasize that the focus of sports participation should be on fun, skill acquisition, safety, and sportsmanship.
5. If the athlete complains of nonspecific muscle or joint problems, fatigue, mood changes, or poor academic

performance, be alert for the possibilities of burnout or overtraining. Ask about sport motivation.
6. To reduce the risk of overtraining, focus on both stress and recovery. Promote proper nutrition and sleep to optimize recovery and identify or manage all the different sources of stress that can add to the physical stress from training.
7. Advise athletes that the weekly training time, number of repetitions, or total distance should increase gradually.
8. Advocate for medical advisory boards for weekend athletic tournaments to educate athletes, parents, and coaches.
9. Encourage the development of educational opportunities for athletes, parents, and coaches to provide information about appropriate nutrition and fluids, the use and potential misuse of supplements, sport safety, and the avoidance of overtraining to achieve optimal performance and long-term good health.
10. Convey a special caution to parents with younger athletes who participate in multigame tournaments in short periods of time.

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ABBREVIATIONS

AAP: American Academy of Pediatrics
ACWR: acute on chronic workload ratio
RED-S: relative energy deficiency in sport

REFERENCES

1. Brenner JS; Council on Sports Medicine and Fitness. Sports specialization and intensive training in young athletes. *Pediatrics*. 2016;138(3):e20162148
2. Merlo CL, Jones SE, Michael SL, et al. Dietary and physical activity behaviors among high school students - youth risk behavior survey, United States, 2019. *MMWR Suppl*. 2020;69(1):64–76
3. Guevara SA, Donaldson A, Keegan RJ, et al. Stakeholder insights into athlete attrition in the high-performance pathway. *J Sci Med Sport*. 2022;25(9):755–763
4. Schroeder AN, Comstock RD, Collins CL, Everhart J, Flanigan D, Best TM. Epidemiology of overuse injuries among high-school athletes in the United States. *J Pediatr*. 2015;166(3):600–606
5. Leppänen M, Pasanen K, Kannus P, et al. Epidemiology of overuse injuries in youth team sports: a 3-year prospective study. *Int J Sports Med*. 2017;38(11):847–856
6. DiFiori JP, Benjamin HJ, Brenner JS, et al. Overuse injuries and burnout in youth sports: a position statement from the American Medical Society for Sports Medicine. *Br J Sports Med*. 2014;48(4):287–288
7. Benjamin HJ, Engel SC, Chudzik D. Wrist pain in gymnasts: a review of common overuse wrist pathology in the gymnastics athlete. *Curr Sports Med Rep*. 2017;16(5):322–329
8. Norton R, Honstad C, Joshi R, Silvis M, Chinchilli V, Dhawan A. Risk factors for elbow and shoulder injuries in adolescent baseball players: a systematic review. *Am J Sports Med*. 2019;47(4):982–990
9. McGuine TA, Post EG, Hetzel SJ, Brooks MA, Trigsted S, Bell DR. A prospective study on the effect of sport specialization on lower extremity injury rates in high school athletes. *Am J Sports Med*. 2017;45(12):2706–2712
10. Bell DR, Post EG, Biese K, Bay C, Valovich McLeod T. Sport specialization and risk of overuse injuries: a systematic review with meta-analysis. *Pediatrics*. 2018;142(3):e20180657
11. Zaremski JL, Zeppieri G Jr, Tripp BL. Sport specialization and overuse injuries in adolescent throwing athletes: a narrative review. *J Athl Train*. 2019;54(10):1030–1039
12. Croci J, Nicknair J, Goetschius J. Early sport specialization linked to throwing arm function and upper extremity injury history in college baseball players. *Sports Health*. 2021;13(3):230–236
13. Gabbett TJ. The training-injury prevention paradox: should athletes be training smarter and harder? *Br J Sports Med*. 2016;50(5):273–280
14. Hulin BT, Gabbett TJ, Lawson DW, Caputi P, Sampson JA. The acute:chronic workload ratio predicts injury: high chronic workload may decrease injury risk in elite rugby league players. *Br J Sports Med*. 2016;50(4):231–236

15. Bowen L, Gross AS, Gimpel M, Li FX. Accumulated workloads and the acute:chronic workload ratio relate to injury risk in elite youth football players. *Br J Sports Med.* 2017;51(5):452–459

16. Hulin BT, Gabbett TJ, Caputi P, Lawson DW, Sampson JA. Low chronic workload and the acute: chronic workload ratio are more predictive of injury than between-match recovery time: a two-season prospective cohort study in elite rugby league players. *Br J Sports Med.* 2016;50(16):1008–1012

17. Blanch P, Gabbett TJ. Has the athlete trained enough to return to play safely? The acute:chronic workload ratio permits clinicians to quantify a player's risk of subsequent injury. *Br J Sports Med.* 2016;50(8):471–475

18. Murray NB, Gabbett TJ, Townshend AD, Blanch P. Calculating acute:chronic workload ratios using exponentially weighted moving averages provides a more sensitive indicator of injury likelihood than rolling averages. *Br J Sports Med.* 2017;51(9):749–754

19. Sonneville KR, Gordon CM, Kocher MS, Pierce LM, Ramappa A, Field AE. Vitamin d, calcium, and dairy intakes and stress fractures among female adolescents. *Arch Pediatr Adolesc Med.* 2012;166(7): 595–600

20. Mountjoy M, Sundgot-Borgen J, Burke L, et al. The IOC consensus statement: beyond the female athlete triad–relative energy deficiency in sport (RED-S). *Br J Sports Med.* 2014;48(7):491–497

21. Martin S, Johnson U, McCall A, Ivarsson A. Psychological risk profile for overuse injuries in sport: an exploratory study. *J Sports Sci.* 2021;39(17):1926–1935

22. Tranaeus U, Martin S, Ivarsson A. Psychosocial risk factors for overuse injuries in competitive athletes: a mixed-studies systematic review. *Sports Med.* 2022;52(4):773–788

23. Wu AC, Rauh MJ, DeLuca S, et al. Running-related injuries in middle school cross-country runners: prevalence and characteristics of common injuries. *PM R.* 2022;14(7):793–801

24. Anderson SA, Haraldsdottir K, Watson D. Mindfulness in athletes. *Curr Sports Med Rep.* 2021;20(12):655–660

25. Bagheri S, Naderi A, Mirali S, Calmeiro L, Brewer BW. Adding mindfulness practice to exercise therapy for female recreational runners with patellofemoral pain: a randomized controlled trial. *J Athl Train.* 2021;56(8):902–911

26. Ivarsson A, Johnson U, Andersen MB, Fallby J, Altemyr M. It pays to pay attention: a mindfulness-based program for injury prevention with soccer players. *J Appl Sport Psychol.* 2015;27(3):319–334

27. Li S, Wu Q, Chen Z. Effects of psychological interventions on the prevention of sports injuries: a meta-analysis. *Orthop J Sports Med.* 2020;8(8):2325967120928325

28. Varghese M, Ruparell S, LaBella C. Youth athlete development models: a narrative review. *Sports Health.* 2022;14(1):20–29

29. Meeusen R, Duclos M, Foster C, et al; European College of Sport Science; American College of Sports Medicine. Prevention, diagnosis, and treatment of the overtraining syndrome: joint consensus statement of the European College of Sport Science and the American College of Sports Medicine. *Med Sci Sports Exerc.* 2013;45(1):186–205

30. Saw AE, Main LC, Gastin PB. Monitoring the athlete training response: subjective self-reported measures trump commonly used objective measures: a systematic review. *Br J Sports Med.* 2016; 50(5):281–291

31. Carfagno DG, Hendrix JC III. Overtraining syndrome in the athlete: current clinical practice. *Curr Sports Med Rep.* 2014;13(1):45–51

32. Hausswirth C, Louis J, Aubry A, Bonnet G, Duffield R, LE Meur Y. Evidence of disturbed sleep and increased illness in overreached endurance athletes. *Med Sci Sports Exerc.* 2014;46(5):1036–1045

33. Hornberger LL, Lane MA; Committee on Adolescence. Identification and management of eating disorders in children and adolescents. *Pediatrics.* 2021;147(1):e2020040279

34. Stellingwerff T, Heikura IA, Meeusen R, et al. Overtraining syndrome (OTS) and relative energy deficiency in sport (RED-S): shared pathways, symptoms and complexities. *Sports Med.* 2021;51(11): 2251–2280

35. Kenttä G, Hassmén P, Raglin JS. Training practices and overtraining syndrome in Swedish age-group athletes. *Int J Sports Med.* 2001;22(6):460–465

36. Rietjens GJ, Kuipers H, Adam JJ, et al. Physiological, biochemical and psychological markers of strenuous training-induced fatigue. *Int J Sports Med.* 2005;26(1):16–26

37. Hynynen E, Uusitalo A, Konttinen N, Rusko H. Cardiac autonomic responses to standing up and cognitive task in overtrained athletes. *Int J Sports Med.* 2008;29(7):552–558

38. Buchheit M, Simpson MB, Al Haddad H, Bourdon PC, Mendez-Villanueva A. Monitoring changes in physical performance with heart rate measures in young soccer players. *Eur J Appl Physiol.* 2012;112(2):711–723

39. Matos NF, Winsley RJ, Williams CA. Prevalence of nonfunctional overreaching/overtraining in young English athletes. *Med Sci Sports Exerc.* 2011;43(7):1287–1294

40. Watson A, Brickson S. Relationships between sport specialization, sleep, and subjective well-being in female adolescent athletes. *Clin J Sport Med.* 2019;29(5):384–390

41. Pandya NK. Disparities in youth sports and barriers to participation. *Curr Rev Musculoskelet Med.* 2021;14(6):441–446

42. Campbell EH, Poudevigne M, McFarlane S, Dilworth L, Irving R. Evidence that sleep is an indicator of overtraining during the competition phase of adolescent sprinters. *J Sports Med (Hindawi Publ Corp).* 2021;2021:6694547

43. Rice SG, Waniewski S; American Academy of Pediatrics (AAP) Committee on Sports Medicine and Fitness; International Marathon Medical Directors Association (IMMDA). Children and marathoning: how young is too young? *Clin J Sport Med.* 2003;13(6):369–373

44. Roberts WO. Children and running: at what distance safe? *Clin J Sport Med.* 2005;15(2):109–110, author reply 110–111

45. Roberts WO. Can children and adolescents run marathons? *Sports Med.* 2007;37(4-5):299–301

46. Roberts WO, Nicholson WG. Youth marathon runners and race day medical risk over 26 years. *Clin J Sport Med.* 2010;20(4): 318–321

47. Goldman JT, Miller E, Runestad S, Serpa R, Beck J. Should adolescents run marathons?: youth marathon training injury epidemiology and risk factors. *Clin J Sport Med.* 2022;32(3):e293–e299

48. Scheer V, Costa RJS, Doutreleau S, et al. Recommendations on youth participation in ultra-endurance running events: a consensus statement. *Sports Med.* 2021;51(6):1123–1135

49. Krabak BJ, Roberts WO, Tenforde AS, et al. Youth running consensus statement: minimising risk of injury and illness in youth runners. *Br J Sports Med.* 2021;55(6):305–318

50. Smith RE. Toward a cognitive-affective model of athletic burnout. *J Sport Exerc Psychol.* 1986;8(1):36–50

51. Raedeke TD, Smith AL. Development and preliminary validation of an athlete burnout measure. *J Sport Exerc Psychol.* 2001;23(4): 281–306

52. DiFiori JP, Benjamin HJ, Brenner J, et al. Overuse injuries and burnout in youth sports: a position statement from the American Medical Society for Sports Medicine. *Clin J Sport Med.* 2014; 24(1):3–20

53. Gustafsson H, Kentta G, Hassmen P, Lundqvist C. Prevalence of burnout in competitive adolescent athletes. *Sport Psychol.* 2007; 21(1):21–37

54. Barynina I, Vaitsekhovskii S. The aftermath of early sports specialization for highly qualified swimmers. *Fitness and Sports Review International.* 1992;27(4):132–133

55. Wall M, Côté J. Developmental activities that lead to dropout and investment in sport. *Phys Educ Sport Pedagogy.* 2007;12(1):77–87

56. Brenner JS; American Academy of Pediatrics Council on Sports Medicine and Fitness. Overuse injuries, overtraining, and burnout in child and adolescent athletes. *Pediatrics.* 2007;119(6):1242–1245

57. Malina RM. Early sport specialization: roots, effectiveness, risks. *Curr Sports Med Rep.* 2010;9(6):364–371

58. Lemyre PN, Hall HK, Roberts GC. A social cognitive approach to burnout in elite athletes. *Scand J Med Sci Sports.* 2008;18(2): 221–234

59. DeFreese JD, Dorsch TE, Flitton TA. The parent-child relationship and sport parents' experiences of burnout and engagement. *J Clin Sport Psychol.* 2018;12(2):218–233

60. Gustafsson H, Hill AP, Stenling A, Wagnsson S. Profiles of perfectionism, parental climate, and burnout among competitive junior athletes. *Scand J Med Sci Sports.* 2016;26(10):1256–1264

61. Barcza-Renner K, Eklund RC, Morin AJS, Habeeb CM. Controlling coaching behaviors and athlete burnout: investigating the mediating roles of perfectionism and motivation. *J Sport Exerc Psychol.* 2016;38(1):30–44

62. Isoard-Gautheur S, Trouilloud D, Gustafsson H, Guillet-Descas E. Associations between the perceived quality of the coach-athlete relationship and athlete burnout: an examination of the mediating role of achievement goals. *Psychol Sport Exerc.* 2016;22:210–217

63. Smith AL, Gustafsson H, Hassmen P. Peer motivational climate and burnout perceptions of adolescent athletes. *Psychol Sport Exerc.* 2010;11(6):453–460

64. Li C, Wang CKJ, Pyun DY. Impacts of talent development environments on athlete burnout: a self-determination perspective. *J Sports Sci.* 2017;35(18):1–8

65. Jowett GE, Hill AP, Hall HK, Curran T. Perfectionism, burnout and engagement in youth sport: the mediating role of basic psychological needs. *Psychol Sport Exerc.* 2016;24:18–26

66. Chen LH, Kee YH, Tsai YM. Relation of dispositional optimism with burnout among athletes. *Percept Mot Skills.* 2008;106(3):693–698

67. Gerber M, Best S, Meerstetter F, et al. Effects of stress and mental toughness on burnout and depressive symptoms: a prospective study with young elite athletes. *J Sci Med Sport.* 2018;21(12): 1200–1205

68. Gustafsson H, Skoog T, Podlog L, Lundqvist C, Wagnsson S. Hope and athlete burnout: stress and affect as mediators. *Psychol Sport Exerc.* 2013;14(5):640–649

69. Coakley J. Burnout among adolescent athletes - a personal failure or social-problem. *Sociol Sport J.* 1992;9(3):271–285

70. Gustafsson H, Hassmen P, Kentta G, Johansson M. A qualitative analysis of burnout in elite Swedish athletes. *Psychol Sport Exerc.* 2008;9(6):800–816

71. Lonsdale C, Hodge K, Rose E. Athlete burnout in elite sport: a self-determination perspective. *J Sports Sci.* 2009;27(8):785–795

72. Gustafsson H, Sagar SS, Stenling A. Fear of failure, psychological stress, and burnout among adolescent athletes competing in high level sport. *Scand J Med Sci Sports.* 2017;27(12):2091–2102

73. Sáez I, Solabarrieta J, Rubio I. Reasons for sports-based physical activity dropouts in university students. *Int J Environ Res Public Health.* 2021;18(11):5721

74. Carlman P, Wagnsson S, Patriksson G. Causes and consequences of dropping out from organized youth sports. *Swedish Journal of Sports Research.* 2013;28(1):26–54

75. Madigan DJ, Gustafsson H, Smith A, Raedeke T, Hill AP. The BASES expert statement on burnout in sport. *The Sport and Exercise Scientist.* 2019;61:6–7

76. Li C, Zhu Y, Zhang M, Gustafsson H, Chen T. Mindfulness and athlete burnout: a systematic review and meta-analysis. *Int J Environ Res Public Health.* 2019;16(3):449