Appropriate Medical Care for the Secondary School-Age Athlete

Communication

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The information contained within this document does not necessarily reflect endorsement from the individual organizations listed above.

Appropriate Medical Care for the Secondary School-Age Athlete

Objective: To provide evidence-based support for the recommendations made by the Appropriate Medical Care for Secondary School–Age Athletes (AMCSSAA) Task Force consensus statement.

Data Sources: MEDLINE, CINAHL, and Sport Discus databases were searched for relevant literature regarding secondary school-age athletes, health care administration, pre-participation physical examination, facilities, athletic equipment, emergency action planning, environmental conditions, recognition, evaluation, and treatment of injuries, rehabilitation and reconditioning, psychosocial consultation, nutrition, and prevention strategies.

Conclusions & Recommendations: There is adequate evidence-based support for all eleven of the AMCSSAA Task Force's consensus points. Organizations that sponsor athletic programs for secondary school-age athletes should establish an athletic health care team (AHCT) to ensure appropriate medical care is provided to all participants.

Key Words: safety, high school, adolescent, injury

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TABLE OF CONTENTS

DOCUMENT BACKGROUND

In 2002, the National Athletic Trainers' Association developed an inter-association task force to develop recommendations and guidelines for adolescents competing in school and club-level sports. The Appropriate Medical Care for Secondary School–Age Athletes Task Force (AMCSSAA) comprised experts from 17 school, health care, and medical associations who all shared the same goal — ensuring young athletes receive consistent and adequate medical care while participating in practices and games.

The group developed a consensus statement (Appendix A) stating minimum standards of health care for adolescent athletes. After unanimously approving the document, the task force decided to take the project one step further and put together this scientifically based document that augments the recommendations set forth in the consensus statement.

This communication will help organizations sponsoring athletic programs for this age group justify the importance of providing appropriate medical care and establishing an athletic health care team to identify the resources they should make available to adolescents participating in organized athletic programs. The article can also be used as an evaluation tool to assess current athletic health care delivery programs.

Disclaimer: This communication provides general practice recommendations and guidelines for medical care provided by organizations sponsoring athletic programs for secondary school-age individuals. Actual medical care provided should not be based solely on the information contained in this manuscript, but should be tailored to specific facts and circumstances unique to each entity and location.

PARTICIPATING IN THE DEVELOPMENT AND IMPLEMENTATION OF A COMPREHENSIVE ATHLETIC HEALTH CARE ADMINISTRATIVE SYSTEM

Organizations sponsoring athletic programs for secondary school–age individuals should establish an athletic health care team (AHCT) that functions to ensure appropriate medical care is provided for all participants. To provide appropriate medical care, the AHCT must function in a coherent, coordinated, and efficient manner with coaches and administrators of sponsoring organizations and adhere to commonly accepted standards of good clinical practice.

Medical and allied health professionals representing various disciplines are involved in the provision of athletic health care to adolescents. This communication summarizes the evidence base for points addressed in the consensus statement, which was was prepared and ratified by professional organizations representing numerous disciplines but does not mandate which specific individuals are essential to the AHCT. Nonetheless, the American Medical Association (AMA), at the request of the American Academy of Pediatrics (AAP), has recommended that athletic medical units (AMUs) include a physician director and an athletic health coordinator, with preference given to NATABOC-certified athletic trainers (ATCs) in this role (AMA Resolution H-470.995 Athletic [Sports] Medicine, 1998).[1] Furthermore, many jurisdictions require that ATCs be supervised by licensed physicians, just as school nurses are supervised by school physicians and emergency medical technicians (EMTs) are supervised by emergency medical services (EMS) physicians. Therefore, the ATC and team physician form the core of the AHCT, with the ATC being the most appropriate on-site member of the AHCT and the official team physician, if one has been designated, being ultimately responsible for medical decisions made by the AHCT (Figure 1). A designated school official or member of the sponsoring organization should be a liaison to the AHCT when having a member of the AHCT on-site is not possible. Other members of the team, along with the relationships among them, should be dictated by local needs and statutes.

A comprehensive athletic health care system should enhance the care of the athlete by allowing the strengths of individual members to complement each other and by preventing the unnecessary duplication of efforts. The roles and responsibilities of all team members should be clearly defined and available to all. Regardless of the specifics of a given situation (i.e., local and state qualifications and regulations) or the personnel involved in the AHCT, the extent to which the ATC is responsible for medical decisions must be explicitly understood between the team physician and ATC, with administrative members of the AHCT (e.g., athletic directors) being wholly supportive of the guidelines for decision-making established between the team physician and ATC.

At the request of the AAP, in 1998 the AMA passed Resolution H-470.995, which called for the establishment of athletic medical units (AMUs) by all organizations that sponsor athletic programs, school boards, and local boards of health. The scientific rationale for this resolution was thoroughly reviewed and published by the AMA and NATA in 1999.[1]

Expert panels[2] and peer-reviewed journal articles[3] have recommended standardization of sports injury surveillance systems to help improve athletic health care, but little to no primary research has been conducted to demonstrate that AMUs either decrease injury rates or improve athletic health care. The AHCT proposed in this document is similar to the AMU with respect to the allied health care professionals recommended to comprise the team and the roles and responsibilities of the team.

Nonetheless, case law over the past three decades[4, 5] has established the precedent that school districts and other agencies sponsoring athletic programs have a legal responsibility to provide medical care for participants. In *O'Brien v. Township High School District* (1979),[6] the court held that a school district has a responsibility to provide proper medical treatment. Care provided by a minor student was not found improper or negligent at the time, but in the interim many states have enacted licensure statutes for athletic training. Therefore, organizations that do not provide appropriate medical care for athletes, defined as that administered by trained and certified professionals, could risk significant liability exposure.

Components of recommendation

To properly develop and implement a comprehensive athletic health care administrative system, the sponsoring organization must create the AHCT, identify their roles and responsibilities, create the appropriate policies and procedures to ensure all on-site athletic staff adhere to safe clinical practice parameters for adequate medical care, designate appropriate physical space and equipment, document the activities of the AHCT, take part in injury surveillance, and commit to cycles of quality improvement so that appropriate medical care is available for all secondary school–age athletes.

Members of the Athletic Health Care Team

Local availability, needs, and statutes should guide organizations that sponsor athletic programs (e.g., schools, school districts, clubs, youth leagues) to establish desirable team members. Also, organizations should be aware of recommendations made in AMA Resolution H-470.995, the American College of Sports Medicine (ACSM)/American Orthopaedic Society for Sports Medicine (AOSSM) *Team Physician Consensus Statement*, the National Federation of State High School Associations (NFHS) *Sports Medicine Handbook*, and the National Collegiate Athletic Association (NCAA) *Sports Medicine Handbook*. The AHCT should include medical professionals from various organizations, including those listed in Table 1. When appropriate, the AHCT should consult with and develop an on-going coordination of efforts with the athlete, the athlete's parents, coaches, administrators, and other school or organization officials.

Individuals interested in improving the care provided to athletes should generate a needs assessment for their program based on injury risk data collected locally as well as that found in national databases, including the NATA surveillance studies, National Electronic Injury Surveillance System (NEISS), NCAA Injury Surveillance System, and National Center for Catastrophic Sports Injury Research.

Local professionals and groups should be identified and approached to join the AHCT. These may include sports medicine and other physician groups, medical schools, athletic training curriculum programs at local universities, physical therapy groups, physical therapy schools, and nursing schools.

Guidelines such as the NATA *Position Proposal Guide* (PPG) for the creation of new programs or the NATA *Position Improvement Guide* (PIG) for the improvement of existing athletic health care programs are available to the sponsoring organization as resources. Funding issues may need to be addressed by demonstrating savings in liability/health insurance premiums through the establishment of an AHCT and athletic health care delivery program, although such national data are not available.

Roles and responsibilities

The roles and responsibilities of each team member should be clearly defined and established, especially with each of the areas addressed in the following sections of this document. It is recommended that an "exclusion policy" be instituted whereby any single member of the AHCT, including but not limited to the ATC, team physician, consulting physician, or primary physician, may, based on the member's particular expertise, render an athlete ineligible for participation due to concerns for the health or welfare of the athlete. This exclusion policy should also allow the athlete, his/her parents, coaches, and sponsoring organization to limit participation for reasons justified by their role.

Policies and procedures

Written policies and procedures for the AHCT should be established and kept in a manual easily referenced by team members as well as outside constituencies (e.g., parent-teacher associations) and governing bodies (e.g., school boards, local boards of health). Specific policies should be established and approved in advance of the athletic season relating to the following: 1) Readiness to participate and return-to-play decisions, 2) Facilities inspection and maintenance, 3) Proper fit, inspection, and maintenance of athletic equipment, 4) Emergency response—the written emergency action plan, 5) Environmental conditions protocols, 7) Sideline preparedness for practice and competition sessions, 8) Nutritional and weight requirements for different activities, such as wrestling, 9) Coordination of referrals to consultants, 10) Channels of communication, 11) Chain of command, 12) Documentation and record-keeping, and 13) Injury surveillance and quality improvement

This communication has been devoted to outlining the recommended roles, responsibilities, policies, and procedures of the AHCT. Several other professional organizations in medicine, sports medicine, and athletic health have also published policies and procedures that may serve as useful templates for local AHCTs.

Physical space and equipment

The physical space and equipment necessary for the AHCT must be established and maintained. To obtain and maintain this equipment, the athletic health care annual budgeting process should include input from a member of the AHCT. Recommended

standard athletic health care equipment and supplies are detailed later in this communication. In addition, other resources[7] have extensive sections devoted to planning, constructing, equipping, and maintaining facilities for appropriate medical care of the adolescent athlete.

Documentation

Issues relating to the safety of equipment and facilities, as well as athlete injuries, treatment, and reconditioning, should be well documented in accordance with generally accepted standards of their respective state practice acts. To facilitate communication among members of the AHCT as well as with outside consultants and primary treating clinicians, all patient encounters should be documented in adherence with federal, state, and local regulations while keeping within the recommendations set forth by the Health Insurance Portability and Accountability Act of 1996 (HIPAA)[8] and Federal Education Records Protection Act (FERPA)[9] when applicable. Patient records (i.e., personal medical information) should be maintained in such as manner as to ensure privacy and confidentiality in all circumstances.

Injury surveillance

As detailed later in of this document, surveillance is the first step in the cycle of developing effective public health injury control strategies. Anonymous, high-quality injury surveillance and outcomes data should be collected regularly and shared not only with public health officials and other supervisory and regulatory agencies but also with professional health care societies committed to the advancement of their respective fields.

Injury surveillance can be defined on a continuum from action at the local level to the national level. At the local level, injury surveillance can be as simple as a coach removing a field hazard following injury to an athlete so as to not cause additional injuries to other athletes or a coach altering the bullpen throwing schedule if a rash of shoulder injuries occurs to the pitching staff. Injury surveillance at the national level could mean establishing a national secondary school–age sports injury and illness database to begin to collect data regarding the incidence of various injuries and illnesses in this population.

To more easily compare and share such information, it would be ideal to establish uniform sports injury surveillance system standards on the local, state, and national levels. Important elements of sports injury surveillance data may include a clearly defined and standardized definition of injury, type of sports event, position played, and particular activity and moment of injury, level of competition, place where the injury occurred, injury mechanism, level of supervision, nature of the injury, injured body region, severity of the injury (e.g., activity lost, working time lost, need for treatment, cost of treatment, permanent damage, impairment, and disability), characteristics of the injured person, duration and nature of the treatments needed, use of protective equipment, follow-up of game rules, cost of the injury, and well-defined exposure data (population at risk and exposure time), which are critical in determining and comparing incidence rates.[10] However, staffing, time, and cost constraints may limit the feasibility of such extensive injury surveillance. A cooperative effort between the primary members of the AHCT along with the administrators of sponsoring organizations, coaches, and

parents provides the best opportunity to establish an injury surveillance system for each specific group. Analysis of the results of this surveillance system can provide vital information regarding recommendations to improve the overall safety of the athletic activity.

Just as injury surveillance is but the first step in the public health model of prevention, AHCTs and members of the sponsoring organization, including administrators, coaches, and parents, should be committed to ongoing, continuous cycles of quality improvement, whereby local surveillance and outcome data are used to suggest changes in its own members' roles, responsibilities, policies, and procedures. Practices involving quality improvement and injury surveillance need to start locally and move toward a national level.
Ideally, such information would be shared regionally and nationally to contribute to the medical literature and to provide a basis for evidence-based practice of clinical medicine.

Strategies for implementation
Potential strategies for the prevention of injury and illness as they relate to athletic participation by secondary school–age individuals are described in detail in the following sections of this communication. A brief overview of each consensus statement point is listed.

Consensus Statement Point 1: Develop and implement a comprehensive athletic health care administrative system
The demands of athletic health care require a team with diverse skills and a comprehensive administrative system. The AHCT should coordinate the various aspects of the athletes' health in a coherent, effective, and professional manner.

Consensus Statement Point 2: Determine the individual's readiness to participate
To promote safe participation of the student athlete, the preparticipation physical examination (PPE) is used to identify individuals who may be at risk for the development of injuries related to their activity and those who may be at risk for sudden death due to an underlying medical problem.

Consensus Statement Point 3: Promote safe and appropriate practice, competition, and treatment facilities
Sports organizations are expected to provide a safe environment for all athletes, including keeping the premises in safe repair, inspecting the premises for obvious and hidden hazards, removing the hazards if possible or warning of their presence, protecting invitees from foreseeable dangers, and conducting operations on the premises with reasonable care for the invitees. It is recommended that a specific treatment facility be set-up by the organization.

Consensus Statement Point 4: Advise on the selection, fit, function, and maintenance of athletic equipment
Sports organizations should, to the greatest degree possible, ensure that athletes have access to appropriate equipment for the sport and that such equipment is properly fit in accordance with manufacturer recommendations and maintained by qualified

personnel.

Consensus Statement Point 5: Develop and implement a comprehensive emergency action plan
Based on the activity, skills of participants, and geographic characteristics, various types of emergency incidents are likely to occur. An emergency action plan (EAP) is essential to ensure that all incidents are responded to in an appropriate manner and that the roles of the AHCT members are well defined and communicated in advance.

Consensus Statement Point 6: Establish protocols regarding environmental conditions
Environmental conditions pose potential threats to the safety and welfare of athletic participants. It is crucial that organizations responsible for athletic events develop policies and protocols to address the safety of play in hazardous environmental conditions.

Consensus Statement Point 7: Provide for on-site recognition, evaluation, and immediate treatment of injury and illness, with appropriate referrals
Injured athletes who do not receive timely evaluation or treatment are at greater risk for improper healing, reinjury, extended time loss from athletic participation and school, and potentially life-threatening consequences. Having a qualified individual on-site and ready to care for the ill or injured person is critical to the safety of the participants and for decision making regarding when an athlete can safely return to play.

Consensus Statement Point 8: Facilitate rehabilitation and reconditioning
Although the evaluation and treatment provided immediately after an injury are critical, a rehabilitation and reconditioning program designed to return the individual to their pre-injury level of function is just as important. The process of rehabilitation and reconditioning is fundamental for the safe return of injured athletes to their prior level of competition as quickly as possible and prevention of further injuries.

Consensus Statement Point 9: Provide for psychosocial consultation and referral
The AHCT should be able to identify potential psychosocial pathologies (e.g., disordered eating) frequently associated with secondary school–age athletes and refer them for appropriate diagnosis and management. Sponsoring organizations must identify local experts in these medical fields and facilitate the referral of athletes to these consultants.

Consensus Statement Point 10: Provide scientifically sound nutritional counseling and education
Nutrition is a key factor for an athlete’s health, growth, and performance. It is essential that valid and understandable information regarding nutrition be provided to secondary school–age athletes, parents, and coaches. Even more essential is the ability to refer athletes to appropriate medical personnel for treatment when necessary.

Consensus Statement Point 11: Develop injury and illness prevention strategies
Injury and illness can be a heavy burden on the well-being of the secondary school–age athlete. A public health framework can be used to develop effective interventions to reduce the affliction of injuries and illnesses to these young persons.

DETERMINING AN INDIVIDUAL'S READINESS TO PLAY: THE PREPARTICIPATION PHYSICAL EXAMINATION

The number of individuals participating in organized sports has increased dramatically, with various sources estimating close to 6.5 million student participants in high school athletics each year.[11] The National Center for Catastrophic Sports Injury Research (NCCSIR) noted that between fall 1982 and spring 2001, close to 72 million males and 35 million females had participated in high school athletics.[12] These numbers unfortunately do not reflect the number of people participating in non–school-sanctioned programs such as community- or religious group–based leagues and recreational and developmental programs.

The Preparticipation Physical Examination (PPE) is essential to identify athletes at risk for injury and implement corrective actions before injuries occur. Yearly screening of these athletes is imperative because health conditions may change from year to year and the development of subtle problems may be overlooked. The PPE is an important requirement for all participants in any organized program and should be performed by the athlete's primary care physician, school physician, or team physician.

The purpose of the PPE is not to exclude an individual from activity but instead to recognize individuals who may be at risk for developing injuries related to their activity and those who may be at risk for sudden death due to underlying medical problems. The goal is to promote safe participation of the secondary school–age athlete. There is an inherent risk of injury in secondary school–age athletes through participation in sports and recreational activities. Krowchuk[13] noted that 22% to 39% of high school athletes sustain a significant injury and that as many as 20% of such injuries may be preventable. The value of identifying those at risk therefore is paramount to prevention.

In 1997, Beachy et al.[14] noted that over an 8-year time span, 14,318 athletes participating in more than 32 different sports reported a total of 11,184 injuries that required medical help. The male injury rate was 0.90 injury per athlete with 0.33 day-lost injury per athlete; the female injury rate was 0.64 injury per athlete with 0.21 day-lost injury. The overall injury rate for day-lost injuries was 28%. Almost all of the injuries reported in this study were musculoskeletal in nature.

Fortunately, the risk of sudden death is not as common as is that of musculoskeletal injuries. Between 1983 and 1993, 126 nontraumatic deaths among high school athletes were identified by the NCCSIR (overall annual death rate, 4.68:1 million athletes).[13] The impact of an unexpected death in a perceived healthy young person is remarkable and warrants screening measures and education for recognizing those at risk. Unfortunately, not all injuries and sudden deaths can be prevented, but strategies to minimize the risk are paramount. Periodic assessment of an athlete's medical history and a comprehensive physical examination provide one such prevention strategy. The AAP noted in a 2001 policy statement that although PPEs are typically not mandated until junior high school and high school, annual examinations for younger children afford the opportunity to promote physical activity and to address issues of readiness as they apply to organized sports.[15]

In July 2002, the NFHS released the second edition of their *Sports Medicine Handbook,* which clearly states that the PPE is "a necessary and desirable pre-condition to participation."[16] It is our objective to have the PPE be required for all participants in all organized programs, including those that are school, community, and religious group based.

Components of recommendation

In 1992, five organizations (American Academy of Family Physicians, American Academy of Pediatrics, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine, and American Osteopathic Academy of Sports Medicine) published a consensus report regarding the PPE. This document, herein referred to as the PPE Monograph,[17] clearly outlines the stated goals of the PPE along with guidelines for the organization and administration of the examination. Along with the 1998 American Heart Association guidelines for cardiovascular screening of competitive athletes,[18] these documents set the standard for the PPE.

The PPE should be incorporated to detect conditions that may predispose injury or preclude participation in specific sports; prevent further injuries by identifying and treating musculoskeletal abnormalities; detect medical conditions that may be life threatening or disabling; determine the athlete's general health; assess fitness level for specific sports; advise the athlete in which sports he or she can participate if a condition exists that precludes participation in some sports; develop treatment and rehabilitation plans for problems; counsel the athlete on health-related issues such as nutrition, alcohol, drugs, and other psychosocial issues,;and meet legal and insurance requirements. [16-20]

Discovery of limiting or disqualifying conditions

Conditions such as acute, recurrent, chronic, or untreated injuries or illnesses may compromise the performance of the athlete and place him or her at greater risk for the development of other injuries. For example, examination of foot pain in a young gymnast may uncover a chronic stress fracture that may be due in part to an underlying eating disorder and, if left unrecognized, may lead to further disability and injury.

The discovery of a new medical condition during the PPE is very rare. Recently, the Mayo Clinic[21] reported that of 2,739 students screened over a 3-year period, 13.9% were given dispositions other than being cleared for sports. In this group, 1.9% (53 students) were not cleared for sports due to underlying medical concerns.

Musculoskeletal abnormalities accounted for the largest proportion of those not cleared (43.4%). Cardiac abnormalities, which included exertional presyncope or syncope and palpitations, were the second leading cause of a "not cleared" disposition.

If medical conditions are identified during the PPE, recommendations for handling these problems should be dealt with on an individual basis and follow guidelines set forth by the AAP[22] and the 26th Bethesda Conference.[23] A summary of these guidelines can be found in various sources, including the PPE Monograph.[17]

Sudden death

The incidence of sudden death in school-age athletes is low compared with the number of musculoskeletal injuries incurred during participation. However, sudden death in a young competitive athlete is usually a devastating and tragic event that affects the community. Most cases of sudden death are related to underlying cardiac abnormalities. Maron et al.[24] evaluated a total of 158 sudden deaths that occurred in trained athletes between 1985 and 1995. A total of 124 deaths were cardiac: 48 (36%) were due to hypertrophic cardiomyopathy and 17 (13%) were due to congenital malformations of the coronary arteries. In 3 individuals (2%), a "normal" heart was found on autopsy with no other apparent cause of death. In the same study, Maron et al.[24] noted that PPEs were performed before competition in 115 of the 158 cases reviewed. Of these 115, only 4 (3%) were suspected of having cardiovascular disease and the cardiovascular abnormality responsible for sudden death was correctly identified in only 1 athlete (0.9%).

Given this information, it has been argued that the PPE may not be an adequate tool in assessing risk for sudden death in young athletes. Many articles have been written about using other noninvasive means for screening this population such as the use of echocardiograms, electrocardiograms, and stress tests to identify those at risk. This testing is cost prohibitive and the yield is too low to have a dramatic impact on the overall screening process and therefore is still not required as part of the PPE.[23, 25-28] However, there remains a critical need for effective, low-cost screening methods. The American Heart Association's[29] history module that consists of five questions has been adopted by some states for use on the PPE and may be a reasonable alternative.

Assessing general health of the athlete

The PPE should be considered as part of an overall health care plan for the secondary school–age athlete and should not be a substitute for the student-athlete's routine medical care. It can be incorporated into a regular examination with the student-athlete's primary care physician and should not replace regular scheduled visits and/or checkups. Unfortunately, approximately 80% to 90% of adolescents report that the PPE substitutes for a routine examination.[30]

It is important to recognize that the PPE may be the only contact that some student-athletes have with a physician on a regular basis and that attention should be given to issues of routine health maintenance. A standardized form, like that printed in the PPE Monograph,[16, 17] helps address some of these issues and can aid in further screening of potential problems and/or deficiencies.

Assessing fitness level for specific sports

The fitness assessment should include body composition, flexibility, strength, and endurance.[16] Not all of these components can be routinely assessed as part of the PPE, but a review of some of these components and a discussion of the sports in which they want to participate can help establish a baseline for training. For example, an obese male who wants to participate in his high school football program should be counseled on the effects his weight may have on his play. The excess weight may also make him more prone to heat injuries and this should be discussed, by a member of the AHCT, with the athlete, his parents/guardians, and the coaching staff. The athlete should be

encouraged to participate because the physical activity is important, but it should also be recommended that he be counseled on proper nutrition, weight training, and aerobic conditioning prior to and during the season to help improve his performance and to avoid injury and illness.

Counseling athletes on health-related topics
The PPE affords an opportunity for the physician to counsel athletes on potentially risky behaviors such as drug, alcohol, and supplement use and nutritional concerns. As previously noted, the PPE may be the only contact a student has with a health care provider during the school year and this opportunity should not be lost.

The use of a standardized PPE form that includes questions about drug, alcohol, and supplement use and concerns about weight can provide a useful screening tool for the physician and coaching staff; any “yes” response should prompt discussions with the athlete at the time of the PPE. Further recommendations for counseling and/or follow-up with the athlete's primary care provider can be made on an individual basis. In female athletes, a review of menstrual history is paramount because many young female athletes have menstrual irregularities that may be related to their training.

Screening for amenorrhea, alterations in body image, and eating disorders can be accomplished by review of the medical history and discussion with the student-athlete at the time of the PPE.

Implement rehabilitation programs
If a chronic condition is uncovered during the PPE or if the athlete has not completely recovered from a prior injury, the examiner should address the potential for reinjury or the risk for other injuries. The medical team should perform a thorough evaluation. Any problems noted during this evaluation should be addressed, treated, or referred to an appropriate medical professional to prevent further injury

McCoy et al.[31] noted that primary care physicians now carry a major responsibility to become familiar with general rehabilitation principles for all types of sports-related injuries and that the reinforcement of a sophisticated plan of applying ice and elevation as treatment for acute injury and range of motion (ROM) exercises followed by strengthening exercises and functional evaluation is critical in the return-to-play decision process. It is no longer acceptable to keep an athlete away from the sport for an indefinite period of time. Short- and long-term goals of treatment need to be established and monitored. In schools or organizations with access to ATCs, this process can usually be accomplished more quickly and efficiently. If ATCs are not available, the responsibility rests with the primary care physician, team physician, school nurse, coaching staff, parents/guardians, and the athlete to ensure proper referrals to appropriate resources for an efficient and safe return to play.

Meeting legal needs
In 1988, Feinstein et al,[32] found that 35 states require yearly physical examinations, 3 states require a physical examination every 3 years, 1 state required only 1 physical examination, and 6 states did not specify their requirements. Many local school districts and organizations have their own policies in place with regard to the medical eligibility of

secondary school–age athletes, with the PPE, generally the cornerstone of this requirement.

Strategies for implementation

Implement an optimal time frame for the PPE

While no time frame exists for performing the PPE, it has been suggested that the PPE be performed in advance of the sports season to allow optimum time to address any issues that may arise during the examination – 4 to 6 weeks before the start of a season seems to be most appropriate. In scholastic sports played in the fall season, the PPE should be performed before the end of the preceding school year so that any chronic injuries can be addressed and a treatment plan can be laid out for the student-athlete for the summer months.

Many schools and states require yearly evaluations as a prerequisite to participation. The American Heart Association[18] recommends that both a history and physical examination be performed before participation in organized high school sports, with repeat screening every 2 years. An interim history should be performed in intervening years or sooner if there have been any changes in the student-athlete's health.

The AMA Group on Science and Technology endorses the work of Risser et al.[33] and McKeag,[34] who recommend that a PPE be performed at the beginning of any new level of competition with an intercurrent review before the start of each new season.[35] Regardless of the time frames adapted, it is important to realize the importance of routine screening for injury and illness recognition and prevention.

Methods of performing the PPE

The PPE can be performed in three different ways: (1) by the athlete's private physician in the office setting; (2) by multiple examiners as part of a station examination; or (3) by a physician as part of a mass "assembly-line" examination.[16, 19, 32]

Examination by the athlete's *private physician* would be the most ideal situation because this offers the most continuity of care with the most comprehensive medical history. The physician is likely to have an established relationship with the athlete, and the components of the PPE can be incorporated into a comprehensive health evaluation. Unfortunately, not all physicians are familiar with sports medicine issues, and they may be limited in their ability to detect musculoskeletal abnormalities. Also, many student-athletes do not have a physician whom they see on a regular basis.[13] Communication issues may arise because the private physician is not usually the school or team physician. Confusion regarding abnormalities, treatment plans and clearance can ensue if concerns are not directly forwarded to the ATC, coaching staff, and/or athletic director by the private physician. Comments from the primary physician should be forwarded to on-site personnel through the AHCT to alleviate any possible problems.

The *station* method, in which components of the PPE are broken down and delegated to adequately trained support staff, has been more widely accepted as the best model for efficiently performing large numbers of examinations.[16, 18, 19, 33]

These stations are often staffed by personnel who are educated in sports medicine and can provide better evaluation of potential problems. The final station is manned by the supervising school or team physician, who reviews each athlete's history and physical examination and makes final recommendations with regard to clearance. This method is very helpful in providing adequate communication with the other members of the AHCT and the coaching staff, as most will be actively involved in the PPE process. A potential drawback to the multistation PPE is lack of sufficient qualified medical personnel to man the stations. In addition, any abnormal findings identified through use of this method should be reported back to the athlete's family physician for follow-up care.

The "*assembly line*" method or traditional "*locker room*" examination, in which one physician examines a large number of athletes with little or no support staff, is very inefficient and not recommended.[18]

Identify and use a standard form for all PPEs
The history portion of the PPE is vital in obtaining accurate and up-to-date information regarding the student-athlete's past medical problems, injuries, and current medications. Rifat et al.[35] reviewed 2,574 PPEs and showed that the history accounted for 88% of the abnormal findings and 57% of the reasons cited for restriction from a particular sport. Many sources advocate the development of a standardized form to help ensure uniformity; these forms can be given to the student-athlete before the PPE for completion of the history section with their parents/guardians. The **history** section should include questions that assess for the following[13, 16, 17, 19]:

1. *Past injuries causing the athlete to miss a game or practice.* Specific questions should be posed regarding a prior history of fractures, operations, or use of casts or braces.

2. *A loss of consciousness or memory after a head injury.* Repeated concussions may be criteria for exclusion from contact sports and/or prompt or warrant a comprehensive assessment.

3. *Previous exclusion from sports for any reason*

4. *Syncope, near syncope, chest pains, or palpitations during exercise.* Specific questions regarding passing out, nearly passing out, chest pains, or irregular heartbeats during exercise must be asked because these may be the only clue to an underlying cardiac condition.

5. *Past medical history.* This includes conditions currently being treated, history of asthma or exercise-induced bronchospasm, history of one paired organ, and history of sickle cell disease or trait.

6. *Prior surgical procedures and complications*

7. *Current medications and dosage*

8. *Allergies to medication, stinging insects, foods, and other environmental triggers*

9. *Immunization records, including tetanus*

10. *Family history of sudden death*

11. *Menstrual history with age of menarche and frequency of menses for all female athletes*

12. *History of significant weight gain or loss and the athlete's perception of his or her current body weight*

13. *History of over-the-counter supplement use*

The **physical examination** portion of the PPE form should include the following[13, 16, 17, 19].

1. *Vital signs, including height, weight, blood pressure, and resting and postexercise pulse*

2. *Vision screening with the use of a traditional Snellen chart.* If corrected acuity in either eye is 20/40 or greater, the athlete should be referred to a specialist for follow-up.

3. *Tanner staging*

4. *Assessment of the head, eyes, ears, nose, mouth, and throat for any abnormalities*

5. *Cardiovascular and lung examination*

6. *Abdominal examination with evaluation for hernia in males.* Pelvic examinations in females should be referred to appropriate specialists if the history warrants concerns because these are usually not required as part of the PPE.

7. *Muscle strength testing and brief neurological assessment*

8. *Examination of the skin for any rashes, chronic skin condition, or abnormal moles*

9. *Musculoskeletal evaluation.* This should include ROM testing in the upper and lower extremities; assessment of laxity or instability in the shoulders, elbows, wrists, hips, knees, and ankles; and assessment of the spine for scoliosis and/or abnormalities of the thorax, such as pectus excavatum.

10. *Section to list abnormalities and recommendations for clearance and, if necessary, treatment plans*

11. *Determine Body Mass Index (BMI)*

Preprinted forms that encompass all of the above points can be found in several sources, including the NFHS *Sports Medicine Handbook*[16] and the PPE Monograph.[17]

These forms can be copied and adapted to the needs of the school district or organization.

Communication system

A good communication system should be in place between the medical staff, athlete, parents/guardians, coaches, and athletic director. It is recommended in HIPAA that this communication begin with a formal letter to parents/guardians advising them of the purpose and nature of the PPE. Consent forms and a copy of the PPE history can be mailed separately or along with the introductory letter with instructions for completion before the PPE. A cover letter should also accompany the PPE to the family physician as a mechanism to avoid any communication problems that could arise. This cover letter should specifically ask for any physician comments on any specific concerns that might affect athletic performance as well as suggested rehabilitation or treatment options for current problems. Once the data have been collected, it must be kept on file for reference purposes; this should be the responsibility of the school nurse or ATC. If the athlete is participating in a non–school-sponsored program, the sponsoring organization should keep these records up to date. Any abnormalities need to be communicated to the student-athlete, his/her parents/guardians, the ATC, and the athletic department. If the student opts to have the PPE performed by his or her primary care physician, the use of the standardized PPE form is imperative to maintain uniformity and to ensure that all components of the examination have been addressed. New regulations instituted by HIPAA may require other specifications with regard to the privacy of these records; this should be part of the organization's overall compliance plan. School-based groups should adhere to FERPA regulations.

PROMOTING SAFE AND APPROPRIATE PRACTICE, COMPETITION, AND TREATMENT FACILITIES

Secondary school–age athletes have a right to play in facilities that are safe and without the potential for unnecessary harm. When injuries do occur, these participants also have a right to be treated in a clean and appropriate environment that is dedicated to this purpose. While the benefits young athletes gain from sports participation are immeasurable, the impact of accidental injuries and deaths to this age group cannot be ignored. Although very few youth sports injuries are fatal, or even catastrophic, their frequency and financial impact warrant our attention. The U.S. Consumer Products Safety Commission has estimated that up to 22% of girls and 39% of boys in organized sports are injured per season.[36] According to the National Youth Sports Safety Council,[37] sports-related injuries to youths up to 14 years of age cost society more than $49 billion in 1997.

These statistics, coupled with a desire to make sports participation a positive experience for children, underscore the need to prevent injuries whenever possible. Making sports facilities safe for young athletes is of paramount importance.

Providing safe facilities is an integral component of effective sports management and is governed by ethical, legal, and other administrative considerations. Safe facilities provide the opportunities for safe participation and a positive experience for the young athlete. The right to participate in safe and healthy environments is contained in *The Bill of Rights for Young Athletes*.[38] Well-maintained facilities ensure that safety is a priority, and that priority is then carried to the public.

A review of case law shows that sponsoring organizations that do not provide a safe environment expose themselves to unnecessary legal action and the athletes they are supposed to help to undue preventable injury. Facilities that are not maintained routinely also provide opportunity for undue accidental injury.

Countless lawsuits have been filed, and frequently won, by parties who have sustained injuries due to improper inspection and maintenance of facilities,[39-41] hazards in and around facilities,[42-45] unsafe grounds and external walkways,[46-48] and improper facility signage.[49-51] Such litigation depletes the financial resources of sponsoring institutions and reflects a negative image to the public about the specific institution and about sports in general.

Federal, state, local, and professional guidelines regulate certain aspects of most sports facilities. Parties who administer youth sports programs can avoid potential professional censure or criminal proceedings through diligent compliance with regulations pertaining to health and safety.

Components of recommendation

Athletic facilities can vary greatly in size and complexity. Regardless of the size and purpose of a facility or the resources of its caretakers, entities that sponsor sports opportunities for secondary school–age athletes should ensure that all facilities are

safe. The AHCT can play a vital role in sports facility safety issues, specifically maintenance and sanitation, use, and supervision.

Maintenance and Sanitation

A regular maintenance program should be developed for all said facilities and capital equipment. Organizations sponsoring athletic events for the secondary school–age athletes, as well as members of the AHCT, should be aware of maintenance issues in and around the athletic facility. In addition, it is imperative for AHCT members to incorporate proper sanitary procedures when treating the secondary school–age athlete and to provide guidance and recommendations for coaches to comply with proper sanitary, maintenance, and repair procedures.

Maintenance schedules should follow industry or regulatory standards. Individuals who will perform specific maintenance tasks must be familiar with the prerequisite techniques (e.g., pool sanitation, field maintenance) and ensure that these techniques are used. With indoor facilities, appropriate circulation, temperature, and humidity must be maintained. Other health and safety considerations pertaining to sports facilities may include electrical, lighting, signage, and slip control areas of floors.

Locker rooms, bathrooms, and shower areas can present special problems in maintaining a safe environment for young athletes. According to Seidler,[52] "Concrete floors and walls, steel lockers with sharp corners, and standing water, all make locker rooms perhaps the single most dangerous facility in sports and recreation." Because of the potential for injury and infection that these areas pose, they should be checked frequently for hazards, sanitized regularly, and supervised closely to prevent horseplay.

When dealing with outdoor facilities, the sponsoring organization should be concerned with the ground and surface conditions, spacing around fields, and vehicular traffic around the facility. Hazards in any of these areas could pose a risk to participating secondary school–age athletes. Ground hazards requiring immediate attention include holes and depressions in fields, excess moisture, erosion, rocks, broken glass, and playing surfaces or access ways that are abnormally uneven. Prior to athletic competitions, the grounds and/or playing fields should be inspected by the coach or an on-site member of the AHCT as a means of injury prevention. Structures that encroach upon playing areas should be moved. If this is not feasible, then the activity should be repositioned or modified to eliminate potential player impact with the structure. Other hazards include low hanging power lines over playing areas and exposing young athletes to vehicular traffic, either as they play or as they enter and leave the facility.

When a facility hazard is discovered, it is appropriate to either avoid using the facility or modify the sports activity to avoid exposing the young athletes to the hazard. If the problem cannot be corrected on the spot, written reports and requests for repairs should be submitted at the earliest opportunity.

Treatment facilities where athletes would be provided injury treatment and rehabilitation should be maintained in a manner consistent with medical facilities.

Use and Supervision

Before activity begins, venue-specific Emergency Action Plans (EAPs) must be formulated, reviewed, and posted within the facility (Section 5 of this document addresses EAPs in detail). Adult sponsors must ensure that first aid/emergency equipment is readily available, that some form of communication is available to contact EMS personnel, and that the facilities are accessible to EMS vehicles. This designation should be clearly marked so all know where help can be obtained. In addition, an area of the facility should be dedicated to sports medicine, with an AHCT member available to provide appropriate treatment and care for injuries sustained through the course of participation in sport.

To minimize injury potential, the activities of young athletes must be supervised. Athletes must also be instructed to use facilities safely. This is particularly true in higher-risk venues, such as aquatic facilities. The use of appropriate signage can help instruct the secondary school–age athlete on safe facility use, but should be used in conjunction with appropriate adult supervision. Some signage, such as those marking emergency exit routes, may be required and/or regulated by local fire codes. Signage should comply with the American National Standards Institute (ANSI) and other professional standards for readability, color, and size. Although specific needs will be unique to a particular facility, safety-oriented signage within sports facilities can include general regulations for facility use, instructions for use of specific equipment (e.g., weight equipment, whirlpools, saunas), the EAP, the location of emergency/first aid equipment, the location of automated external defibrillators (AEDs) if available, warning signs identifying known or potential hazards, and markers to delineate play/activity areas, as well as those used to designate buffer areas around equipment.

Facilities specifically designated for injury treatment and rehabilitation should be used in a manner that promotes a safe environment for all participants and allow direct supervision of all athletes and equipment at all times by a qualified member of the AHCT.

Construction and Design

The opportunities to be involved in the design and construction of sports facilities are limited, but there is little doubt that a well-designed facility can make the job of injury prevention easier. In addressing the significance of design and construction on sports facility safety, it has been noted that poorly planned, designed, or constructed sports and recreation facilities often lead to an increase in the exposure to hazardous conditions for the participants.[52] In addition, these hazardous conditions may make facility maintenance and daily operation more difficult and can increase liability.

Problems commonly encountered in the design and construction of sports facilities include the use of improper building materials, poor access control and security, poorly planned pedestrian traffic flow through activity areas, a lack of proper storage space, inadequate lighting, and inadequate safety zones around courts and fields. It should be noted that once construction on a sports facility has been completed, these problems can be difficult to correct.

Strategies for implementation
The best implementation strategy begins during the design and construction of new athletic facilities to ensure that all of the safety features listed above are present. However, because most secondary school–age athletes practice and compete in existing facilities, individuals and organizations involved with these athletes should implement strategies to establish procedures, inspect facilities, and record and repair potential hazards.

All parties involved with youth sports activities should regularly and thoroughly inspect their facilities: coaches, administrators, grounds/facilities staff, and members of the AHCT. Some areas, such as fixed building structures, will require less frequent inspections, whereas other areas, such as fields and floors, must be constantly inspected. Young athletes should be encourage to be a part of this "injury prevention team" by immediately reporting any unsafe conditions to their adult sponsor.

The methods to be used for evaluating the safety of facilities and locations to be inspected should be established and recorded (Table 2). In general, sports safety inspections should include all structures and surfaces used by the athletes. A form or other instrument onto which findings are recorded can be helpful. The individual performing the inspections should sign the tool. As Hossler[53] points out, "It is better to prepare than to repair." This statement underscores the importance of aggressive injury prevention in youth sports. Many strategies for providing safer sports facilities have been previously mentioned in this document. The success of any sports facility safety program depends on the cooperation of many individuals, from players to parents to coaches to administrators. Therefore, it is of paramount importance to involve these persons as the program is planned and then implemented.

In addition, Clover[54] suggests professional staff use the mental cue "S.A.F.E." to ensure safety in the performance of their duties and responsibilities: **Supervision** from the locker room to the practice field. **Aid** the athletes when needed. This includes creating and practicing the EAP; keeping proper records of physical examinations, injuries, treatments, insurance, parental releases, and equipment; ensuring first aid kits are available and well stocked; and checking to ensure that water and injury ice are available for the athletes. **Facilities** must be checked daily for possible hazards. If there is a hazard, the area must be clearly marked or precluded from use. A written work order must be filled out and a time frame for completion of work must be established in writing on the work order. A copy of the work order should be kept on file. **Equipment** in facilities should be checked daily. From the pitching machine to the modalities used in the athletic training room, all equipment should be well maintained. This ensures the equipment lasts longer and stays in proper working condition.

ADVISING ON THE SELECTION, FIT, FUNCTION, AND MAINTENANCE OF ATHLETIC EQUIPMENT

Participation without proper equipment, or with equipment that is inappropriate or improperly fitted, subjects the participant to an increased risk of injury, illness, and even death. A great number of secondary school–age children want to participate in sports, and most parents allow and encourage their participation. Equipment essential to some sports (helmets, shoulder pads for football, sticks for field hockey) may be supplied by the sponsoring organization or the individual participant. If a sponsoring organization requires the participant to provide such equipment, it is incumbent upon the sponsoring entity to ensure that all equipment worn and used is appropriate and properly fitted. In addition, equipment specific to the purpose of caring for injuries and illnesses of athletes on-site will be addressed. Proper supervision is also essential when using equipment, including frequent inspections to ensure proper fit and function. Safe, effective, and appropriate equipment should be maintained and provided to the participant. Sponsoring organizations that require the participant to provide their own equipment must ensure that personal equipment complies with requirements outlined by a sports regulatory agency.

Entities that provide guidelines for approval of athletic equipment are the National Operating Committee on Standards in Athletic Equipment (NOCSAE) and the American Society for Testing and Materials (ASTM). Equipment that has not been approved by certifying bodies – that is, inappropriate equipment or appropriate equipment that is improperly fitted or in poor repair or not maintained on a regular schedule – could introduce the athlete to injury that is needless and preventable.

Equipment that is properly fitted and appropriate for the sport or activity is essential for the secondary school–age athlete to be able to enjoy athletic participation in a safe and orderly environment. ATCs and educated coaches of the particular sport are the persons most likely to have the education and qualifications to select, fit, maintain, inspect, and supervise athletic equipment use. An on-site member of the AHCT may be recommended as responsible to perform this activity and a member of the AHCT can be responsible to oversee this in the absence of an on-site AHCT member. A review of case law shows that equipment that is not well maintained or improperly fitted can contribute to, if not cause, injury to participants. In addition, the use of equipment that has not been approved by the appropriate certifying body exposes the athlete to injury as well as liability and negligence to the sponsoring entity.[4-6, 55-65]

<u>Fitting Protective Equipment</u>

Ensuring that all athletes have properly fitting equipment is important to maintaining a safe athletic environment. Sponsoring agencies should ensure that qualified personnel (coach, ATC, equipment manager) fit equipment and that the participant has appropriate equipment for participation. Schutt Inc., a helmet manufacturer, as well as other manufacturers, provide detailed instructions on the fitting of their equipment.[66-68] Use of these instructions should be followed when fitting participants or the sponsoring agency could be found liable. In the case of *Gerritty v. Beatty,*[63] the school was found liable when an athlete reported poorly fitting equipment and the school had done nothing about it.

Maintenance and Reconditioning

Once equipment is properly fit to the athlete, sponsoring agencies and members of the AHCT must make sure the equipment is properly maintained and reconditioned. All athletic equipment should be examined periodically during the season and the fit maintained throughout the season (i.e., if an athlete shaves his head, the helmet should be refit).[69] In addition, school and team officials should closely inspect any equipment used by or around participants and know the risks involved in the use of such equipment. Case law has judged in favor of the plaintiffs in cases where a latent defect in a pitching machine caused injury to the face of an athlete while the machine was unplugged[58] and where a vaulting horse was altered and the holes for the pommels were exposed.[65]

Many manufacturers now recommend that equipment be reconditioned on a regular basis, checking for flaws and defects in the product. Most manufacturers state that they will not stand behind the product if the proper reconditioning and checks have not been made.[70] In the case of *Gerritty v. Beatty*,[63] the school district was found negligent for refusing to furnish well-maintained equipment. Therefore, school districts should ensure that qualified personnel purchase, fit, and maintain appropriate athletic equipment and recondition existing equipment according to manufacturer recommendations. In addition, the sponsoring organization should be cautioned not to accept used equipment passed down from higher level organizations unless the equipment has been properly maintained and reconditioned.

Supervision During Use of Equipment

Finally, all participants in physical education, sports, and recreational teams and events have the right to be supervised by qualified and competent coaches and provided with competent health care.[71] *Competent* may be defined as being proficient in the skills required by the job description and training. Sponsoring entities and governing bodies should ensure that competent, trained individuals always supervise participants. State or local regulations may influence the parameters of what is required for appropriate supervision. Training should focus on the sport(s) to be supervised, as well as proper fit and use of equipment. In addition, the sponsoring entity or school should provide adequate and appropriate health care as described throughout this monograph.[71, 72]

Lack of appropriate supervision when using equipment in sport can also expose the athlete to undue risk. Two cases, *Grant v. Lake Oswego School District Number 7*[59] and *Tiemann v. Independent School District #740,*[65] provide emphasis that not only should participants be supervised while using equipment but also that the supervisors or coaches should be trained in how to adequately supervise individuals. In both cases, equipment was used that either was set up incorrectly or dangerously (*Grant*) or was faulty (*Tiemann*).

Components of recommendation

The sponsoring organization should identify personnel to educate in the necessary procedures to appropriately select, fit, and maintain all equipment specific to individual sports; protective equipment consistent with specific sports; and protective equipment general to all sports. The person who issues equipment should be trained in the proper fit, function, and use of athletic equipment specific to his/her sport. Members of the

AHCT should be educated on the proper selection, fit, and maintenance of athletic equipment and take an active role in reviewing quality and selection of safety equipment provided by a sponsoring organization. Equipment should be chosen based on the appropriateness to the sport, level of competition, age of participants, and overall quality. Maintenance of such equipment should be subject to a predetermined schedule and follow all of the manufacturer's recommendations and rules of the governing sporting association.

Rule changes should be investigated by governing bodies of contact and collision sports and of small ball sports to protect the face and eye from injury. Rules should include requiring the use of eye protection in practice and games.[73, 74] Investigation by a governing body provides the basis for rules changes to be implemented by that governing body. These changes should be based on scientific data. Governing bodies should use such scientific data to amend rules to best protect the participant.
Many times, professional athletes do not wear a complete set of *pads*, making it enticing for younger athletes to emulate the actions of the professionals. Secondary school leagues and officials should be encouraged to enforce the rules designed to protect these players.

Strategies for implementation
Coaches, parents, athletes, and members of the AHCT should be aware of the limitations of each piece of equipment and be able to instruct the athlete in its proper use, as well as potential hazards with its misuse. Sponsoring entities should mandate general training as well as sport-specific training for all coaches and individuals dealing with participants, including but not limited to equipment fit, function, and maintenance.[71, 72] In addition, sponsoring organizations should require appropriately trained personnel to maintain adequate supervision (i.e., within a close proximity as to prevent an inappropriate or dangerous action) of participants at all times.

With respect to equipment, braces should be used to treat or prophylactically prevent injury as directed by, or under the supervision of, a physician.[75] A qualified member of the AHCT should be the designated person to determine and fit appropriate braces, tape, or safety equipment. *Shoulder harnesses; braces* for the wrist, elbow, ankle, and knee; and custom-made braces should all conform to the rules of the sport and be used under the direction of a physician or other health care provider.[75] No equipment should be modified from manufacturers' standards. Equipment should be used only for the intent it was manufactured.

Mouthguard use is recommended for all sports with a risk for mouth and dental injuries. The use of a *mouthguard* is required by some organizations in football, lacrosse, ice hockey, and boxing for both practices and games.[76-78] Organizations that sponsor sports in which mouthguards are required should provide education to the participants and parents on the appropriate fit and care of mouthguards.[79]

Helmets for all sports should always comply with the appropriate standards. They should be periodically inspected and reconditioned in accordance to the manufacturers' recommendations. Helmets should be used only as directed and should never be used as a weapon or be the point of attack.[16, 69, 80, 81]

Facial protection or *facemasks* should be worn in sports where such rules apply or the possibility for injury to the face is high, such as football, ice hockey, men's lacrosse, baseball, and softball. In baseball and softball, it is recommended that children between 5 and 14 years of age wear a batting helmet with a polycarbonate face shield.[82-84]

Eyewear is recommended as a wise precaution in limited-contact sports[85] such as racquetball and high school girls' lacrosse.[74] Extra eye protection should be required for any athlete with corrected vision poorer than 20/40 in either eye or with a history of eye injury or surgery.[69, 74]

Footwear that fit and is appropriate for the sport and playing surface should be used. The footwear should be replaced when worn out.[69]

Athletic mats, such as those used in wrestling, should be cleaned at least once daily and on a regular schedule with a tuberculocidal cleaner. Further study is recommended to determine the effectiveness of mat-cleaning programs to prevent the spread of skin disorders in wrestling.[86]

Maintenance and reconditioning are essential in providing appropriate safe equipment. A member of the AHCT should document that a designated employee of the sponsoring organization has been trained in the proper fit and care of athletic equipment in the absence of an on-site AHCT member. Sponsoring entities should schedule regular maintenance before equipment is issued to or used by participants. Inspections should be performed on a regular basis throughout the course of the season. In addition, season-end equipment inspections are also recommended to ensure that equipment is repaired or replaced before the start of the next season.

In some sports, forms stating "assumption of risk" for equipment fitting and appropriate use should be used to ensure that there is proper documentation that the participants, and their parents, understand these concepts. If rule changes are to be used to implement improved equipment to protect the participant, care must be used to address public education, the cost of implementation, liability, manpower to implement the rule changes, and the timing of the program. [87]

Additional research has been identified in a number of recommendations. This research is vital in determining how best to protect the participant in any sports program. Every effort or consideration should be made to fund research when it is proposed.

DEVELOPING AND IMPLEMENTING AN EMERGENCY ACTION PLAN

Sports-related injuries and illnesses are common in athletics involving secondary school–age athletes. Members of the AHCT, along with coaches and administrators, need to be prepared for possible emergency situations through the development and implementation of a comprehensive Emergency Action Plan (EAP).

An understood principle within athletics is the possibility that a serious or life-threatening injury and/or illness may occur. There are both intrinsic and extrinsic risks involved with participation in athletics, and it is essential for the sponsoring organization to have a well-developed EAP for such instances to ensure that the appropriate care can be provided in a timely manner. In addition, the EAP should include planning for events that are not athletic related such as natural disasters and crowd control problems that may occur when large groups of people are gathered for athletic events.

In 2002, NATA issued a position statement regarding the need for established emergency plans in all athletic venues and suggested guidelines for developing and implementing the plans.[88] The need for an EAP has been well documented in literature and injury/illness statistics[15, 88-94] and supported in case law.[95] In *Kleinknecht v. Gettysburg College* in 1993,[96] it was decided that an institution owes a duty to each athlete to provide an emergency plan that is adequate for the risks involved in sport participation. This extends beyond the collegiate level and interscholastic athletic events, as seen in *Barth by Barth v. Board of Education* in 1986,[97] which showed the need for obtaining prompt medical treatment for students injured in physical education activities. In the case of *Jarreau v. Orleans Parish School Board* in 1992,[98] a school board was found to be vicariously liable for the failure to promptly seek medical attention for an injured athlete. The implementation of an EAP addresses these needs and provides the most efficient opportunity for treatment for injury and/or illness.

Components of recommendation

The AHCT is an important component of establishing a good EAP. The medical personnel who make up the AHCT often have experience in various areas of emergency athletic care and can contribute to the plan to ensure it is comprehensive and appropriate for school-age athletic events. The development of an EAP requires the input of all members of the AHCT in addition to the administrators of the sponsoring organization, coaches, and facility managers, along with parents and official groups. This allows for the writing of a comprehensive EAP that fully covers all aspects of emergency situations and environmental conditions and involves the expertise and cooperation of all team members. Examples of individuals to participate in EAP development include the members of the AHCT, coaches, administrators, venue managers, officials, and organizations.

If the event will take place in areas such as city parks, recreation departments, or golf courses, then the governing bodies of these organizations should also be involved or consulted in the development of the EAP. This multiorganization committee would be responsible for developing protocols to manage emergency situations, including establishing the chain of command for emergencies, the specific responsibilities for each team member, emergency situations specific to each sport, emergency situations

specific to a particular venue, the necessary emergency equipment and use of said equipment and the training of athletes to help the coach in an isolated situation.

Once the EAP has been developed and implemented, it is essential that all personnel be fully trained in the steps of emergency management, that these training procedures are documented and that there is communication with EMS personnel before the event to ensure cooperation and quicker response to emergency situations. Game and event personnel should also be trained in the necessary skills for emergencies, such as first aid, CPR and AED use, and the prevention of disease transmission.

Minimum athletic emergency equipment should include vacuum splints (or suitable alternative), a long spine board (or scoop stretcher), hard neck (Philadelphia) collars, facemask removal equipment, resuscitation masks, shoulder immobilizers, blankets, crutches, blood pressure cuff, gloves for universal precautions, and a first aid kit. [99]
It is also advisable to have access to an AED during practice and/or competition. This emergency equipment must be readily accessible during all practices and games to all staff responsible for first aid or medical care of the injured athlete.[72]

Steps should also be in place for the documentation of all injury and/or illness situations that occur during the event. A review of the established procedures and all incidences of emergency situations should occur at the conclusion of each event, and a comprehensive review of the entire EAP should occur on an annual basis.

Strategies for implementation
One of the most important immediate steps is to identify the appropriate personnel to write the EAP. The AHCT should be led by a medical director, preferably the team physician, and include the other members of the team. The members of this team must take into consideration all possible emergency situations that might arise during practice and/or competition. Categories of incidences to consider would be life-threatening injuries, life-threatening illness, and environmental threats. There should be specific thought given to the types of possible incidents based on the type of activity as well as the specific venue in which it is being held. It is also imperative to ensure that emergency medications, such as an individual athlete's asthma inhaler, EpiPen, Glucagon, or insulin, are available and that the correct protocols for use are followed. Although it is not anticipated that all contingencies will be thought of, a well-developed plan can cover most emergencies and leave a protocol in place to address other issues that arise. The development team should carefully document the emergency treatments and procedures for incidences based on the input and advice of physicians, ATCs, EMS personnel, and other qualified AHCT members. Careful consideration should be given to establishing and documenting specific responsibilities for each member of the AHCT before and during the event.

Written documentation should also include the types and locations of emergency equipment present, methods of communication (e.g., walkie-talkie, cellphone, land line telephone), venue-specific maps, and the location of the hospital or other health care facility for transportation and a list of emergency telephone numbers.

Once the EAP has been written, it is essential to review, practice, and revise the EAP

so that all duties and responsibilities are clearly outlined and understood. Placing the responsible individuals in mock scenarios is an effective way of testing the EAP for validity. Documentation of all emergency situations during an event is key for liability issues and for revision of the existing EAP. At a minimum, the EAP should be reviewed and practiced on an annual basis and subsequent retraining should take place to refamiliarize the necessary personnel with their duties and responsibilities.

There are several existing documents from supporting organizations that can assist in the development and implementation of an EAP for various venues and athletic settings, including those published by the NATA [88], NFHS[16], NCAA[94, 100], American Academy of Pediatrics [15, 91, 92, 94, 100], AOSSM[101], and The Inter-Association Task Force for Appropriate Care of the Spine-Injured Athlete.[102]

ESTABLISHING PROTOCOLS REGARDING ENVIRONMENTAL CONDITIONS

Secondary school–age individuals participating in athletics are subject to injury due to adverse environmental conditions. Each organization that sponsors an athletics program should establish protocols related to adverse environmental conditions specific to their region. The organizations should identify individuals responsible for ensuring the implementation of the protocols.

Adverse environmental conditions pose varying challenges to athletic events based on geographic regions and the influencing factors specific to those regions. The sponsoring organization's AHCT should be responsible for the development and implementation of policies regarding adverse environmental conditions. Threats can include heat stress, cold stress, lightning, severe weather, air quality, insects, rodents, reptiles, fire, and possible allergic reaction–inducing conditions. Other factors as indicated by geography and climate should be taken into consideration.

It is an understood principle that adverse environmental conditions can pose potential threats to the safety and welfare of athletic participants. Therefore, it is essential that institutions and organizations associated with athletic events have policies and protocols in place to regulate athletic participation.[101] These protocols should be specific to each athletic venue and should take individual geographic effects into consideration. Some environmental conditions can pose greater threats to athletes in particular regions of the country.

There are several environmental considerations and threats that can be included in an individual protocol depending on the venue and geographic region, as given earlier. Several established policies regarding heat stress,[103-107] cold stress,[107, 108] and lightning[109, 110] can be used as models for development. Other environmental condition protocols should be established with the members of the AHCT to ensure that all contingencies have been discussed in detail.

Heat Stress

Exercising in hot temperatures has been shown to have a variety of physiological effects on the human body and can compromise the health of the athlete if not closely monitored.[111, 112] *Heat acclimatization* is a process through which athletes improve from a physiological standpoint when exposed to exercise in the heat through careful monitoring.[113] Athletes often become acclimatized and adjust to the demands placed on the body by exercise in heat. Throughout this acclimatization period, they should be closely monitored by qualified personnel, most preferably an on-site member of the AHCT.[114] The responsibility of the members of the AHCT should be to allow athletes to acclimatize to heat conditions within certain limits.

There are several position statements and supporting documents that outline safe methods of participation in heat stress conditions and when practice and competition should be suspended.[103, 105, 106, 115] In 2000, the NATA position statement on fluid replacement for athletes outlined the practices that would encourage the optimum fluid replacement for athletes, decreasing the chances for occurrence of heat stress syndromes.[115] In 2002, the NATA position statement on exertional heat illness

established recommendations for preventing, recognizing, and treating illnesses that occur from athletic participation. This position statement,[103] as well as the Inter-Association Task Force on Exertional Heat Illnesses Consensus Statement,[105] contains many details concerning the methods of preventing heat stress syndromes as well as the necessary accommodations that should be made for practices and competitions under given conditions.[103] The NFHS also addresses heat illnesses in detail in their *Sports Medicine Handbook*.[16] The handbook describes the signs and symptoms of heat stress syndromes, as well as treatments and prevention techniques, and provides information on when practices and competitions should be limited based on the ratio of heat to relative humidity.[16] Other organizations that have issued policy statements, position stands, and/or guidelines for heat illnesses include the ACSM,[107] the NCAA,[106] and the AOSSM.[101]

Cold Stress

Cold stress is often an overlooked cause of injury and illness, as heat stress syndromes tend to receive the most attention. However, exposure to cold is obviously more of a concern in certain geographic regions than in others.[116] Extensive research has been done concerning the effects of and possible damage caused by cold on the body during exercise. Exercise and athletic activity in a cold environment can have deleterious effects on performance and human health, which may not be realized by the participant until damage has occurred.[117] Therefore, it is essential to carefully establish a protocol regarding participation in cold environments.

Lightning

Lightning is the second most common environmental cause of death in the United States after floods.[118] It is particularly abundant in early afternoon storms, during which many outside athletic practices and competitions occur.[109] Because there is no absolute protection against the effects of lightning while outside, proper education and a well-established protocol can prevent many deaths and injuries.[119, 120]

The NATA published a position statement on lighting safety for athletics and recreation in 2000 to educate those involved in athletics about the risks involved with participation in a lightning environment and to provide guidelines for safe behaviors during lightning and to advocate appropriate care for lightning strike victims.[109] The NCAA guidelines for lightning safety emphasize many of the same points, including details on an established chain of command and on obtaining weather reports and monitoring of weather systems to provide the most accurate and up-to-date data.[110] The NATA and the NCAA advocate evacuating outside areas as soon as lightning is seen or thunder is heard and seeking shelter in safe buildings. This is the protocol encouraged by the NFHS.[16] The key to lightning injury prevention is to carefully monitor the weather conditions and to allow those individuals in the chain of command to perform their duties in protecting the athletes and participants.

The established environmental protocols should be carefully documented and distributed to all members of the AHCT, coaches and administrators. Opportunities for rehearsing scenarios and revising policies should also be made. It is imperative to ensure that all involved individuals must be aware of the protocols and understand their role in the event of an environmental emergency. An annual revision (similar to that of

the EAP) should take place to retrain AHCT members and to address any inaccuracies and inadequacies in the plan.

Components of recommendation

Before an athletic event or contest takes place, it is essential for the necessary members of the AHCT to meet to develop policies regarding adverse environmental conditions, including lightning, heat stress, and cold stress. The details of this vary as each individual venue and geographic region have concerns that are inherent to that area. The AHCT will begin to develop methods for assessing the site-specific concerns that have been identified. There is a great deal of information available concerning the various environmental conditions and the appropriate planning for prevention and treatment that can be used in identifying the steps to take in each circumstance.[103, 109, 115] Each AHCT will have to decide what is best for each geographic region based on normal environmental conditions for that area.

Taking into account the given possible adverse environmental concerns, written detailed plans that provide for the safety and welfare of all participants will assist the AHCT and event management personnel with decisions regarding participation. In writing these environmental policies, it is also important to carefully delegate responsibility to the appropriate decision makers. Factors to take into consideration include who is responsible for monitoring conditions, what methods will be used to monitor the environment, the time frame parameters for decision making, detailed alternative plans for participants and spectators, and who communicates plans to all relevant individuals.

Strategies for implementation

There are many members of the AHCT who may be capable of providing input into the development of environmental conditions policies, but it is essential that there is effective communication between the medical director, the ATC, and the administrators of the sponsoring agency. These individuals have the greatest opportunity to effectively design and provide input for the development of these policies. The involvement of all members of the team not only increases the effectiveness of the document but also ensures that all individuals are aware of the policies for safeguarding athletes. It is also essential that communication from the AHCT during contest continues to include the administration and officials.

The use of existing position statements and policies will ease the process of developing individual policies. It is essential that these policies be put into writing so that they may be adequately enforced. Responsibilities for each member of the AHCT should also be put in writing to ensure compliance and to ensure that all members are clear as to what they are to do in given situations. The methods of communication between AHCT members and for the acquisition of necessary environmental information need to be clearly outlined as well (e.g., walkie-talkie, cellphone, CB radio, weather radio).

Heat Stress

Members of the AHCT should be involved with the written guidelines regarding when it is potentially hazardous to participate in athletic events during times of heat and humidity. These guidelines should be implemented by the sponsoring organization and AHCT to determine when it is unsafe for the secondary school–age athlete to participate

in sporting events. Several position statements have been written regarding heat illness, and they recommend that an individual be responsible for evaluating the temperature and humidity. Established local guidelines (limiting personal equipment, increasing fluid replacement breaks, limiting practice intensity and duration, avoiding the heat of the day when possible, etc.) can be followed. Inexpensive sling psychrometers can be used to evaluate wet-bulb and dry-bulb temperatures and humidity, and heat stress.[103, 105, 106, 115]

Cold Stress

Sponsoring agencies and the AHCT also need to create guidelines for determining when it is unsafe to participate in athletics due to the cold and/or wind chill. The implementation of these protocols should fall to a designated individual who determines the outdoor temperature with the wind chill and advises whether it is safe for the secondary school–age athlete to participate without the added risk of frostbite or hypothermia. The NCAA has written a guideline for member institutions that reflects the effects of exposure to cold temperature and wind over a period of time and the increased risk for frostbite. These guidelines also include methods of preventing cold illness, such as appropriate clothing, maintenance of energy/hydration levels, and use of a proper warm-up.[108] The NFHS also addresses cold illness in their *Sports Medicine Handbook* and includes greater details on the effects of temperature and wind on the body as well as recognition and treatment of frostbite, hypothermia, and related syndromes.[16] Both organizations provide a solid foundation that can be used to develop an individual cold stress protocol to protect athletic populations.

Lightning

A written lightning policy, such as that published by the NATA,[109] should be put into place by the sponsoring agency. It should include the name of a person(s) responsible for monitoring the weather, the criteria for suspension and resumption of activity during lightning, and the safe areas to which the participants and spectators should retreat during inclement weather. Often, the criterion used to determine when activities should cease and resume during lightning is the 30-30 rule, which dictates suspension of activities when the flash-to-bang count nears 30 seconds and resumption of activities after a 30-minute wait following the last lightning flash thunder or after lightning has been seen or heard.[121] In addition, there are other methods of detection, including the weather service radio, lightning detection equipment, and lightning detection services.

There should be a designated person responsible for determining the flash-to-bang count at each outside venue, practice, and competition when severe storms are forecast. It is recommended that this designee be someone other than a game official or coach due to the attention they must pay to the game. This count is determined by beginning to count the seconds from the time the lightning is seen to the time the thunder is heard. The time in seconds between the flash of the lightning and the bang of the thunder is divided by 5 to determine the how far the storm is from the individual who is counting.[119, 121] It is recommended that as the flash-to-bang count nears 30 seconds (means that lightning strike was 6 miles away), all participants and spectators should immediately seek a safe shelter.[109]

Other Environmental Conditions

Special consideration should be given to the incidence of environmental allergens and potential bites from insects, rodents, and reptiles. The on-site member of the AHCT, or the coach when there is no on-site AHCT member, should be aware of those athletes with allergies who might be at increased risk for respiratory ailments or anaphylaxis. The AHCT should monitor the exposure of those athletes and plan ahead for proper treatment (e.g., have an athlete's EpiPen available) should it occur. Specific information can be gathered from the American Academy of Asthma, Allergy and Immunology (AAAAI) and from organizations such as the National Outdoor Leader School (NOLS) and their Wilderness Medicine School.

PROVIDING ON-SITE RECOGNITION, EVALUATION, AND IMMEDIATE TREATMENT OF INJURIES AND ILLNESSES

Secondary school–age individuals participating in athletics are subject to injury, including certain injuries and medical conditions unique to this population.[3] Each organization that sponsors an athletics program should develop an EAP that highlights mechanisms for evaluating and treating adolescents sustaining an injury. As part of the EAP, the organization should identify individuals responsible for providing these services and ensure they are educated, trained, and appropriately certified and licensed (if required by state law) to provide these services during every practice and competition. The ATC offers the best option, offering advanced first aid knowledge, CPR/AED use, and the ability to make return-to-play decisions. The AMA recommends that ATCs provide these services, although the AMA recognizes that EMTs, paramedics, and physicians are viable options in the absence of an ATC.[1, 122] In some cases, the coach is the only person available on-site during practices and games and should be trained in first aid and CPR; however, the coach cannot practice outside of his/ her scope of practice, which would include making decisions regarding when it is appropriate for an athlete to return to play following an injury or illness.

Early injury evaluation and treatment encourages proper healing and decreases the risk of reinjury,[1, 3, 123-125] and the initiation of prompt treatment is critical in the management of life- or limb-threatening injuries or conditions. These services should be available to injured athletes at each and every athletic activity.

The amount of epidemiological data concerning the incidence of injury in youth sports participation is increasing.[1, 3, 14, 85, 91, 125-144] The injuries sustained by the participants vary in severity, from relatively minor to catastrophic.[3, 14, 135, 139] It is important to remember that secondary school–age athletes are not miniature adults[124] and are susceptible to injuries that are specific to their age and level of physical maturity, presenting special challenges with respect to their participation in athletic activities.[85] A thorough, on-site initial evaluation is important in recognizing the nature and severity of the injury, determining if more advanced treatment and care are required, and limiting participation to protect the initial injury and prevent further harm.

One of the primary concerns regarding adolescent injuries is the child's developing musculoskeletal system.[124, 135, 136, 139, 145] The fact that the epiphysis, or growth plates, remain open is the reason physically immature youngsters are at greater risk, especially if they compete against more mature youngsters who have completed puberty and have closed growth plates and more mature muscular support for joints.[124, 145] An adolescent’s bones and articular surfaces may not be sufficiently developed to handle the stresses associated with athletic activity. Therefore, adolescents may develop a number of characteristic injuries, including osteochondritis dessicans, spondylolysis, stress fractures, and Salter-Harris fractures, many of which may have long-term consequences.[135, 136, 139, 144, 145]

Adolescents who have sustained an injury should be evaluated immediately to determine the nature and extent of the injury, because its signs and symptoms may change relatively quickly.[1, 3, 123-125] For example, the signs and symptoms of a head

injury may resolve soon after the injury, even though a significant, possibly life-threatening, head injury has occurred.[132] This individual may return to play because of resolution of their symptoms; however, Guskiewicz et al.[132] report that football players sustaining one concussion were three times more likely to sustain a second concussion during the same season than were athletes who have not had a concussion. Identifying the head injury through a thorough initial injury evaluation is essential to limiting the "serious sequelae" associated with repeated head injury.[132] An example of this sequelae is second impact syndrome (SIS), which occurs when an individual with a head injury receives a second blow to the head before the brain has recovered from the first injury and can lead to death.[127, 134] Immediate recognition of the initial concussion by members of the AHCT, as well as team members and coach, is important in the prevention of SIS and can be made through a proper initial evaluation.

An immediate injury evaluation also permits the quick initiation of appropriate medical treatment, which is associated with proper healing and a reduced risk of reinjury.[1, 124] Immediate treatment can mean the difference between life and death. Heat exhaustion, for example, is one condition that can be fatal without prompt recognition and treatment.[103] In addition, improper treatment of a suspected neck or spine injury may lead to secondary injury or a worsening of the original injury.[102]

When identifying the individuals to fulfill these roles, most organizations consider several options: physicians, paramedics or EMTs, coaches, and ATCs. Physicians certainly have the knowledge to complete an injury evaluation. Physicians also possess the medical expertise required to make decisions regarding injury treatment. However, one concern when asking physicians to provide these services is their availability at each practice and competition.

Several studies discuss the medical coverage afforded high schools for athletic activities in a variety of states.[128, 143, 146] In a survey of 240 California high schools, physicians provided medical coverage at football games over 70% of the time.[146] In contrast, a survey of 119 high schools in Alabama reported physician coverage at less than 25% of school-sponsored sporting events and less than 15% of practices.[128] Although practice coverage was not addressed specifically, reports from 301 high schools in Wisconsin indicated that only 35.5% of schools had a designated team physician.[143] Hence, although physicians certainly have the skills and training required to provide immediate medical care, they are often not available or able to satisfy the need for immediate injury evaluation and treatment at all practices and games.[1]

Similar results were found when schools were surveyed regarding the presence of an ambulance during practices and competitions. Vangsness et al.[146] report that less than 38% of schools had an ambulance with an EMT or a paramedic available at home football games. Culpepper[128] found that at least 80% of schools provided an ambulance during varsity football games, although less than 38% provided an ambulance for junior varsity football games. In a survey of 302 high schools, Rutherford, Niedfeldt, and Young[143] found that almost 79% of schools had an ambulance available or on call for practices or scrimmages. Although this percentage is higher than reports from other states,[146] having an ambulance "on call" does not necessarily mean the ambulance is on-site. In cases where an ambulance is available on-site, that ambulance may be

called away at a moment's notice in response to an emergency. An athlete's medical condition can change dramatically in a few minutes, less time than it may take an ambulance to arrive on the scene. Relying on the presence of an ambulance and personnel to provide medical care may not satisfy the need for immediate injury evaluation or treatment.

Coaches are another viable option for providing immediate injury evaluation and treatment. Coaches certainly are available on-site at each practice and competition and are encouraged to become educated about responding to emergencies, including certification in first aid and CPR.[16, 85, 88, 91, 123, 125, 126] In fact, some states require coaches to obtain these certifications.[141, 146] However, state laws often prohibit coaches from making return-to-play decisions or care beyond first aid such as taping an injured body part. The U.S. Navy defines *first aid* as the emergency care and treatment of a sick or injured person before professional medical services are obtained. First aid measures are not meant to replace proper medical diagnosis and treatment – they only provide temporary support until professional medical assistance is available. The purposes of first aid are to save life, prevent further injury, and minimize or prevent infection. Therefore, using coaches as health care providers is not always appropriate.

Moreover, a study by Ransone and Dunn-Bennett[141] questions the ability of coaches to provide these services. They surveyed 104 coaches of boys' and girls' sports at 17 high schools in California. The survey consisted of two separate parts: a test of first aid knowledge and a game situation data sheet that asked coaches to make decisions regarding athletic injuries in nine different athletic scenarios. Of the coaches surveyed, 92% were certified in first aid, yet only 36% passed the first aid assessment. The game situation questionnaire asked coaches to indicate whether they would return a starting player to the game after an injury. The authors note that, in general, coaches tended to return players to the game, especially those coaches who passed the first aid assessment. The authors express concern that coaches may not understand the "ramifications of returning an athlete to competition" and suggest that "additional knowledge on the treatment and rehabilitation of athletic injuries should enable coaches to make more objective decisions."[141] Of additional concern is that standard first aid courses do not teach the specifics regarding athletic-related injuries so many coaches have not been taught how to make these types of decisions. There is also a conflict of interest in allowing coaches to make return-to-play decisions.

Coaches should not be expected to split their attention between evaluating athletes, making return decisions, and their coaching duties. In addition, they do not possess the education to appropriately make the decision to return an athlete to participation following an injury.

In many cases, coaches are asked to fill the role of injury evaluator and treatment provider. However, during the course of an athletic practice or competition, coaches focus their energy on supervising their athletes and instructing them in the skills of the game. In addition, of the coaches responding to Culpepper's survey examining medical coverage in Alabama high schools, "only about half of them said they felt adequately trained to handle a medical emergency."[128] Given the concerns expressed regarding a coach's ability to handle medical emergencies, their expertise in first aid and CPR, and

their ability to make objective return-to-play decisions, assigning coaches the additional responsibility of providing immediate injury care may not be the best solution. The CDC will soon release a coach's kit for concussion management that was developed based on input from coaches and an expert task force. The consensus was that coaches should be able to identify a concussion but should make no decisions about return to play based on their preoccupation with all the other players and a limited knowledge. Providing an individual, such as the ATC, to specifically provide injury evaluation and treatment services at all athletic activities has been recommended.

In summary, while physicians are capable of performing injury evaluations and rendering decisions about injury treatment, they generally are not available to perform these duties at all practices and competitions. And although an ambulance complete with EMTs and paramedics is only a telephone call away, rarely is an ambulance available at each and every athletic activity. Immediate injury evaluation and treatment is a critical component in the successful management of many athletic injuries; however, EMTs are trained in only emergency care and cannot fulfill the role of the comprehensive AHCT. Therefore, organizations that sponsor athletic programs must ensure that an individual or individuals capable of performing these tasks are on-site at each and every athletic event.

The AMA recommends that schools sponsoring athletic programs establish an AMU that consists of a physician and an athletic health coordinator.[1, 122] The AMA suggests that athletic organizations place an ATC in the role of the athletic health coordinator.[1, 122, 147] ATCs are appropriate choices for the athletic health coordinator because they have the skills and knowledge required to perform injury evaluations and to provide immediate treatment.[1]

Components of the recommendation

Organizations that sponsor athletic programs should establish an AHCT, identify an athletic health coordinator, and develop a comprehensive EAP[1, 122] that includes mechanisms for providing immediate injury evaluation and treatment. Individuals capable of providing these services should be available for all athletic practices and competitions.

Strategies for implementation

On-site medical professionals such as the team physician or ATC should lead the AHCT. The organization sponsoring the athletics program should identify the individuals responsible for performing injury evaluations and providing injury treatment within applicable state law. The selection of this individual should be based on his/her education and availability to provide these services at each athletic practice and competition. At a minimum, a coach or other individual who is with the team on a regular basis, and is trained in CPR (including AED use) and first aid, should be available to tend to injuries that occur. In addition, protocols should be established, in advance, governing referrals and return-to-play decisions, especially in instances where a sponsoring organization may have multiple events going on at several sites.

Another viable option is the presence of an EMT/paramedic or a registered nurse at practices and games. These individuals would offer a higher level of care than an

individual with first aid and CPR training; however, these individuals may be limited in their ability to render return-to-play decisions and apply protective taping and padding following an injury.

FACILITATING REHABILITATION AND RECONDITIONING

Adolescents who participate in athletics are subject to injury. When injuries occur, the injured individual requires proper treatment and rehabilitation to regain full physical function and safely return to athletic participation. This treatment should include not only the care provided immediately after the injury but also the postinjury rehabilitation and reconditioning. Rehabilitation and reconditioning programs reduce the likelihood of reinjury and promote a safe return to play. Organizations that sponsor athletic programs should establish an on-site member of the AHCT and identify this individual to manage the postinjury treatment plans of the athletes. Coaches should also be taught to follow the AHCT's recommendations in regard to athlete rehabilitation.

Injuries are a common occurrence in all levels of athletics. For most athletes, a return to activity after the injury is expected. However, when the individual returns to competition, the likelihood of reinjury is directly dependent on the care this individual receives after the injury. Although the evaluation and treatment provided immediately after the injury are critical, a rehabilitation and reconditioning program designed to safely return the individual to play is just as important.

Trauma to the body causes tissue damage and cell death, resulting in swelling, pain, and decreased ROM.[148] Prolonged periods of disuse can further limit ROM and lead to decreases in strength, cardiovascular conditioning, and muscular endurance.[148] Effective postinjury care can limit the long-term consequences of the initial injury by decreasing pain and increasing ROM, muscular strength, and overall function.[149-151]

Programs designed to return an injured individual to a preinjury level of function can be described using a variety of terms, including *injury treatment, rehabilitation programs*, and *therapy.* In general, these programs consist of exercise, therapeutic modalities, and functional activities specific to the individual and his/her injury.[148, 152, 153] The goals of rehabilitation and reconditioning programs include preventing further injury and promoting a safe return to play.[148] Adolescents who are injured during athletic performance should complete a rehabilitation and reconditioning program to promote a safe return to play.

Adolescents who sustain an athletic injury should receive treatment. This, as a whole, consists of two distinct parts or phases. The first component is the treatment received immediate after the injury; the second component is the postinjury rehabilitation and reconditioning. The rehabilitation and reconditioning component should be viewed as a process that lasts days, weeks, or months, with the length dependent on the severity of the injury.

Programs designed to return an injured individual to a preinjury level of function can be described using a variety of terms, including *injury treatment, rehabilitation and reconditioning programs, therapy,* and *physical therapy*. Although these terms are familiar to most, the concepts behind them are less well known. Understanding these concepts is best achieved by describing the characteristics and goals of rehabilitation and reconditioning programs. The first primary goal of every rehabilitation and reconditioning program is injury prevention.[3, 148] The second goal is a safe and timely

return of injured athletes to their preinjury level of competition.[148] Rehabilitation and reconditioning programs consist of individualized therapeutic exercise that is performed in orderly, progressive steps until return to play.[148]

One of the hallmarks of rehabilitation and reconditioning programs is the progression of *therapeutic exercise*. This is enhanced through the setting of both short- and long-term goals. Short-term goals tend to focus on increasing ROM, strength, and flexibility and on restoring proprioception.[130, 148] Long-term goals tend to focus on optimizing the individual's functional status.[148, 154] Achieving these goals depends on many factors, of which perhaps the most important is *frequent reevaluation* of the athlete to modify the goals and treatments as needed.[148] Therefore, qualified personnel capable of reevaluating and modifying the rehabilitation and reconditioning program as needed should be available.

The benefits of completing rehabilitation and reconditioning programs are also well known. Stylianos[155] notes that individuals participating in "effective rehabilitation programs will often surpass expectations for functional recovery." Entering into a rehabilitation and reconditioning program after injury permits injured athletes to return to play sooner with fewer long-term disabilities.[136] Individuals have noted decreased pain and disability and increased ROM and functional activity following the completion of rehabilitation programs for patellofemoral pain and neck pain, respectively.[149, 151] Gilbey et al.[150] found that individuals who completed an exercise program before total hip arthroplasty and continued with the program after surgery exhibited an earlier return to functional activity.[150] In a study of injury patterns in select high school sports, Powell and Barber-Foss[3] noted that, as part of an overall injury prevention program, rehabilitation after the initial injury minimized the risk of reinjury.

Adolescents who return to participation before completing a rehabilitation and reconditioning program are risking reinjury and other long-term consequences. There are a number of reasons why an adolescent may not successfully complete a rehabilitation and reconditioning program. An adolescent may lack access to such a program or choose not to participate in the program. Compliance with rehabilitation and reconditioning programs and the length of time an individual receives these services correlates strongly with better treatment outcomes.[156, 157]

The rehabilitation and reconditioning of athletic injuries represents a major component of a comprehensive injury prevention program and should be undertaken by a selected member of the AHCT. The NATABOC-certified athletic trainer (ATC) is the choice of the AMA because they have the appropriate training and educational background to provide appropriate care for injured athletes and to make sound decisions regarding when an athlete can return to play.[1, 122] Although it has been noted that not all organizations have the resources to hire an ATC or implement a sophisticated sports medicine program, they can designate a qualified member of the coaching staff to work with a member of the AHCT to prevent injuries, provide medical care, and rehabilitate injured athletes.[1]

Components of recommendation

Organizations that sponsor athletic programs should identify an individual who is responsible for coordinating rehabilitation and reconditioning programs with physicians

and other health care professionals. This individual should also be responsible for determining return-to-play following rehabilitation.

Strategies for implementation

Organizations that sponsor athletic programs should establish an AHCT consisting of a team physician and an athletic health coordinator.[1, 122] The organization may choose to provide an athletic health coordinator such as an ATC who is qualified to evaluate injured individuals and develop appropriate rehabilitation and reconditioning programs. If the organization cannot provide an ATC, it should identify both (1) an athletic health coordinator to provide rehabilitative care and (2) an athletic health coordinator to work with health care providers outside the organization to ensure their recommendations regarding treatment and participation are being followed.

The on-site member of the AHCT can ensure injured athletes receive appropriate rehabilitation and reconditioning services in several ways. An ATC possesses the education and credentials to design the rehabilitation and reconditioning program, supervising and reevaluating individuals as they progress through it. In cases where the athletic health coordinator does not have the training to provide these services, s/he can coordinate with outside health care providers to ensure that the recommendations of the treating physician, physical therapist, and others are followed. Regardless of the athletic health coordinator's qualifications, this individual plays an important role in injury rehabilitation and reconditioning.

PROVIDING FOR PSYCHOSOCIAL CONSULTATION AND REFERRAL

Members of the AHCT may be the health care professionals who most often interact with adolescent athletes. In some cases, a PPE or injury management may be an adolescent's only interaction with any health care system. Members of the team must therefore be capable of identifying potential psychosocial pathologies and referring the athlete for appropriate diagnosis and management. Organizations that sponsor athletic programs must identify local experts who specialize in these areas.

Adolescents are at significant risk for morbidities associated with substance abuse, sexual activity, depression, eating disorders, suicidal tendencies, weapon use, violence, and vehicular recklessness. Adolescent athletes in particular may have an increased risk of depression associated with injury or athletic "burn-out." Furthermore, although adolescent athletes may have a decreased risk of cigarette smoking, some studies have suggested an increased use of smokeless tobacco, unsafe sexual activity, alcohol abuse, vehicular recklessness, and other risk-taking behaviors among certain adolescent athletes.

The AMA has estimated that the athletic PPE serves as the only routine health maintenance for 80% to 90% of adolescents.[30] Even though the consensus PPE monograph recommends counseling and screening for psychosocial problems,[17] some have called the PPE a "missed opportunity"[158] to adequately evaluate the physical, emotional, and psychological well-being of secondary school–age athletes.

Studies have shown that not only do secondary school–age athletes engage in numerous health risk behaviors,[159] they may also have a higher rate of certain behaviors than their non-athletic peers. Due to the requirement for parental consent, conducting research to estimate the prevalence of health-risk behaviors is difficult in secondary school–age athletes. However, if one extrapolates conclusions from data in the collegiate population, to which many secondary school–age athletes aspire and will graduate, some conclusions can be made regarding athletes and risky health habits. Nattiv and Puffer[160] found that collegiate athletes have higher proportions of risky behaviors than do their non-athletic peers, including a higher quantity of alcohol consumed, lower use of contraception, higher number of sexual partners and sexually transmitted diseases, greater rates of driving while intoxicated with alcohol or other drugs and riding with an intoxicated driver, and lower use of seatbelts and of helmets when riding a motorcycle or moped. In addition, high school athletes have been found to have a higher rate of accidental non-athletic injuries[161] and to demonstrate earlier sexual contact[162] compared to non-athletes.

The risk-taking behaviors seem to vary by gender, with male athletes disproportionately more likely to engage in them than female athletes.[163] Nattiv et al.[164] confirmed this finding in a follow-up study to their prior work and further identified participants in contact sports as at the highest risk. They also showed that athletes who engage in one high-risk behavior are more likely to engage in multiple high-risk behaviors. There are suggestions that addictive disorders, such as gambling, may often be seen as a comorbid factor with depression among athletes.[165] An excellent review of certain risk-

taking behaviors of athletes and the studies comparing health risk behaviors in athletes and nonathletes was published by Patel and Luckstead.[166]

Of importance is that the same studies also demonstrated important benefits of athletic participation, including lower likelihood to smoke cigarettes or marijuana, greater likelihood to engage in healthy dietary behaviors, and lower likelihood to feel bored or hopeless[161]; a significant decrease in drug and alcohol use and abuse over all 4 years of high school[162]; and less depression, less suicidal ideation, and fewer suicide attempts.[167] Looking more critically at the Nattiv and Puffer[160] data, if certain male contact sports were removed from the sample, the remaining athletes may have demonstrated no greater risk-taking behaviors than the general student body.

In general, then, athletic participation seems to correlate with improved emotional well-being in adolescents.[168] Injured patients in sports medicine clinics may therefore experience significant psychological distress associated with the loss of this participation.[169] Interestingly, among injured adolescent athletes who reported higher athletic self-identity, higher depressive symptom scores were measured.[170]

The health professionals best positioned and suited to address these psychosocial concerns in the athletic setting may be ATCs, because the necessary skills and knowledge are standard to their professional practice and because they are more likely to be consistently available on-site.[171]

Components of recommendation

Members of the AHCT team and coaches often develop close and/or long-term relationships with adolescent athletes and may be well positioned to identify subtle early warning signs of common psychosocial problems. Coaches should work with members of the AHCT to provide for psychosocial consultation and referral of adolescent athletes with the following guidelines:

- Coaches and AHCT members should be aware of the psychosocial problems of adolescence, including disordered eating, substance abuse, sexual activity, athletic “burn-out,” depression, suicidal tendencies, weapon use, violence, and vehicular recklessness.
- At least one AHCT member should review the PPE to look for specific warning signs.
- Coaches and AHCT members should be aware that psychosocial problems of adolescent athletes might manifest themselves as overtly as dropping out of participation or as subtly as small decreases in performance.
- AHCT team members should be able to easily refer athletes to identified consultants who can further evaluate and treat these suspected conditions.
- The organizations that sponsor athletic programs must establish systems to facilitate these referrals by identifying local mental health providers, ensuring prompt access to them, and minimizing barriers such as insurability and payment.

- At least one, if not all, of the AHCT members should be aware of the specialized developmental needs and stages of growing adolescents.
- At a minimum, one on-site AHCT or coach should be well versed in the recognition of psychosocial issues and the referral system established by the sponsoring organization

Strategies for implementation

Members of the AHCT may be well positioned but, because of their training, not well suited to identify emerging psychosocial problems. Implementation of this recommendation would therefore require some, if not all, of the following elements: As detailed in the PPE monograph,[17] thorough psychosocial screening should be an important component of the PPE and should be conducted, ideally, by the athlete's primary care provider. If not conducted by the primary care provider, a thorough psychosocial screening could be conducted by another health care professional who is comfortable with adolescents and familiar with the basic tenets of confidential and sensitive interviewing. The issues that can be addressed in a thorough psychosocial screening can include questions regarding home life and family dynamics, education (school performance and relationships), activities (sports, jobs, and leisure enjoyment), diet, drug use, safety issues (violence, weapon use vehicular recklessness), sexuality (contraception, type, number and frequency of partners), depression, and suicidal tendencies

Texts such as Neinstein's *Adolescent Health Care*[172] provide more detailed examples of the content of and techniques for adolescent psychosocial screening. Other tools for screening specific conditions include a screening instrument that can reliably and validly identify disordered eating behaviors in the secondary school–age population and ones that evaluate depressive symptoms such as sleep disturbances, irritability, guilt, low energy levels, inability to concentrate, changes in appetite, and suicidal tendencies.

Team members should be provided education and training by local experts in adolescent health such as the multidisciplinary members of the Society for Adolescent Medicine (SAM) (http://www.adolescenthealth.org). Curricular goals could include understanding of the basic cognitive, emotional, physical, and psychosocial developmental stages of adolescence (Table 3) and identifying signs and symptoms of common psychosocial problems, such as disordered eating, substance abuse, sexual activity, athletic "burn-out," depression, suicidality, weapon use, violence, and vehicular recklessness.

While a sports psychologist may be a valuable member of or consultant to the AHCT, ATCs are specifically trained in the components listed and often practice on-site with adolescent athletes and therefore would be extremely valuable members of the AHCT. In addition, the ATC should refer any athletes with identified problems to the school counselors and, if comfortable, discuss the issue with the athlete and/or his or her parents.

PROVIDING SCIENTIFICALLY SOUND NUTRITIONAL COUNSELING AND EDUCATION

Sports nutrition is a key factor in an athlete's growth, development, and performance. It is well known that adolescents have unique nutritional requirements that are further complicated by sport participation. The massive industry of supplements marketed to enhance sports performance and the lack of regulation as to the effectiveness and safety of such products pose an additional risk to secondary school–age athletes. Athletes need guidance to make sound nutritional decisions in an age where fad diets and performance enhancement products are prevalent.

Sponsoring organizations of athletic programs have a responsibility to provide a safe environment including sound, scientifically based information regarding nutrition and supplements. A solid knowledge of nutritional concepts is crucial to any AHCT; especially those caring for secondary school–age athletes. In addition to basic growth and development, competition puts an increased demand on daily nutritional requirements. Factors such as ethnicity, social and economic status, family history and environment, peer pressure, and inaccurate diet information can complicate the prescription for good nutrition. In addition, adolescents' tendencies to skip meals, snack on junk food, and feast at fast food restaurants can add to poor eating habits.

A system for reviewing an athlete's nutritional status is the basis of providing appropriate information to athletes and parents regarding long-term nutritional health. Childhood obesity is on the rise in United States and puts children at risk for heart disease, illness, and injury.[173] A review of an athlete's nutritional status could alert the child and parents to a problem. If a child is found to have poor nutritional habits, an allied health care professional should help combat the problem by creating a plan to address the issues identified in the nutritional review.

Included within the topic of nutrition is proper hydration, especially during activities conducted in high heat stress environments. The availability of hydration fluids in a clean, noninfectious environment at all sport settings should be ensured. It has been well documented in the NATA's Heat Illnesses Position Statement[103] that one major preventative measure is to maintain proper hydration. Not only should the athlete be given the opportunity to consume the appropriate amount of fluid, but s/he should also be educated as to how much to consume and why it is important. Athletic performance may decrease due to hypohydration.[115] Education of athletes, coaches, and parents in regard to hydration is crucial in the prevention of unwanted injuries and illness and should be a consideration of any group working with adolescent athletes. In addition, coaches or other personnel should never restrict fluids for exercising athletes.

Pre-event and post-event nutritional needs are important considerations for the secondary school–age athlete. For optimal performance, an athlete needs to know what to eat and when to stop eating before a competition. Eating the wrong foods at the wrong time will not give an athlete the appropriate energy for competition and may cause bloating and discomfort.[174]

After exercise, it is important to replenish the nutrients used. Athletes, parents, and coaches should have an avenue to find out the necessary information. Resources reflecting sound scientific material should be used; examples are provided in the Identification of Additional Resources section of this document.

Body weight has a direct influence on some sports such as wrestling and crew and is associated with performance in many other sports such as gymnastics and dance. It has an aesthetic impact in sports such as cheerleading. The pressure to achieve or maintain a low body weight during the secondary school years can lead some to develop disordered eating. There should be a system in place to identify athletes at risk for eating disorders and to treat those who have been identified. It is important that someone close to the athlete knows what to look for. People with eating disorders are very manipulative; so once they have been identified, it is very important to have a plan set in place to provide referral to an appropriate allied health care professional who specializes in this field.

Use of sports supplements and performance-enhancing drugs is fairly common among secondary school students.[175] Young people are taking them to perform better or to build muscle, as well as to look better. The main sources of knowledge regarding supplements and performance-enhancing drugs are friends and advertising. Most athletic governing bodies prohibit the use of supplements and drugs that are designed to enhance performance.[16] Supplements marketed to enhance athletic performance often are touted as “herbal” or “natural,” which implies an element of safety. This, coupled with the massive marketing campaigns and use by professional athletes, provides for the “easy path to success” for the secondary school–age athlete. Society’s emphasis on winning and a child’s desire to please parents and coaches make for a potentially deadly combination. While young people may realize that supplements and performance-enhancing drugs are dangerous, few are reported to know the potential side effects.[175]

Dietary supplements are not required to be standardized in the United States. In fact, no legal or regulatory definition exists in the United States for standardization as it applies to dietary supplements.[176] Studies conducted on sports supplements rarely include subjects of adolescent population. Adverse potential side effects of sports supplements may include, but are not limited to, heart failure/cardiac anomalies, organ malfunction, personality disorders, reproductive disorders, headache, and acne.

Members of the AHCT should be well versed in proper sports nutrition for the adolescent and have a basic knowledge of proper nutrition and eating habits. They should also have access to a professional nutritionist or dietician.

Components of recommendation

Sponsoring organizations should establish components of a comprehensive sports nutritional support system, based on current scientific facts, and should include, 1) A system for reviewing an athlete’s nutritional status, 2) Policies to ensure the availability of hydration fluids in a clean, noninfectious environment at all sport settings, 3) Encouragement of appropriate pre-exercise and post-exercise food, 4) A system to identify athletes at risk for disordered eating and a system to treat those who have been

identified, and 5) The use of scientifically supported literature when developing rules that restrict the use of performance-enhancing supplements, drugs and substances, or educational programs to inform coaches, athletes, and parents of the dangers of ergogenic aids

Strategies for Implementation

Reviewing the athlete's nutritional status

Information sheets with general nutrition goals for an active secondary school–age athlete can be provided by the sponsoring organization. Each athlete should have a basic understanding of what nutritional requirements s/he needs to have for normal growth and activities of daily living as well as the additional needs that exist because of the energy expenditure caused by his/her sport. Reference to appropriate print and Web media can also be provided; sources are available later in this document. Coaches, as well as members of the AHCT, should be alert to the athletes' nutritional well-being and provide additional information and interaction when circumstances warrant.

Maintaining adequate hydration

The sponsoring organization, via the coaches and members of the AHCT, has a responsibility to provide an environment and information to facilitate or help athletes maintain adequate hydration during physical activity. Several documents are available to assist with the development of a fluid replacement program such as NATA's Position Statement on Fluid Replacement,[115] as well as educational materials that can be provided to athletes, coaches, and parents, such as NATA's Exertional Heat Illness Consensus Statement.[105] Encouraging fluid replacement adequate to replace fluids lost due to sweating before, during, and after intense physical activity is essential to maintain performance levels and general health.

Pre-exercise and post-exercise nutrition

There should be an encouragement of appropriate preexercise and postexercise food. For optimal performance, an athlete needs to know what to eat and when to stop eating before a competition. Informational handouts with recommendations based on accurate scientifically proven information can be provided to athletes and parents.

Sponsoring organizations that provide opportunities for athletes to travel (e.g., youth travel soccer) can lead by example and provide the teams with nutritionally sound eating opportunities, both before and after exercise. Members of the AHCT should investigate available resources such as community-based wellness centers and hospitals that have registered dietitians and nutritionists on staff to provide appropriate information to the team, coaches, and parents.

Identify athletes at risk for disordered eating

Disordered eating can have a variety of signs and symptoms. Providing information to coaches about the signs and symptoms of disordered eating can encourage early recognition. The complexity of dealing with disordered eating necessitates referral of athletes who exhibit signs and symptoms to an appropriate professional. Appropriate professionals include physicians, psychologists, school nurses, and nutritional counselors. Establishing, in advance, a systematic protocol to follow when an athlete is

suspected of disordered eating is essential to ensure athletes receive the appropriate support.

Performance-enhancing supplements

Supplements marketed to enhance athletic performance come in many different forms. Most athletic governing bodies prohibit the use of supplements and drugs that are designed to enhance performance. Sponsoring organizations should support rules prohibiting supplement use and provide education addressing the potential health risks associated with them. Caution should be taken when researching information on specific supplements and drugs to ensure it is from a reputable source.

DEVELOPING INJURY AND ILLNESS PREVENTION STRATEGIES

Injuries and illnesses are a heavy burden on the well-being of secondary school–age athletes and a leading reason why people stop participating in physical activities. There are many interventions that have proved to be effective in reducing the severity of athletic injuries.[177-180] Still, many opportunities for prevention remain. This document establishes recommendations for the prevention, care, and appropriate management of athletic-related injury and illness specific to the secondary school–age individual. This overview presents a public health framework for developing effective interventions to reduce the burden of injuries to secondary school–age athletes.

Participation by secondary school–age children in sports, recreation, and exercise is widespread, with nearly 6.5 million high school students participating in organized athletics.[11] However, many of these activities involve elevated risks of injury. As a result, approximately 715,000 sports- and recreation-related injuries occur in the school setting each year.[181] These injuries may lead to a number of costs, some of which are financial and some of which affect a person's quality of life.[182] In the short term, costs include medical care expenses and time lost from classes and athletic play. Of U.S. schoolchildren who received medical attention for a sport/recreation injury, 20% had one or more days of lost time from school.[183] Long-term costs may include medical and rehabilitation expenses, restriction of future athletic activities, loss of some amount of physical function, and increases in insurance premiums.

A wide variety of injury control interventions have been accepted in the athletic community over the years, including changes to the environment (e.g., break-away bases),[184] use of protective equipment in contact sports (e.g., helmets),[185] and rule changes (e.g., football's prohibition of spearing).[186] Scientific progress has demonstrated that certain sports, certain positions, and certain competitive situations have greater risks of injury than others. By recognizing the greatest risks, we can develop ideas that reduce the chances of a serious injury to a young athlete.

Developing a comprehensive approach to injury control strategies for athletics is difficult. To begin to establish this direction, NATA sponsored the development of recommendations for appropriate medical care of secondary school–age athletes. This effort addresses more than basic emergency care during sports participation; it involves virtually all aspects of prevention, and activities of ongoing daily athletic health care. The recommendations are intended for use by the sponsoring organizations of athletic programs, and the AHCT they establish, in consultation with administrators, coaches, parents, and participants. Establishing an AHCT should be one of the sponsoring organization's first priorities and should include medical professionals such as ATCs, allopathic or osteopathic physicians, school nurses, and other allied health care providers.[1] By approaching the issue of athletic injuries in a comprehensive way, we develop a better sense of where the problems lie and what can be done to eliminate or reduce them.

This holistic approach involves considering characteristics of the athlete (host), the environment associated with athletic performance (both physical and social-cultural), and the energy that is transferred to the body that causes damage. These elements and

their relationships are represented as a public health framework. This framework has long been used in the study of disease and has recently been applied to the topic of athletic injury. As described by Weaver et al.,[125] “The public health framework suggests that multiple types of social environments…operate within a physical environment, and provide the context in which an energy vector acts on an athlete to cause an injury. Each of these components and their multiple interactions can be further investigated as a potential target for injury prevention efforts."

Athletics includes a long history of interventions designed to protect players from specific injuries. However, not all of these efforts have been scientifically evaluated to demonstrate their effectiveness. Also, not all interventions have been found to be acceptable to players, and enforcement of protective rules may be rejected by the athletic community, who view the rule change as an offense to the sport’s tradition.[182] Nevertheless, games are constantly evolving with safety concerns often driving the changes. The following outline presents some examples of the best practices for injury control in modern sport using elements of the implementation hierarchy previously described.

Engineering controls
Although safety balls have long been assumed to cause fewer injuries, no epidemiological study had examined their effectiveness before the study of Marshall et al.[84] in a 3-year nationwide study involving more than 6.7 million player-seasons, the use of safety balls was associated with a 23% reduced risk of ball-related injury in Little League Baseball. The effect was more dramatic among younger divisions than among older divisions. The authors also suggest that concerns of poorer performance by the reduced-impact ball, the greatest barrier to wider acceptance, are based on misperception “of the ball’s play, rather than the actual performance of the ball.”[84]

Administrative controls
Based on surveillance data of head and neck injuries occurring in tackle football, axial loading was identified in 1975 as the primary cause of serious cervical spine injuries.[187] The incidence of catastrophic head and neck injuries increased in 1976 as a result of the new helmets, which led some athletes to consider themselves indestructible. Subsequent rule changes in high school and college play banned “spearing” and using the top of the helmet as the initial point of contact in striking an opponent during a tackle or block. Once the actual mechanism of injury was understood, modification of the rules to affect a change in playing technique was very effective. From 1976 to 1984, cervical spine injury rates sharply decreased and injuries that resulted in quadriplegia decreased 85% from 34 to 5 incidences.[186]

Educational intervention
In a prospective controlled intervention study, a prevention program that focused on education and supervision of soccer coaches and players demonstrated 21% fewer injuries in the intervention group among male youth amateur players.[178] The effects were more dramatic for injuries that were mild, resulted from overuse, or occurred during training. Also, the program was more successful with low-skill teams, demonstrating the potential of education strategies for a great number of youth teams.

Personal protective equipment
A good case study of the need for personal protective equipment involves the long-running debate over whether protective eyewear should be required in women's lacrosse. Proponents of protective equipment cite a fast-moving sport, the use of sticks and a hard rubber ball, and documented eye injuries as evidence of the need for protective eyewear. Opponents suggest that by requiring protective equipment, players will feel secure enough to increase their aggression and ultimately change the nature of the game from one of incidental contact to one of full contact, similar to the men's game. Further, it is argued that this increase in aggression will eventually cause more injuries than the original intervention (protective eyewear) prevents.

To assess the true effect of protective eyewear, Webster et al.[188] collected field data from 700 varsity and junior varsity players in central New York over a 2-year transition from sparse to almost complete eyewear use. The findings indicated a 16% reduction in overall head/face injuries among goggle wearers, with an even greater effect in game situations (51% reduction). This and similar studies[189] demonstrated a beneficial use of eyewear and provided the basis for strategic decisions on how best to prevent head and facial injuries in young athletes. One such change is the recent decision by the U.S. Lacrosse Women's Division Board of Governors to amend the rules of women's lacrosse to highly recommend the use of protective eyewear meeting current ASTM lacrosse standards for 2004 and to mandate use beginning in 2005.[190]

Components of recommendation
There is a well-accepted scientific process for addressing a public health injury problem, and in this case, athletic injury among secondary school–age athletes. This public health approach[191-194] includes the following five components, which are then described in greater detail: 1) Determine the existence and size of the problem, 2) identify what may cause the problem, 3) determine strategies and interventions that may prevent the problem, 4) implement prevention strategies, and 5) monitor and evaluate the effectiveness of prevention efforts.

Determine the existence and size of the problem
The success of the first step relies on a complete and accurate collection of relevant data. This includes a good description of the circumstances surrounding the injury, including person, place, and time. Surveillance describes such characteristics as the magnitude of the problem ("How many players have been injured?"), the physical location of the problem ("Where on the field do injuries occur?"), what body parts are at greatest risk of injury ("Are there more head injuries than shoulder injuries?"), and who is affected ("Are more boys injured than girls?").[195] Along with the descriptive injury data, it is imperative that injury surveillance also takes into consideration exposure data (athlete-exposures). Additional information should be collected to allow for comparisons to be made within and between positions, sports, and those with and without a previous injury history. Only with a strong surveillance effort can we be sure that the biggest problems are being addressed and our efforts to reduce them are successful.

Identify what may cause the problem
This information suggests why certain people may be at greater risk of injury while others are protected. This type of data requires long-term, expensive longitudinal

studies. However, some risk factors have already been identified in high school athletes and interventions can be developed from these known risk factors (e.g., landing biomechanics and anterior cruciate ligament [ACL] injury in females has led to jump training programs). Understanding which risk factors are involved is often overlooked, yet is crucial to developing effective interventions.

Determine strategies and interventions that may prevent the problem
Developing strategies for injury prevention is usually based on the approach introduced by William Haddon, known as the Haddon Matrix.[196] It is based on Haddon's observation that all injury events come from the uncontrolled release of physical energy.[197] Efforts focused on prevention can occur at one of three times: before the injury (when the energy becomes uncontrolled), during the injury (when the energy transferred to the body is more than can be safely absorbed), or after the injury (when the body attempts to heal the damage). In addition to the time axis, the Haddon Matrix includes an axis of risk factors also found in the public health framework; the host (potentially injured person), the agent (the energy and the way in which it is transferred), and the environment (both physical and social). The resulting 12-cell matrix can be used as a brainstorming tool to devise interventions according to a specific time phase and a specific risk factor. An example of the use of the Haddon Matrix applied to the problem of athletic injuries is found in Table 4. A strong prevention program incorporates interventions that address the different risk factors and span the time axis.

Implement prevention strategies
Once potential strategies are identified, the next step is to assess which strategies should be implemented and how to put them into action. Recently, Runyon[198] added another dimension to the Haddon Matrix to help with this decision. A set of value criteria is included as a starting point for planners to consider. Depending on the nature of the injury problem, some criteria will be weighted more heavily than others; these criteria include

- *Effectiveness:* How well does the intervention work when applied?
- *Cost:* What are the costs of implementing and enforcing the program?
- *Freedom:* Do the freedoms of some groups have to be sacrificed to achieve the goal?
- *Equity:* Are people treated equally or in a universal fashion?
- *Stigmatization:* Does a program result in a person/team being stigmatized?
- *Preferences:* Are preferences recognized to encourage compliance?
- *Feasibility:* Can the intervention actually be produced?

Another strategy for developing effective interventions for athletic injuries is to consider whether players are protected from injury without having to take additional precautions.[125, 199] A passive strategy, such as adding padding to an outfield wall, provides automatic protection without requiring the cooperation of the athlete to be effective. An active strategy, such as a rule change to ban slaps to the side of the helmet, requires an athlete to modify his or her play or cooperate in some other way. Passive strategies are generally considered to be more effective because they do not rely on player compliance each and every time a potential injury situation presents itself.

Different types of interventions can be classified according to the degree of compliance required of athletes. This principle is presented in an intervention implementation hierarchy that includes engineering modification to the athletic environment, administrative changes to a rule, educational efforts to introduce a safer technique or less risky behavior during play, and the use of personal protective equipment. [200] Engineering controls are typically considered to be most effective because they require the least amount of effort/cooperation from the athlete to provide safety, although they also require a greater commitment and resources from the organization with overall responsibility for player safety. Educational controls and personal protective equipment are more active interventions because they require the players to consider the risk of a situation and to act in a safe manner every time the situation presents itself during play.

Monitor and evaluate the effectiveness of prevention efforts

The evaluation step provides answers to the ultimate questions, “Does our intervention work?” or “Have injuries been reduced?”[195] We return to our first step of surveillance for data that support or deny the effectiveness of the interventions that have been implemented. Although we are most interested in this primary question, we also must consider whether there may be other reasons, unrelated to the intervention, which might explain why injuries were reduced. Another key issue is whether there are any unintended consequences (good or bad) that are a direct result of the intervention. A bad unintended consequence may ruin any positive effect of the intervention, so it must be determined not only whether fewer injuries occurred, but also whether the intervention had a positive effect on the athletes' overall well-being. Evaluation requires the conduct of well-designed randomized controlled effectiveness studies.

Strategies for implementation

The potential strategies for the prevention of injury and illness in the secondary school–age athlete have been presented in the previous 10 sections of this monograph. These interventions address various aspects of the framework previously described, including the athlete, energy transfer, and environment. They also relate to efforts that affect the safety and welfare of athletes before, during, and after the injury or illness.

CONCLUSIONS

Appropriate medical care of the secondary school–age individual involves more than basic emergency care during sports participation. It encompasses the provision of many other health care services. While emergency medical care and event coverage are critical, appropriate medical care also includes activities of ongoing daily athletic health care. The athletic health care team (AHCT) comprises appropriate health care professionals in consultation with administrators, coaches, parents, and participants. Appropriate health care professionals could be certified athletic trainers, team physicians, consulting physicians, school nurses, physical therapists, emergency medical services (EMS) personnel, dentists, and other allied health care professionals. Organizations sponsoring athletic programs for secondary school–age individuals should establish an AHCT that functions to ensure appropriate medical care is provided for all participants.

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TABLE 1. MEDICAL PROFESSIONALS WHO SHOULD BE CONSIDERED MEMBERS OF THE ATHLETIC HEALTH CARE TEAM

Certified athletic trainers
Team physicians
Orthopaedic physicians
School physicians
Primary care providers (pediatricians, family practice, nurse practitioners, etc.)
Consulting and other physicians
School nurses and guidance counselors
Physical therapists
EMS personnel
Physician assistants
Registered dieticians
Public safety personnel
Public health officials
Dentists
Other allied health care professionals
Students and trainees in the above disciplines

TABLE 2. STRATEGIES TO ENSURE SAFE FACILITIES

Develop a written EAP for all venues or facilities
Evaluate your present facilities for safety
Develop appropriate checklists, forms, and other documentation to ensure thorough and consistent standards of facility evaluation
Follow a standardized timeline for when facility evaluations will take place and who will be responsible for completing the forms
Use “Critical Incident Reports” to direct corrective actions whenever an accident occurs
Post warning signs where appropriate.
Provide in-services for staff regularly on injury prevention and how to monitor and manage facility safety
Cultivate a safety awareness culture in your program
Ensure facilities are adequately secured to prevent improper use
Ensure athletes are properly supervised during participation
Maintain a regular schedule for cleaning shared equipment shared and encourage athletes to maintain good hygiene
Follow universal precautions for blood and body fluids

TABLE 3. CHARACTERISTICS OF THE DEVELOPMENTAL STAGES OF ADOLESCENCE

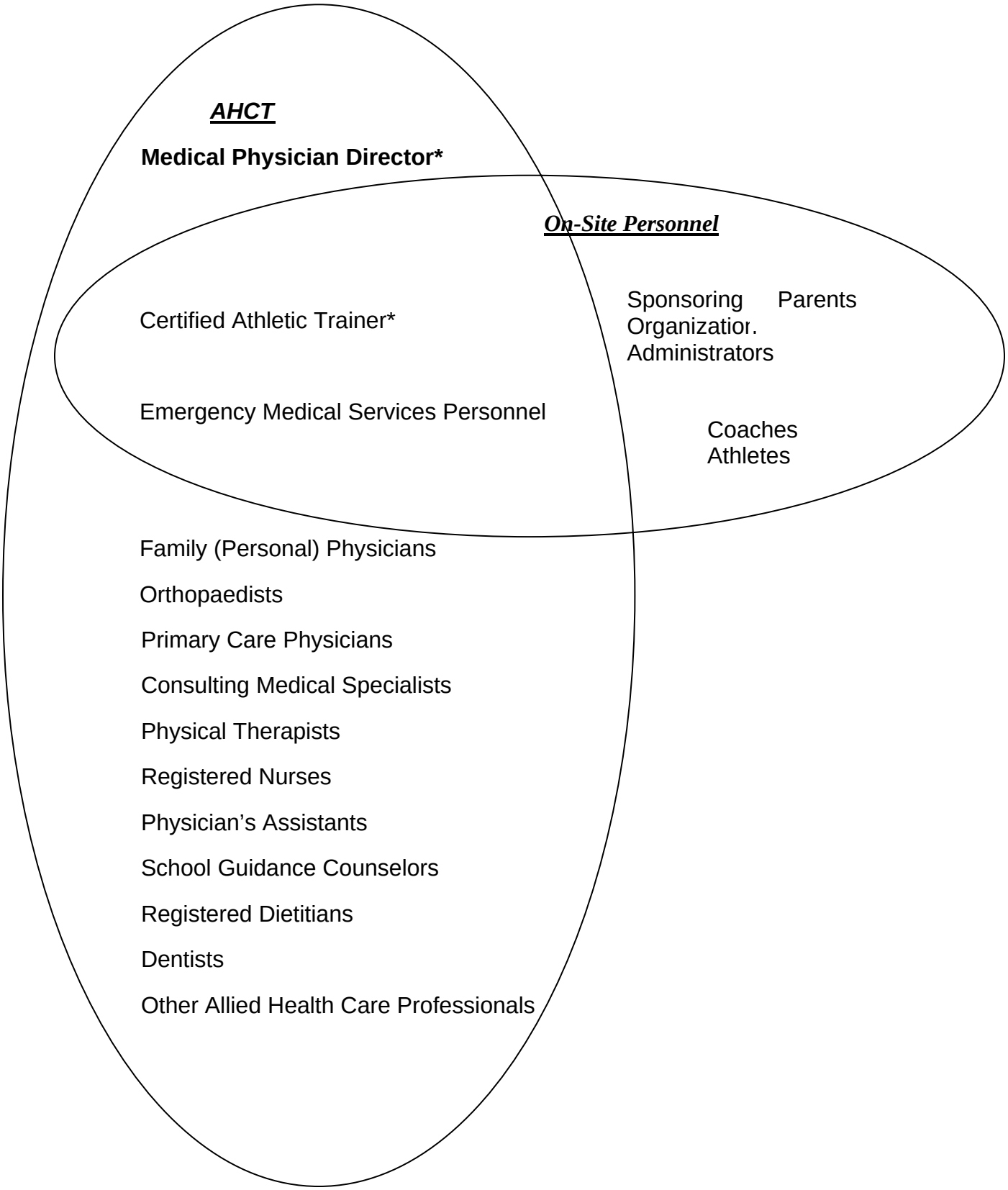
Stage	Characteristics
Early – individuation	During this time, athletes may become confused or question their identity as they encounter the physical and emotional changes of puberty.
Middle – separation/rebellion	This is the phase during which many of the risk-taking behaviors may be initiated or reach their peak
Late – abstract thinking, future/goal orientation	This level of maturity is not often reached during the secondary school years

TABLE 4. HADDON MATRIX APPLIED TO THE PROBLEM OF ATHLETIC INJURIES*

Phases/Factor	Host	Agent	Physical environment	Social environment
Before injury	CS #2. Determine the individual's readiness to participate.	CS #3. Advise on the selection, fit, function, and maintenance of athletic equipment.	CS #3. Promote safe and appropriate practice, competition, and treatment facilities. CS #5. Establish protocols regarding environmental conditions.	CS #10. Provide scientifically sound nutritional counseling and education. CS #1. Develop and implement a comprehensive athletic health care administrative system.
Injury	Protective responses	Player size and speed	Field condition	Rules enforcement
After injury	CS #8. Facilitate rehabilitation and reconditioning.	Exposure to repeat trauma	CS #4. Develop and implement a comprehensive emergency action plan. CS #7. Provide for on-site recognition, evaluation, and immediate treatment of injury and illness, with appropriate referrals.	CS #9. Provide for psychosocial consultation and referral.

*Consensus Statement # (revised)

FIGURE 1.


AHCT
Medical Physician Director*
On-Site Personnel
Certified Athletic Trainer*
Emergency Medical Services Personnel
Sponsoring Organizatior.
Parents
Administrators
Coaches
Athletes
Family (Personal) Physicians
Orthopaedists
Primary Care Physicians
Consulting Medical Specialists
Physical Therapists
Registered Nurses
Physician's Assistants
School Guidance Counselors
Registered Dietitians
Dentists
Other Allied Health Care Professionals

*Denotes core members of the AHCT

APPENDIX A. CONSENSUS STATEMENT

APPROPRIATE MEDICAL CARE FOR SECONDARY SCHOOL–AGE ATHLETES

CONSENSUS STATEMENT

(Revised April 2004)

Mission Statement

Establish recommendations for the prevention, care, and appropriate management of athletic-related injury and illnesses specific to the secondary school–age individual.

Athletic Health Care Team

The athletic health care team (AHCT) may be composed of appropriate health care professionals in consultation with administrators, coaches, parents, and participants. Appropriate health care professionals could be certified athletic trainers, team physicians, consulting physicians, school nurses, physical therapists, emergency medical services (EMS) personnel, dentists, and other allied health care professionals.

Recommendations for Appropriate Medical Care

Appropriate medical care of the secondary school–age individual involves more than basic emergency care during sports participation. It encompasses the provision of many other health care services. While emergency medical care and event coverage are critical, appropriate medical care also includes activities of ongoing daily athletic health care.

Organizations sponsoring athletic programs for secondary school–age individuals should establish an AHCT that functions to ensure appropriate medical care is provided for all participants.

The AHCT should have a designated athletic health care provider(s) who is educated and qualified to

1. Participate in the development and implementation of a comprehensive athletic health care administrative system (e.g., personal health information, policies and procedures, insurance, referrals).
2. Determine the individual's readiness to participate.
3. Promote safe and appropriate practice, competition, and treatment facilities.
4. Advise on the selection, fit, function, and maintenance of athletic equipment.
5. Develop and implement a comprehensive emergency action plan.

6. Establish protocols regarding environmental conditions.
7. Provide for on-site recognition, evaluation, and immediate treatment of injury and illness, with appropriate referrals.
8. Facilitate rehabilitation and reconditioning.
9. Provide for psychosocial consultation and referral.
10. Provide scientifically sound nutritional counseling and education.
11. Develop injury and illness prevention strategies.

Education

Designated athletic health care providers shall maintain expertise through continuing education and professional development.

All coaches should be trained in first aid, cardiopulmonary resuscitation (CPR), and automated external defibrillator (AED) use; utilization of AHCT professionals; injury prevention; and modification of training in response to injury and illness.

DEFINITIONS

Certified athletic trainer: An allied health care professional who, on graduation from an accredited college or university, and after successfully passing the National Athletic Trainers' Association Board of Certification (NATABOC) examination, is qualified and appropriately credentialed according to state regulations to work with individuals engaged in physical activity in the prevention of injuries and illnesses; the recognition, evaluation, and immediate care of injuries and illnesses; the rehabilitation and reconditioning of injuries and illnesses; and the administration of this health care system. This individual must have current certification in cardiopulmonary resuscitation (CPR) and be qualified in first aid and blood-borne pathogens. Other health care professionals with equivalent certification and/or licensure would also meet this standard.

Team physician: The team physician must have an unrestricted medical license and be an MD or a DO who is responsible for treating and coordinating the medical care of athletic team members. The principal responsibility of the team physician is to provide for the well-being of individual athletes, enabling each to realize his or her full potential. The team physician should possess special proficiency in the care of musculoskeletal injuries and medical conditions encountered in sports. The team physician also must actively integrate medical expertise with that of other health care providers, including medical specialists, athletic trainers, and allied health professionals. The team physician must ultimately assume responsibility within the team structure for making medical decisions that affect the athlete's safe participation.

(Reference: Team Physician Consensus Statement, http://www.acsm.org.)