

# Give your sports physicals a performance boost

A new evidence-based guideline can help you improve your approach to the preparticipation physical. Two downloadable forms can streamline the process.

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## **PRACTICE RECOMMENDATIONS**

› Cover the 12 components of the preparticipation physical evaluation (PPE) recommended by the American Heart Association to screen young athletes for potentially life-threatening cardiovascular disease. **(B)**

› Perform a genitourinary exam as part of the PPE for young men; assess young women for the criteria associated with the female athlete triad. **(C)**

› Perform auscultation while the patient is squatting and while doing the Valsalva maneuver to determine whether any murmurs you detected on examination are associated with hypertrophic cardiomyopathy. **(B)**

### Strength of recommendation (SOR)

- (A)** Good-quality patient-oriented evidence
- (B)** Inconsistent or limited-quality patient-oriented evidence
- (C)** Consensus, usual practice, opinion, disease-oriented evidence, case series

**W**ith preparticipation physical evaluations (PPEs) required for competitive athletic activities at colleges nationwide<sup>1</sup> and at high schools and middle schools in the vast majority of states,<sup>2</sup> the start of a new school year often brings a barrage of student visits. Yet despite this almost universal requirement, there is no universal standard for the PPE.

There is, however, a new evidence-based guideline. *Preparticipation Physical Evaluation*, 4th edition,<sup>3</sup> released earlier this year, was created by the American Academy of Family Physicians, American Academy of Pediatrics, American College of Sports Medicine, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine, and American Osteopathic Academy of Sports Medicine.

This guideline describes how to conduct a thorough medical history and a targeted physical exam, with a focus on activity-related risks to various organ systems. Regardless of the specific activity the student is interested in pursuing, however, emphasis on cardiac, neurological, and musculoskeletal systems is crucial because of the frequency and gravity of complications.

## **Help with the medical history: A downloadable form**

The history is the most important part of the PPE, which should be scheduled at least 6 weeks before the sports season starts to allow time for follow-up testing or consultation. A form (which can be downloaded along with a physical exam form from the American College of Sports Medicine's [ACSM] Web site at <http://www.ppesportsevaluation.org/body.html>) features 54 questions, which cover a range of organ systems and highlight areas of common sports injury and disability. The answers to these questions alone can identify 75% of problems affecting athletes,<sup>3</sup> including chronic conditions and medications that may require adjustment or closer monitoring.

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**> Cervical cord neuropraxia—characterized by a history of numbness or weakness in more than 1 extremity—requires further evaluation for spinal stenosis and cervical and spinal cord injury.**

**Start with the cardiovascular system**

As many as 85% of sudden deaths in young athletes are related to underlying cardiac abnormalities, according to a 10-year study of 150 such cases.<sup>4</sup> Indeed, sudden cardiac death occurs in approximately 1 in 200,000 high school athletes.<sup>5,6</sup> Not surprisingly, those engaged in high-intensity activity are at highest risk.<sup>7</sup>

Thus, screening school-aged athletes for potential causes of sudden cardiac death is a primary objective of the PPE.<sup>3</sup> The American Heart Association (AHA) recommends a 12-part evaluation (TABLE 1) of the heart, with 8 history questions and 4 physical exam components, to properly screen for cardiac disease in the young athlete.<sup>8</sup> Syncope, chest pain, and dyspnea, particularly if associated with exertion, may be signs of underlying cardiac disorders that warrant confirmatory testing;<sup>5</sup> a family history of premature death or disability from cardiac disease indicate a need for additional testing, as well. Further evaluation normally entails a combination of cardiac testing and consultation with a cardiologist.

■ **Ask about asthma, including exercise-induced asthma (EIA).** Identifying any respiratory conditions is vital to ensure adequate treatment and optimal performance. Patients with EIA are normally asymptomatic at rest, with no disturbance of peak expiratory flow. The presence of cough, chest tightness, wheezing, dyspnea, or loss of endurance during exercise suggests an EIA diagnosis.<sup>9</sup> If a patient reports any such symptoms, order pulmonary function tests for confirmation.

EIA affects between 10% and 50% of athletes, depending on the sport.<sup>10</sup> In up to 80% of athletes with EIA, use of inhaled short-acting beta-agonists prior to participation can help to prevent symptoms.<sup>9</sup> Any athlete who reports symptoms of asthma, whether or not it is exercise-induced, requires treatment to prevent serious respiratory sequelae.

**Take a neurologic history**

The neurologic system is highly susceptible to injury during sports activity. Identifying a history of concussion, nerve injury, or neurologic deficit is important both to prevent future injury and to avoid worsening of a current disability.

Always ask about transient neuropraxia, also known as a “stinger” or “burner”—a

traction or compression injury to the nerves of the brachial plexus or cervical nerve roots that is sustained by 50% to 65% of college football players.<sup>11</sup> The injury causes numbness, weakness, or both, in an upper extremity. Although symptoms are commonly transient, the injury may be severe enough to cause more prolonged symptoms; about 5% to 10% of the time, symptoms related to transient neuropraxia persist for hours to weeks.<sup>11</sup>

A history of numbness or weakness that occurs simultaneously in more than 1 extremity is suggestive of underlying cervical cord neuropraxia.<sup>12</sup> Patients with such symptoms require further evaluation for the presence of spinal stenosis, cervical ligamentous injury, and spinal cord injury before being cleared to participate in sports.

■ **Concussion is a common neurologic insult** among competitive athletes (See “Update on concussion: Here’s what the experts have to say,” on page 428), accounting for anywhere from 6.5% to 18.5% of injuries in collegiate contact sports.<sup>1,13</sup> Identifying students who have had head injuries and are therefore at increased risk for future concussion is a key function of the PPE.<sup>13,14</sup>

An individual who suffers even a mild head injury prior to full resolution of an initial concussion is at risk for second impact syndrome—a devastating brain injury that causes a loss of autoregulation of cerebral blood flow, leading to rapid swelling, herniation, and death. Thus, any athlete with a recent history of concussion requires further evaluation—and disqualification from play until symptoms fully resolve. In fact, anyone with a history of concussion—recent or not—may need neuropsychologic testing to assess baseline level of cognitive function. Thorough documentation is critical in such cases. In the event of a repeat concussion, having this information may assist with treatment and return-to-play decisions.

■ **Review other significant findings** noted on the history form. Follow up, as needed, with questions about any missing or dysfunctional organ or bodily system (The ACSM Web site includes a supplemental history form for athletes with special needs to document additional details, if necessary).

In some cases, protective equipment may be sufficient (a student with defective vision in 1 eye can wear protective eyewear to prevent injury to the other eye, for instance). In other cases, a conversation with the patient and his or her family regarding the risk of serious injury may be in order. Parents of a child with only 1 kidney, for example, should be advised that contact sports pose a small, but real risk of damage to that kidney, potentially resulting in the need for dialysis.

### Take the opportunity to discuss body image, mental health

For many adolescents—up to 50%, by some counts<sup>15</sup>—the PPE is their only interaction with a clinician. Thus, it provides a good opportunity for you to talk to young athletes about such sensitive topics as high-risk behaviors, mental health issues, body image, and personal safety. To help ensure that students feel free to talk openly, the new PPE forms have removed key questions about high-risk behaviors from the patient history (which requires a parent's signature). Instead, a series of questions is listed under the heading "physician reminders" at the top of the form for the physical exam,<sup>3</sup> which is typically conducted in a private setting.

■ **Overweight? Underweight?** Height and weight, a standard part of the physical along with blood pressure and pulse rate, may clue you in to the existence of an eating disorder. Calculate body mass index (BMI), looking for students who are underweight (BMI <19 kg/m<sup>2</sup>) or overweight (BMI >25 kg/m<sup>2</sup>). Overweight athletes are at increased risk for heat illness and may need a preseason conditioning program.<sup>16</sup> Underweight athletes—particularly young women—may be at additional risk.

■ **Female athlete triad.** When examining young women, be alert to signs and symptoms of the female athlete triad, a syndrome of disordered eating, amenorrhea, and osteopenia or osteoporosis. This related spectrum of medical problems can pose a significant health risk, as it involves a cycle of low energy intake that "turns off" the reproductive cycle and creates a hypoestrogenic state. The lack of estrogen has a devastating effect on bone mineral resorption and can lead to osteopenia.<sup>17</sup>

TABLE 1

## Ask these 12 questions during cardiovascular screening<sup>5</sup>

### Personal history

#### Has the patient had:

1. exertional chest pain/discomfort?
2. unexplained syncope/presyncope?
3. excessive exertional and unexplained dyspnea/fatigue?
4. a heart murmur?
5. elevated systemic blood pressure?

### Family history

#### Has a family member:

6. died prematurely (sudden or unexpected) before age 50 due to heart disease?
7. suffered a disability from heart disease before age 50?
8. been diagnosed with a cardiac condition, such as hypertrophic or dilated cardiomyopathy, long QT syndrome, ion channelopathies, or Marfan syndrome?

### Physical exam

#### Does the patient have:

9. a heart murmur?
10. femoral pulses?
11. physical stigmata of Marfan syndrome?
12. brachial artery blood pressure?

While the prevalence of the female athlete triad is low in the general population, 1 study noted that nearly 6% of young female athletes met the criteria for 2 of the 3 components of the triad, and as many as 20% had at least 1.<sup>18</sup>

### Is eye protection needed? Ear plugs?

Check vision in each eye, both with and without corrective lenses. A student whose corrected vision is 20/50 or worse in 1 eye qualifies as functionally one-eyed—and must wear full eye protection during athletic activities.<sup>19</sup> Document pupil size for all patients to ensure that anisocoria is not confused with a neurological insult in the event of a sports injury.

■ **Water sports?** Examine the nares, inspecting the septum for signs of deviation or perforation. This portion of the exam, however, can be tailored to the type of sport in which the patient plans to participate. Students who



As many as 20% of female athletes have 1 aspect of the female athlete triad.

**TABLE 2**

**Hypertension in children:  
 Is it significant or severe?<sup>24</sup>**

Age	Significant HTN (mm Hg)	Severe HTN (mm Hg)
<b>6-9 y</b> Systolic Diastolic	122-129 78-85	>129 >85
<b>10-12 y</b> Systolic Diastolic	126-133 82-89	>133 >89
<b>13-15 y</b> Systolic Diastolic	136-143 86-91	>143 >91
<b>16-18 y</b> Systolic Diastolic	142-149 92-97	>149 >97

HTN, hypertension.

expect to be on a swim team or participate in other water sports require an evaluation of the ears, including the tympanic membranes and external auditory canals. Swimming and humid environments are risk factors for otitis externa, and repeated cold water exposure is a risk for the development of external auditory exostoses.<sup>20,21</sup> A swimmer with perforated tympanic membranes should be advised to wear ear plugs to protect the middle ear.

■ **Is the patient a wrestler?** Pay close attention to the ears of any student who plans to join a wrestling team, documenting the absence—or presence—of cauliflower ear. A notation about the presence of this ear-deforming condition in the medical record ensures that any new auricular hematoma can be evaluated and treated with knowledge of the prior injury.

**Cardiac findings that warrant further work-up**

Elevated blood pressure, the most common cardiovascular abnormality in people participating in competitive sports,<sup>22</sup> is categorized in stages as defined by the Second Task Force on Blood Pressure Control in Children<sup>23</sup> and the Joint National Commission VII for adults ages 18 and older.<sup>24</sup> Children with significant hypertension (TABLE 2) and adults with stage I hypertension (140-159/90-99 mm Hg) may participate as long as there is no indication of end organ disease. A child with severe hyper-

tension or an adult with stage II hypertension (>159/99 mm Hg), however, should not be cleared for participation until he or she has had further evaluation and treatment.<sup>22,25</sup>

Similarly, any patient with an elevated heart rate needs a medical work-up prior to participation to determine the underlying cause of tachycardia.<sup>22</sup> This may be a sign of an underlying cardiac arrhythmia or another medical condition that must be treated prior to athletic competition.

■ **Auscultate the heart** to screen for underlying cardiac disease. Listen to all 4 standard regions, with the patient in both a supine and a standing position. If you detect a murmur, perform auscultation while the patient squats and while performing the Valsalva maneuver. The murmur of hypertrophic cardiomyopathy (HCM)—the key cause of sudden cardiac death—is systolic, increasing with standing and the Valsalva maneuver and decreasing with squatting and a supine position. Any murmur that is 3/6 or greater in sound or has characteristics of HCM needs further evaluation before the patient can be cleared for sports activities. (See “Hypertrophic cardiomyopathy: Ask athletes these 9 questions,” *J Fam Pract.* 2009;58:576-584).

■ **Palpate the femoral pulses.** Absence of, or decreased, femoral pulses compared with brachial pulses may suggest coarctation of the aorta.

**Check lungs, abdomen, and skin**

**Auscultate the lungs**, which should be clear and absent of adventitious or diminished breath sounds. Any patient with abnormal breath sounds requires further evaluation and/or treatment before being cleared for sports participation.

■ **Examine the abdomen** to assess the presence of organomegaly. Enlargement of the liver and spleen may be a sign of an underlying disease process. Mononucleosis, which causes splenomegaly, is associated with a 0.1% to 0.2% rate of rupture that may be related to trauma or the Valsalva maneuver.<sup>26</sup> Athletes with organomegaly should not be cleared for athletic activity without further evaluation.<sup>3</sup>

■ **Perform a genitourinary examination on young men.** Check for the presence of both testicles and palpate for masses and in-

guinal hernias. A patient with a solitary testicle will require protective gear during certain sporting events to prevent injury.<sup>27</sup>

■ **Assess the condition of the skin.** In this case, the activity the student plans to pursue will determine the extent of the examination. Skin condition is particularly important for wrestlers, as the close contact involved predisposes the athletes to infectious skin conditions. Molluscum contagiosum, tinea corporis, and herpes gladiatorum, in particular, should be treated before the student is cleared to participate in wrestling. Regardless of the sport involved, however, identify chronic skin problems and institute prophylaxis, as needed.

#### Conduct a general musculoskeletal exam

A brief evaluation of strength and mobility of each joint and muscle group is sufficient to determine if a student has adequate baseline musculoskeletal function to compete.<sup>3</sup> A joint-specific exam will not only help to assess the particular function and stability of each joint, but may reveal subtle deficits of particular joints or muscle groups that may be amenable to rehabilitation or other treatments prior to the start of the sport season.

The emphasis here, too, may vary based on the sport the patient plans to participate in. If you examine the ankles of a volleyball or soccer player and find ligamentous laxity from a prior injury, for example, consider prescribing a brace or physical therapy.

■ **Follow up with a neurologic exam,** which is often paired with the musculoskeletal exam and is considered adequate if the patient possesses full strength in all muscle groups. A patient with a history of multiple stingers may warrant a more detailed examination of strength, reflex, and sensation in the upper extremities to screen for signs of residual nerve injury. Similarly, a patient with a history of multiple concussions may need a more detailed exam that includes the cranial nerves, evaluation of balance, and possibly baseline neuropsychological testing.

#### Screen for Marfan syndrome

This genetic disorder involves mutations of the fibrillin gene that lead to a diverse presentation of abnormalities in multiple organ systems. Primarily because of the effects of

Marfan syndrome on the cardiovascular system, it is important to identify it as part of the PPE. Individuals with this disorder have an increased risk for valvular disorders and for aortic dilation that can lead to dissection or rupture. If the history reveals that the patient has a family member with this disorder or has a history of spontaneous pneumothorax or mitral valve prolapse, look closely for the following skeletal and cardiac abnormalities:

- pectus carinatum or excavatum
- arm span-to-height ratio >1.05
- arachnodactyly
- pes planus
- scoliosis
- reduced elbow extension
- highly arched palate
- murmur of mitral valve prolapse or regurgitation.

If you find any of these abnormalities, postpone sports clearance until the patient undergoes further evaluation.<sup>28</sup> To establish a diagnosis of Marfan syndrome, the patient must have major criteria in 2 organ systems, with involvement of a third system.

#### Make a determination: Should the patient be cleared?

The final part of the PPE, of course, is your decision as to whether the patient should be cleared to engage in competitive activities. Clearance falls into 4 categories: (1) Clearance without restriction; (2) clearance with recommendations for further evaluation or treatment; (3) not cleared; restricted until completion of further testing/consultation; (4) complete restriction from certain or all sports.

The goal of the PPE is to provide safe participation in sports for all athletes, not to disqualify anyone. Fortunately, the vast majority of student athletes qualify for clearance without restriction. About 3% to 10% of those who undergo preparticipation screening require further evaluation prior to sports clearance, and less than 1% are disqualified.<sup>3</sup>

■ **Being prevented from participating in sports can be a major stressor** that interferes with the student's sense of well-being. The inability to exercise or participate in organized sports poses a risk to the patient's overall

➤ **Patients with Marfan syndrome are at risk for aortic dilation that can lead to dissection or rupture, and are predisposed to valvular disorders.**

**Being restricted from playing organized sports may be as stressful to a student as the death of a close friend.**

health, and may contribute to social isolation. In fact, being restricted from playing organized sports has been reported to be as stressful as the death of a close friend.<sup>29</sup>

■ **Help in making the determination.** Nonetheless, there are circumstances when restriction is necessary. In addition to the new PPE, there are 2 sources you can turn to for help in making that determination. The Bethesda guidelines—*Eligibility Recommendations for Competitive Athletes with Cardiovascular Abnormalities*, published by the American College of Cardiology and available at <http://content.onlinejacc.org/cgi/content/full/45/8/1318>, call for disqualifying students only when the activity would pose a clear danger to their health.<sup>23</sup>

The American Academy of Pediatrics (AAP) has published a set of sports participation guidelines of its own (available at [http://www.guideline.gov/summary/summary.aspx?doc\\_id=13439](http://www.guideline.gov/summary/summary.aspx?doc_id=13439)) for children with conditions that range from diabetes mellitus and human immunodeficiency virus to mitral valve prolapse, rheumatoid arthritis, and bleeding disorders. There are, of course, some disorders for which the AAP would disqualify students from participation, but in many cases it recommends a “qualified Yes.”<sup>27,30</sup> **JFP**

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