The Preparticipation Examination (PPE): The Primary Care Provider’s Survival Guide

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The information presented in this activity represents the opinions of the author and not those of the Department of Defense or the Uniformed Services University.

Francis G. O’Connor, MD, MPH, has no financial interests or relationships to disclose.
John is a rising High School Senior

• John is a 17/o male being seen for his PPE.
• He is a multiple sport athlete and intends to play football, basketball and track.
• He has potential for a college scholarship as a wide receiver.
• **Practice starts tomorrow.**
You have a Resident helping with Preparticipation Examinations

- Jason is a third year Resident in Family Medicine helping you with PPEs.
- Jason has lots of questions!
Objectives

- **Identify** Standard of Care Resources for performing preparticipation examination (PPE)
- **Discuss** the Purpose, Timing, Frequency and Setting of the PPE
- **Identify and Discuss** history questions on the PPE **not to miss**!
- **Identify and Discuss** physical examination findings on the PPE **not to miss**!
- **Discuss** the role of **Special Tests**
- **Discuss** common Clearance Issues
What Resources Address the PPE?

- Jason inquires as to what references and resources he should be familiar with in assisting you with the PPEs?
Preparticipation Examination Resources
American Academy of Family Physicians
American Academy of Pediatrics
American College of Sports Medicine
American Medical Society for Sports Medicine
American Orthopedic Society of Sports Medicine
American Osteopathic Academy of Sports Medicine
Preparticipation Physical Evaluation

History Form

(Note: This form is to be filled out by the patient and parent prior to seeing the physician. The physician should keep this form in the chart.)

Date of Exam: ______________________ Date of birth: ______________________

Sex: ____________________________ Age: ____________________________
Grade: ____________________________ School: ____________________________
Sport(s): ____________________________

Medicines and Allergies: Please list all of the prescription and over-the-counter medicines and supplements (herbal and nutritional) that you are currently taking.

Do you have any allergies? Yes ☐ No ☐ If yes, please identify specific allergies below:

☐ Medicines ☐ Pollens ☐ Food ⬤ Stinging Insects

Explain "Yes" answers below. Circle questions you don't know the answers to.

GENERAL QUESTIONS
1. Has a doctor ever directed or restricted your participation in sports for any reason? Yes ☐ No ☐
2. Do you have any ongoing medical condition(s)? If yes, please identify below:
   ☐ Asthma ☐ Diabetes ☐ Heart Disease
   ☐ Other:
3. Have you ever spent the night in a hospital? Yes ☐ No ☐
4. Have you ever had surgery? Yes ☐ No ☐

HEART HEALTH QUESTIONS ABOUT YOU
5. Have you ever passed out or nearly passed out during or after exercise? Yes ☐ No ☐
6. Have you ever fainted, felt dizzy, had shortness of breath or chest pain? Yes ☐ No ☐
7. Does your heart ever race or skip beats (irregular heartbeats) during exercise? Yes ☐ No ☐
8. Have you ever been told you have any heart problems? If yes, check all that apply:
   ☐ High blood pressure ☐ A heart murmur
   ☐ High cholesterol ☐ Kawasaki disease
   ☐ Other:
9. Have you ever had a heart test ordered for you? For example, EKG/ECG, echocardiogram
10. Do you get shortness of breath more than expected during exercise? Yes ☐ No ☐
11. Have you ever been diagnosed with an unexplained heart murmur? Yes ☐ No ☐
12. Do you get more tired or less breath more quickly than your friends during exercise? Yes ☐ No ☐

HEART HEALTH QUESTIONS ABOUT YOUR FAMILY
13. Has any family member or relative died of heart problems or had an unexpected or unexplained sudden death before age 50 (including drowning, unexplained sudden death in infancy, infant death syndrome, SIDS)? Yes ☐ No ☐
14. Does anyone in your family have hyperthyroidism or hypothyroidism? Marfan's syndrome, atrioventricular canal defect, long QT syndrome, atrial septal defect, aortic valve stenosis, coarctation of the aorta, polyhydramnios, or multiple congenital anomalies? Yes ☐ No ☐
15. Does anyone in your family have a heart problem, pacemaker, or implantable defibrillator? Yes ☐ No ☐
16. Has anyone in your family had unexplained death, unexplained weakness, or near drowning? Yes ☐ No ☐

BONE AND JOINT QUESTIONS
17. Have you ever had an injury to a bone, muscle, ligament, or tendon that caused you to miss a game or a practice? Yes ☐ No ☐
18. Have you ever had any broken bones or dislocated joints? Yes ☐ No ☐
19. Have you ever had any injury that required x-rays, MRI, CT scan, injections, therapy, a brace, cast, or crutches? Yes ☐ No ☐
20. Have you ever had a stress fracture? Yes ☐ No ☐
21. Have you ever been told that you have or have had an injury on your way for fresh activity or obtained sports injury? Yes ☐ No ☐
22. Do you regularly use a brace, orthotics, or other assistive device? Yes ☐ No ☐
23. Do you have a bone, muscle, or joint injury that bothers you? Yes ☐ No ☐
24. Do any of your joints become painful, swollen, or feel warm or tender? Yes ☐ No ☐
25. Do you have any history of pediatric arthritis or connective tissue disease? Yes ☐ No ☐

Explain "Yes" answers here.

MEDICAL QUESTIONS
26. Do you have asthma or are you at risk for developing asthma? Yes ☐ No ☐
27. Have you ever had an aneurysm or aortic dissection? Yes ☐ No ☐
28. Have you ever had an aneurysm or aortic dissection? Yes ☐ No ☐
29. Have you ever been told you have or have had an injury on your way for fresh activity or obtained sports injury? Yes ☐ No ☐
30. Have you ever had a heart attack or had chest pain? Yes ☐ No ☐
31. Have you ever had any heart tests ordered for you? For example, EKG/ECG, echocardiogram
32. Do you have any other condition that you, your doctor, or your physician feels is important? Yes ☐ No ☐
33. Have you ever had a heart test ordered for you? For example, EKG/ECG, echocardiogram
34. Have you ever had a heart test ordered for you? For example, EKG/ECG, echocardiogram
35. Have you ever had a heart test ordered for you? For example, EKG/ECG, echocardiogram

Explain "Yes" answers here.

PHYSICIAN REMINDERS
1. Consider additional questions on more sensitive issues:
   a. Do you feel distracted due to a list of pressures?
   b. Do you ever feel sad, hopeless, depressed, or purposeless?
   c. Do you feel that there is no way out or no hope for your future?
   d. Have you ever felt like committing suicide or attempted to harm yourself?
   e. During the past 30 days, did you use tobacco, alcohol, or illegal drugs?
   f. Do you drink alcohol or use any other drugs?
   g. Have you ever taken blood pressure medication or used any other performance supplement?
   h. Have you ever taken any supplements to help you gain or lose weight or improve your performance?
   i. Do you use a weight belt, use a helmet, and use Cardio-Pulmonary

   j. Consider reviewing questions on cardiovascular symptoms (questions 5-14)

EXAMINATION

Height: ____________________________ Weight: ____________________________

Age: ____________________________ M/F: ____________________________

Date of Birth: ____________________________

EXAMINATION

Heart rate: ____________________________ Respiratory rate: ____________________________

Systolic blood pressure: ____________________________ Diastolic blood pressure: ____________________________

Physician's signature: ____________________________ Date: ____________________________

I certify that the above student has been medically evaluated for participation in athletics and deemed:

☐ Eligible for participation
☐ Eligible for participation with modification
☐ Not recommended for participation

Date: ____________________________

Signature of physician: ____________________________
46th Bethesda Conference: Recommendations for Determining Eligibility for Competition in Athletes with Cardiovascular Abnormalities

Maron BJ, Zipes DP, Kovacs RJ; American Heart Association Electrocardiography and Arrhythmias Committee of Council on Clinical Cardiology, Council on Cardiovascular Disease in Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and American College of Cardiology.

Recommendations for Determining Eligibility for Competition in Athletes with Cardiovascular Abnormalities 2015

- 15 Distinct Task Force Reports
The Cardiovascular Preparticipation Evaluation (PPE) for the Primary Care and Sports Medicine Physician, Part I

Editors: Irfan M. Asif, MD; William O. Roberts, MD, MS, FACSM; Michael Fredericson, MD, FACSM; and Vic Froelicher, MD

Purpose: To provide a rational approach to positive responses to the American Heart Association (AHA) 12-Step Questionnaire and fourth-edition “Preparticipation Physical Evaluation” (PPE) monograph for assessing cardiovascular (CV) risk in athletes. This will assist primary care and sports medicine physicians in determining the need for the following:

1. Follow-up questions to a positive response that will enhance the history and help determine whether a condition that puts an athlete at increased CV risk exists
2. Any basic diagnostic tests to further assess the athlete and that will assist with making an informed decision
3. The need for a consultation or referral to an appropriate specialist

Our goal is to help the primary care and sports medicine physician with the critical decision-making regarding positive responses to the AHA 12-Step Questionnaire and criteria for athlete clearance, as follows:

1. Could this be a potentially lethal problem?
2. Does this need additional workup or just an electrocardiogram?
3. Does this require consultation with a specialist (and which specialty)?

For example, to address a positive response to the question regarding “excessive shortness of breath or fatigue with exercise beyond what is expected for your level of fitness,” it would be useful for physicians to know which elements in the history, physical, or diagnostic tests point to a potentially lethal CV diagnosis versus an easily treated pulmonary issue like exercise-induced asthma. If a lethal diagnosis can be excluded, the responsible physician may be able to determine that no restriction is warranted and clear the athlete for appropriate activity without a referral to a cardiologist or another specialist.

While there are some differences in the questions from the AHA 12 points and the CV questions in the PPE fourth-edition monograph, the underlying intent is the same and the focus of this special communication. Cardiac events during sporting events, albeit rare, can be fatal, and these events are often very public (5,7,10). In the United States, most athlete PPE for ages 6 to 24 years are performed by family physicians and pediatricians (8), some with subspecialty training in sports medicine. Often, the PPE is the first encounter with the health care system for adolescents and serves as the sole opportunity for general screening, risk factor evaluation, and health education. This may be especially true for adolescents in lower income areas. The PPE is intended to reduce the risk of adverse outcomes without unduly restricting athlete participation. A thorough history examination can uncover a large portion of the athlete’s risk for injury or illness, and the physical examination uncovers other abnormalities. There are very few proven screening methods that assure an athlete’s health, but the PPE provides a framework to assess and stratify sport participation risk. The intent of these evaluations is to deliver to health care providers pertinent information to educate athletes and parents and enable them to make an informed participation decision.

The first PPE monograph was published in 1992 by five organizations (American Academy of Family Physicians, American Academy of Pediatrics, American Medical Society for Sports Medicine, American Orthopedic Society for Sports Medicine, and American Osteopathic Academy of Sports Medicine). The American College of Sports Medicine joined for the third edition in 2005, and the fourth edition was published in 2010 (1). The American Heart Association (AHA) developed CV preparticipation screening recommendations for young athletes in 1996 and updated the statement in 2007 (8). The AHA and the American College of Cardiology have reaffirmed their position regarding the CV PPE and electrocardiography (ECG) screening in healthy 12- to 23-year-old young people with a comprehensive review that endorses the 12-element history and physical examination in the 2014 Scientific Statement (9). This recent document added two elements regarding palpitations and previous evaluations similar to those in the fourth PPE. The question sets from the two examination recommendations are similar, and the fourth PPE monograph uses the same general questions, with some differences in syntax and depth of question content. The question wording of the third PPE monograph and the school athlete focus (safety) of the fourth question sets are subjected to scientific review and poor compliance rates and the AHA considers the PPE and the AHA
### SORT: KEY RECOMMENDATIONS FOR PRACTICE

<table>
<thead>
<tr>
<th>Clinical recommendation</th>
<th>Evidence rating</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparticipation physical evaluations should occur approximately six weeks before activity to allow for further evaluation, treatment, or rehabilitation as needed.</td>
<td>C</td>
<td>4</td>
</tr>
<tr>
<td>All persons undergoing preparticipation physical evaluations should be questioned about exertional symptoms, the presence of a heart murmur, symptoms of Marfan syndrome, and family history of premature serious cardiac conditions or sudden death.</td>
<td>C</td>
<td>13, 16</td>
</tr>
<tr>
<td>Athletes with sustained systolic blood pressure of less than 160 mm Hg and diastolic blood pressure of less than 100 mm Hg should not be restricted from playing sports.</td>
<td>C</td>
<td>25</td>
</tr>
<tr>
<td>Athletes with well-controlled asthma who are asymptomatic at rest and with exertion can be safely cleared to play sports.</td>
<td>C</td>
<td>26</td>
</tr>
<tr>
<td>Screening blood and urine tests are not recommended for asymptomatic athletes.</td>
<td>C</td>
<td>37</td>
</tr>
</tbody>
</table>

*A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to http://www.aafp.org/sort.*
Why are we doing these PPEs?

• Jason inquires as to why are we doing these PPEs, in particular on a Friday night when he may have issues with work hour restrictions?
Purpose of the PPE

• Primary Objectives:
  ▪ Screen for conditions that may be life threatening or disabling.
  ▪ Screen for conditions that may predispose to illness or injury.

• Secondary Objectives:
  ▪ Determine general health.
  ▪ Serve as an entry point to the health care system for adolescents.
  ▪ Provide an opportunity to initiate discussion on health related topics.

Timing and Frequency of the PPE

• **Timing:**
  - Ideally, the preparticipation physical evaluation (PPE) should take place four to six weeks before the season starts, permitting time to evaluate and treat medical problems and/or rehabilitate musculoskeletal injuries before sports participation.

• **Frequency:**
  - Most sports medicine clinicians recommend that the PPE be conducted before each new level of participation (eg, middle school, junior high, high school, and college), with yearly updates of the history and targeted physical examinations.
  - Requirements for the frequency of PPE vary by state, but most state high school athletic associations require annual evaluations.
  - The AHA recommends that a PPE examination be performed every two years during sports participation, with an interim history taken in the intervening years.

Setting of the PPE

- **Office setting:**
  - Examination in the office setting by the athlete's primary care provider has the advantages of privacy, continuity of care, and the provider's knowledge of past medical and family history.
  - However, the complete examination is time consuming and may have insufficient focus on the important sports-related components of the PPE.
Setting of the PPE

• Station approach:
  ▪ In the station approach, the athlete is examined by multiple examiners through a series of stations specific to individual components of the evaluation.
  ▪ The station approach is time efficient, sports oriented, and inexpensive, and has a high yield for identifying abnormalities; however, it generally does not afford confidentiality and may not provide for continuity of care.
Exertional Sudden Death in Athletes

- Jason inquires as to what are the more common causes of exertional illness we are screening for?
Sudden cardiac death in athletes is an **uncommon** event.

Risk in young athletes is approximately 1:50,000 - 100,000/yr.

Risk ranges from 1:15,000 to 1:50,000/yr in older athletes.

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Sudden cardiac arrest is the leading cause of **EXERTIONAL** death in Young Athletes!
Epidemiology of Exertional Sudden Death

- Estimated death rates in male athletes are 5X higher than in female athletes.
- Estimated death rates in college athletes are 2X higher than in high school athletes.
- Non-cardiac deaths account for 22% of deaths.
- Football and basketball account for the majority of sudden deaths.
- African Americans appear to be at greater risk.

The incidence of SCD in Division 1 male basketball athletes was 1:5200 AY.

The most common findings at autopsy were autopsy-negative sudden unexplained death in 16 (25%), and definitive evidence for hypertrophic cardiomyopathy was seen in 5 (8%).

RESULTS:

– During the 5-year period, there were 273 deaths and a total of 1,969,663 athlete participation-years.
– Of these 273 deaths, 145 (53%) were due to accidents or unintentional injury, 45 (16%) from cardiac arrest, 25 (9%) suicides, and 18 (6%) homicides.
– Motor vehicle accidents accounted for 100 accidents (69%).

CONCLUSIONS:

– Motor vehicle accidents are the most common cause of sudden death in athletes across NCAA divisions, gender, race, and sport.

An Appropriate History and Physical Examination

• Jason inquires as to appropriate questions to ask athletes as you begin the preparticipation examinations.
# Preparticipation Physical Evaluation

**History Form**

*Note: This form is to be filled out by the patient and parent prior to seeing the physician. The physician should keep this form in the chart.*

<table>
<thead>
<tr>
<th>Date of Exam</th>
<th>Date of birth</th>
</tr>
</thead>
</table>

**Medicines and Allergies:** Please list all of the prescription and over-the-counter medicines and supplements (herbal and nutritional) that you are currently taking.

<table>
<thead>
<tr>
<th>Do you have any allergies?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine</td>
<td></td>
<td></td>
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<tr>
<td>Pollen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stinging Insects</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Explain Yes answers below. Circle questions you don’t know the answers to.**

## General Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Has a doctor ever denied or restricted your participation in sports for any reason?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Do you have any ongoing medical conditions? If so, please identify below:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
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<tr>
<td>Allergy</td>
<td></td>
<td></td>
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<tr>
<td>Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Have you ever spent the night in the hospital?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Have you ever had surgery?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Heart Health Questions About You

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Have you ever passed out or nearly passed out during or after exercise?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Have you ever had a prolonged (more than 15 minutes) episode of chest pain?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Does your heart ever race or skip beats (irregular beats) during exercise?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Has a doctor ever told you that you have any heart problems? If so, check all that apply:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High blood pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A heart murmur</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High cholesterol</td>
<td></td>
<td></td>
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<tr>
<td>A heart infection</td>
<td></td>
<td></td>
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<tr>
<td>Kawasaki disease</td>
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<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Does a doctor ever order a test for your heart? For example: ECG, EKG, echocardiogram?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Do you get tired or feel more short of breath than expected during exercise?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Have you ever had unexplained dizziness?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Do you ever tire or short of breath more quickly than your friends during exercise?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Heart Health Questions about your Family

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Has any family member or relative died of heart problems or had an unexpected or unexplained sudden death before age 50 including drowning, unexplained car accident, or sudden infant death syndrome?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Does anyone in your family have hypertrophic cardiomyopathy, Marfan syndrome, amyloidosis, long QT syndrome, aortic stenosis, Mitral valve disease, polycystic kidney disease, or carotid stenosis?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Does anyone in your family have a heart problem, pacemaker, or implantable defibrillator?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Has anyone in your family had unexplained fainting, unexplained symptoms, or near drowning?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Bone and Joint Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. Have you ever had an injury to a bone, muscle, ligament, or tendon that caused you to miss a practice or a game?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Have you ever had any broken or fractured bones or dislocated joints?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Have you ever had an injury that required x-rays, MRI, CT scan, injections, therapy, a brace, a cast, or surgery?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Have you ever had a stress fracture?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Have you ever been told that you have or you have had an x-ray for neck instability or vertebrobasilar instability? (Scoliosis or deformity)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Do you regularly use a brace, aerothics, or other assistive device?</td>
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<td>23. Do you have a bone, muscle, or joint injury that bothers you?</td>
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<tr>
<td>25. Do you have any history of juvenile arthritis or connective tissue disease?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I hereby state that, to the best of my knowledge, my answers to the above questions are complete and correct.

Signature of athlete: [Signature]  
Signature of parent/guardian: [Signature]

Date: [Date]


[Form Number] 902385  5-2007 (D40)
History Questions on the PPE Not to Miss!
12 Element AHA Recommendations

- **Family History**
  - Premature death (sudden and unexpected, or otherwise) **before age 50 years** due to heart disease in a close relative
  - **Disability** from heart disease in a close relative **<50 years of age**
  - Specific knowledge of certain cardiac conditions in **family members**: hypertrophic or dilated cardiomyopathy, long QT syndrome or other ion channelopathies, Marfan Syndrome, or clinically important arrhythmias.

Personal History
- Exertional chest pain/discomfort
- Unexplained syncope/presyncope
- Excessive exertional and unexplained dyspnea/fatigue, associated with exercise
- Prior recognition of a heart murmur
- Elevated systemic blood pressure
TABLE. The 12-Element AHA Recommendations for Preparticipation Cardiovascular Screening of Competitive Athletes

<table>
<thead>
<tr>
<th>Medical history*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal history</td>
</tr>
<tr>
<td>1. Exertional chest pain/discomfort</td>
</tr>
<tr>
<td>2. Unexplained syncope/near-syncopal‡</td>
</tr>
<tr>
<td>3. Excessive exertional and unexplained dyspnea/fatigue, associated with exercise</td>
</tr>
<tr>
<td>4. Prior recognition of a heart murmur</td>
</tr>
<tr>
<td>5. Elevated systemic blood pressure</td>
</tr>
<tr>
<td>Family history</td>
</tr>
<tr>
<td>6. Premature death (sudden and unexpected, or otherwise) before age 50 years due to heart disease, in ≥1 relative</td>
</tr>
<tr>
<td>7. Disability from heart disease in a close relative &lt;50 years of age</td>
</tr>
<tr>
<td>8. Specific knowledge of certain cardiac conditions in family members: hypertrophic or dilated cardiomyopathy, long-QT syndrome or other ion channelopathies, Marfan syndrome, or clinically important arrhythmias</td>
</tr>
<tr>
<td>Physical examination</td>
</tr>
<tr>
<td>9. Heart murmur‡</td>
</tr>
<tr>
<td>10. Femoral pulses to exclude aortic coarctation</td>
</tr>
<tr>
<td>11. Physical stigmata of Marfan syndrome</td>
</tr>
<tr>
<td>12. Brachial artery blood pressure (sitting position)§</td>
</tr>
</tbody>
</table>

Table 1. The 14-Element AHA Recommendations for Preparticipation Cardiovascular Screening of Competitive Athletes

<table>
<thead>
<tr>
<th>Medical history*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal history</td>
</tr>
<tr>
<td>1. Chest pain/discomfort/tightness/pressure related to exertion</td>
</tr>
<tr>
<td>2. Unexplained syncope/near-syncopal‡</td>
</tr>
<tr>
<td>3. Excessive and unexplained dyspnea/fatigue or palpitations, associated with exercise</td>
</tr>
<tr>
<td>4. Prior recognition of a heart murmur</td>
</tr>
<tr>
<td>5. Elevated systemic blood pressure</td>
</tr>
<tr>
<td>6. Prior restriction from participation in sports</td>
</tr>
<tr>
<td>7. Prior testing for the heart, ordered by a physician</td>
</tr>
<tr>
<td>Family history</td>
</tr>
<tr>
<td>8. Premature death (sudden and unexpected, or otherwise) before 50 years of age attributable to heart disease, in ≥1 relative</td>
</tr>
<tr>
<td>9. Disability from heart disease in close relative &lt;50 years of age</td>
</tr>
<tr>
<td>10. Hypertrophic or dilated cardiomyopathy, long-QT syndrome, or other ion channelopathies, Marfan syndrome, or clinically significant arrhythmias; specific knowledge of genetic cardiac conditions in family members</td>
</tr>
<tr>
<td>Physical examination</td>
</tr>
<tr>
<td>11. Heart murmur‡</td>
</tr>
<tr>
<td>12. Femoral pulses to exclude aortic coarctation</td>
</tr>
<tr>
<td>13. Physical stigmata of Marfan syndrome</td>
</tr>
<tr>
<td>14. Brachial artery blood pressure (sitting position)§</td>
</tr>
</tbody>
</table>

Is Exertional Syncope an Important Symptom?
Seventy-two percent of SCA victims were reported by their parents to have at least one cardiovascular symptom before SCA, with fatigue (44%) and near-syncope/lightheadedness (30%) the two most common.

Twenty-four percent of SCA victims had one or more (average 2.6; range, 1 to 10) events of syncope or unexplained seizure that remained undiagnosed as a cardiac disorder before SCA.

Parents reported that cardiovascular symptoms first occurred, on average, 30 months (range, 19 to 71 months) before SCA; a symptom was brought to the attention of the child's physician in 41% of cases.

Twenty-seven percent of families reported a family member had suffered sudden death before age 50 because of a heart condition.

Not to be Forgotten!

- **Musculoskeletal Symptoms**
  - Status of rehabilitation of prior injuries

- **Concussion Symptoms**
  - Baseline symptoms

- **Respiratory Symptoms**
  - Occult asthma

- **Eating Disorders**

- **Psychologic Stress**
An Appropriate History and Physical Examination

• Jason inquires as to how detailed the physical examination needs to be?
PREPARTICIPATION PHYSICAL EVALUATION

PHYSICAL EXAMINATION FORM

**Name:** ______________________  **Date of birth:** ______________________

**PHYSICIAN REMINDERS**

1. Consider additional questions on more sensitive issues:
   - Do you feel stressed out or under a lot of pressure?
   - Do you feel sad, hopeless, depressed, or anxious?
   - Do you feel safe at your home or residence?
   - Have you ever used cigarettes, chewing tobacco, snuff, or dip?
   - During the past 30 days, did you use chewing tobacco, snuff, or dip?
   - Do you drink alcohol or use any other drugs?
   - Have you ever taken any steroids or or any other performance supplement?
   - Have you ever taken any medications to help you gain or lose weight or improve your performance?
   - Do you wear a seat belt, use a helmet, and use condoms?

2. Consider reviewing questions on cardiovascular symptoms (questions 2-11).

**EXAMINATION**

<table>
<thead>
<tr>
<th>Height</th>
<th>Weight</th>
<th>Male</th>
<th>Female</th>
<th>BP</th>
<th>Pulse</th>
<th>Vision N</th>
<th>L V</th>
<th>Corrected</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
</table>

**MEDICAL**

- 

**ABNORMAL FINDINGS**

- 

**APPEARANCE**

- 

**Eyes/ears/nose/throat**

- 

**Pupils**

- 

**Menstrual**

- 

**LYMPH NODES**

- 

**Simultaneous femoral and radial pulses**

- 

**Lungs**

- 

**Abdomen**

- 

**ABDOMINAL**

- 

**Genitourinary (males only)**

- 

**Skin**

- 

**Vision suggestive of MERSA, tinea corporis**

**NEUROLOGIC**

- 

**MUSCULOSKELETAL**

- 

**Neck**

- 

**Back**

- 

**Shoulder/arm**

- 

**Elbow/forearm**

- 

**Wrist/hand/fingers**

- 

**Hip/thigh**

- 

**Knee**

- 

**Leg/ankle**

- 

**Foot/toes**

- 

**Functional**

- 

**Duck-walk, single-leg hop**

*I certify that the above student has been medically evaluated for participation in athletics and deemed:*

1. [ ] CLEARED/WITHOUT RESTRICTIONS
2. [ ] CLEARED FOR LIMITED PARTICIPATION
   - [ ] Not cleared for (specific sports)
   - [ ] CLEARED only for (specific sports)
3. Requires further evaluation before a final recommendation
4. Not cleared for participation
   - [ ] Reasons:
5. Other recommendations:

Name of physician (printed/typed): ______________________  Date of Examination: ______________________

Signature of physician: ______________________
Performing the Cardiovascular Preparticipation Examination
Physical Examination

– Brachial Artery Blood Pressure
– Femoral Pulses to Exclude Aortic Coarctation
– Physical Stigmata of Marfan Syndrome
– Heart Murmur (Supine and standing, or Valsalva to identify murmur of dynamic left ventricle outflow obstruction)
Blood Pressure Measurement

- You need:
  - the right sized cuff;
  - pediatric blood pressure tables that are gender, age and height dependent;
  - Trained personnel.
Diagnosis:
- A diagnosis requires at least three measurements.
- 90 to 95% was high-normal, now prehypertension;
- 95% to 99% plus 5 mmHg is Stage I; Greater than 99% plus 5 mmHg is Stage II.
- The plus 5 mmHg is new from 1996.
- Ambulatory blood pressure monitoring recognized as useful in “white” coat hypertension.
Screening for Coarcation of the Aorta:

- **Simultaneous palpation** of femoral and radial pulses
- systolic blood pressure gradient between the arms and legs of greater than 10 mmHg
Marfan Syndrome Screening

- Screening recommended for men taller than 6 feet and women taller than 5’ 10”, who have two or more physical manifestations or a FH of Marfan’s Syndrome.
- Investigation should include an ECG, ECHO and slit-lamp eye examination.
- Diagnosis is clinical; made in conjunction with a regional referral center [www.marfan.org](http://www.marfan.org)
Marfan Syndrome Stigmata

- **wrist sign** - thumb overlaps the distal phalanx of the fifth digit when grasping the contralateral wrist.
- **thumb sign** - entire nail of the thumb projects beyond the ulnar border of the hand when the hand is clenched without assistance.

- [www.marfan.org](http://www.marfan.org)
- [www.MarfanDX.org](http://www.MarfanDX.org)
Physical Examination - Cardiac Auscultation

Normal:
- systolic ejection murmur
- begins after first heart sound
- ends before the second heart sound
- crescendo-decrescendo profile
- normal inspiratory S2 split
- normal dynamic assessment

Suspicious:
- diastolic, holosystolic, or continuous
- grade III or greater in intensity
- abnormal S2 splitting
- abnormal dynamic assessment
Improving Cardiac Auscultation

- Normal versus Pathologic Heart Sounds
Not to be Forgotten!

- Musculoskeletal Screening Examination
- Pulmonary Examination
- HEENT/Skin
- Abdomen/Genital Examination
- Functional Testing
Abdominal/Genitourinary
Pulmonary Auscultation
Musculoskeletal Screening Examination
Functional Testing

The Functional Movement Screen

1. Squatting
2. Stepping
3. Lunging
4. Reaching
5. Leg Raising
6. Push-up
7. Rotary Stability

Functional Movement Systems

FunctionalMovement.com
The Role of Special Tests

• Jason asks about a number of special tests that he has heard might be valuable in athletes:
  ▪ CBC and UA
  ▪ Electrocardiogram and Echocardiography
  ▪ Sickle Cell Screening
  ▪ Neurocognitive Testing
Overriding Ethical Principles

- “Beneficence”
  - is the obligations to confer benefits, to prevent and remove harms, and to weigh and balance the possible goods against the costs and possible harms of an action.

- “Non Maleficence”
  - requires an intention to avoid needless harm or injury that can arise through acts of commission or omission.
Routine laboratory testing is not recommended as part of the preparticipation physical evaluation (PPE) in the absence of symptoms.
Baseline Concussion Testing

• Pre-participation assessment. A one-time, pre-participation baseline concussion assessment for all varsity student-athletes should include, but not necessarily be limited to:
  ▪ A brain injury/concussion history.
  ▪ Symptom evaluation.
  ▪ Cognitive assessment.
  ▪ Balance evaluation.
  ▪ The team physician should determine pre-participation clearance and/or the need for additional consultation or testing.
Neurocognitive Testing

WHAT IS THE SCAT5?

The SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals. The SCAT5 cannot be performed correctly in less than 10 minutes.

If you are not a physician or licensed healthcare professional, please use the Concussion Recognition Tool 5 (CRT5). The SCAT5 is to be used for evaluating athletes aged 18 years and older. For children aged 12 years or younger, please use the CRT5.

Provisional SCAT5 baseline testing can be useful for interpreting post-injury test scores, but is not required for that purpose. Detailed instructions for use of the SCAT5 are provided on page 7. Please read through these instructions carefully before testing the athlete. Brief verbal instructions for each test are given in the tool. The only equipment required for the test is a water or timer.

This tool may be freely copied in its current form for distribution to individuals, teams, groups and organizations. It should not be altered in any way, re-branded or sold for commercial gain. Any revision, translation or reproduction in a digital form requires specific approval by the Concussion in Sport Group.

Recognise and Remove

A head impact is a direct blow or indirect transmission of force that can be associated with a serious and potentially fatal brain injury. If there are significant concerns, including any of the red flags listed in Box 5, then activation of an emergency procedure and urgent transport to the nearest hospital should be arranged.

Key points:

- Any athlete with a suspected concussion should be REMOVED FROM PLAY immediately assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If an athlete suspected of having a concussion and medical personnel are not immediately available, the athlete should be referred to a medical facility for urgent assessment.
- Athletes with suspected concussion should not drink alcohol or use recreational drugs or medication unless cleared by a medical professional.
- Concussion signs and symptoms evolve over time and it is important to consider repeat evaluation in the assessment of concussion.
- The diagnosis of a concussion is a clinical judgment, made by a medical professional. The SCAT5 should NOT be used by itself to make, or exclude, the diagnosis of concussion. An athlete may have a concussion even if their SCAT5 is "normal".

Remember:

- The basic principles of first aid (prompt, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the athlete (other than that required for airway management) unless trained to do so.
- Assessment for a spinal cord injury is a critical part of the initial on-field assessment.
- Do not remove a helmet or any other equipment unless trained to do so safely.

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Visual Ocular-Motor Testing (VOMS)

Vestibular/Ocular-Motor Screening (VOMS)

Smooth Pursuits (Horizontal & Vertical)
Tests ability to follow a slowly moving target
- Both patient and clinician are seated
- Patient follows finger with eyes
- Patient does not move head, just eyes
- 2 reps at rate of 2 sec / rep
- Rate symptoms (0-10)
- Complete for both horizontal & vertical

Saccades (Horizontal & Vertical)
Tests ability of eyes to move quickly between targets
- Both patient and clinician are seated
- Clinician holds fingers 3" apart
- Patient does not move head, just eyes
- 10 reps as quickly as possible
- Rate symptoms (0-10)
- Repeat with patient looking up-down

Convergence
Measures ability to view a near target without double vision
- Patient holds target with 14-point "X" at arm's length
- Patient brings target forward using fingers on the "X"
- Stop when their eyes double
- Clinician records distance from tip of nose to target (cm)
- Repeat 3x recordings 3
- Rate symptoms (0-10)

Visual Motion Sensitivity
Tests visual motion sensitivity & ability to adapt head to maintain balance using eyes
- Patient holds arms outstretched in front with thumbs up
- Turn body left to right in 120 deg
- Patient's eyes must follow the target
- Repeat 5x recordings
- Rate symptoms (0-10)

Vestibular-Ocular Reflex (Horizontal & Vertical)
Tests ability to stabilize vision as head moves
- Patient holds target 1" from patient's eye level
- Patient initially turns head left & right
- Keep eyes focused on target
- Use metronome 180 bpm
- Wait 15 seconds
- Rate symptoms (0-10)
- Repeat with patient looking up-down

Visit natafoundation.org/for-the-profession for more info including the NATA Foundation e-article on VOMS

Sickle Cell Screening
The National Collegiate Athletic Association (NCAA) adopted a policy requiring Division I institutions to perform sickle cell trait testing for all incoming student athletes.

Policy was partly in response to legal settlement with Dale Lloyd Case.

But then....
American Society of Hematology: ASH

- Policy **Opposes Mandatory SCT Screening** for Athletic Participation
  - Recommends universal training interventions and additional research
- Believes NCAA Division I policy, as currently written and implemented, **has potential to harm student athletes and larger community of individuals with SCT**.

Advanced Cardiac Screening
Special Tests to Include
Echocardiography and Electrocardiography are not Mandated
However, A Word About the Role of the Electrocardiogram?
“...there is INSUFFICIENT information... to support the view that universal screening ECGs in asymptomatic young people ... is appropriate or possible on a national basis for the United States, in competitive athletes or in the general youthful population...”

However

“...individual quality controlled local, community, or student-related initiatives were, however, supported by the AHA if conducted properly and with adequate resources...”
The differential risk of SCA/D between athletes and non-athletes is not fully understood based on current epidemiologic evidence.

Athletes display a differential risk for SCA/D based on age, sex, race, and sport.
Why cardiovascular screening in young athletes can save lives: a critical review

Jonathan A Drezner, Kimberly G Harmon, Irfan M Asif, Joseph C Marek

Black male college basketball athlete age 17-23

RR=19

“ Injury prevention should be given to high risk groups… ”
Roald Bahr, MD

RR=12

RR=7
Strength of Rationale for ECG Screening

- **Athlete Risk**: High
  - Incidence of SCA/D in Targeted Athlete Population

- **Resources**: Low
  - ECG Interpretation / Secondary Testing / Cardiology Partnership

- **Assessment of Benefit to Harm**: Low
  - False-positives vs. Risk Reduction

- **Requirements**: Low
  - Team or Institutional Standard / League Policy

**Strength of Rationale for ECG Screening**

*American Medical Society for Sports Medicine*

*Leading Sports Medicine into the future*
The Sad Reality: Screening is a Challenge

METHODS: From 1996 through 2016, 11,168 adolescent athletes with a mean (±SD) age of 16.4±1.2 years (95% of whom were male) in the English Football cardiac screening program; health questionnaire, physical examination, electrocardiography, and echocardiography.

RESULTS:
- During screening, 42 athletes (0.38%) were found to have cardiac disorders that are associated with sudden cardiac death.
- After screening, there were 23 deaths from any cause, of which 8 (35%) were sudden deaths attributed to cardiac disease. Cardiomyopathy accounted for 7 of 8 sudden cardiac deaths (88%).
- Six athletes (75%) with sudden cardiac death had had normal cardiac screening results.
- The mean time between screening and sudden cardiac death was 6.8 years.
- On the basis of a total of 118,351 person-years, the incidence of sudden cardiac death among previously screened adolescent soccer players was 1 per 14,794 person-years (6.8 per 100,000 athletes).

Final Assessment

• You’ve completed the PPE on John, and it’s time for the final assessment.
• Jason noted his BP was slightly high; how do you proceed with final clearance?
• He is also found to be SCT positive; can he play?
Athletic Clearance Decision

I certify that the above student has been medically evaluated for participation in athletics and deemed:

1. ☐ CLEARED WITHOUT RESTRICTIONS

2. ☐ Cleared for LIMITED PARTICIPATION
   ☐ Not cleared for (specific sports)
   ☐ Cleared only for (specific sports)

3. Requires further evaluation before a final recommendation

4. Not cleared for participation
   ☐ Reasons:

5. Other recommendations:

Name of physician (printed/typed): ____________________________ Date of Examination: ____________

Signature of physician: ____________________________

☐ CLEARED WITHOUT RESTRICTIONS

☐ Cleared for LIMITED PARTICIPATION
   ☐ Not cleared for (specific sport)
   ☐ Cleared only for (specific sport)

☐ Requires further evaluation before a final recommendation

☐ Not cleared for participation
   ☐ Reasons:

5. Other recommendations ____________________________

Name of physician (printed/typed): ____________________________ Date of Examination: ____________

Signature of physician: ____________________________
Resource Documents

2015
ACC/AHA Guidelines
Competitive Athletes with Cardiovascular Abnormalities
**Contraindicated Sports**

<table>
<thead>
<tr>
<th>Table 1. Contraindications for Sports Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active myocarditis or pericarditis</td>
</tr>
<tr>
<td>Acute enlargement of spleen or liver</td>
</tr>
<tr>
<td>Eating disorder in which athlete is not compliant with therapy and follow-up, or when there is evidence of diminished performance or potential injury because of the eating disorder</td>
</tr>
<tr>
<td>History of recent concussion and symptoms of postconcussion syndrome (no contact or collision sports)</td>
</tr>
<tr>
<td>Hypertrophic cardiomyopathy</td>
</tr>
<tr>
<td>Long QT syndrome</td>
</tr>
<tr>
<td>Poorly controlled convulsive disorder (no archery, riflery, swimming, weight lifting or powerlifting, strength training, or sports involving heights)</td>
</tr>
<tr>
<td>Recurrent episodes of burning upper-extremity pain or weakness, or episodes of transient quadriplegia until stability of cervical spine can be assured (no contact or collision sports)</td>
</tr>
<tr>
<td>Severe hypertension until controlled by therapy (static resistance activities, such as weight lifting, are particularly contraindicated)</td>
</tr>
<tr>
<td>Sickle cell disease (no high-exertion, contact, or collision sports)</td>
</tr>
<tr>
<td>Suspected coronary artery disease until fully evaluated (patients with impaired resting left ventricular systolic function less than 50%, exercise-induced ventricular dysrhythmias, or exercise-induced ischemia on exercise stress testing are at greatest risk of sudden death)</td>
</tr>
</tbody>
</table>

Prudent Recommendations

- Task Force 9
Arrhythmias

Recommendations

1. Athletes with exercise-induced syncope should be restricted from all competitive athletics until evaluated by a qualified medical professional (Class I; Level of Evidence B).

2. Athletes with syncope should be evaluated with a history, physical examination, ECG, and selective use of other diagnostic tests when there is suspicion of structural heart disease or primary electrical abnormalities that may predispose to recurrent syncope or sudden death (Class I; Level of Evidence C).

3. Athletes with syncope caused by structural heart disease or primary electrical disorders should be restricted from athletic activities according to the recommendations for their specific underlying cardiovascular condition (Class I; Level of Evidence C).

4. Athletes with neurally mediated syncope can resume all athletic activities once measures are demonstrated to prevent recurrent syncope (Class I; Level of Evidence C).

Hypertension in the Athlete

- Hypertension is the most common cardiovascular disorder detected during PPE screening.
- BP readings are altered by various factors that influence the patient, the techniques used and the accuracy of the sphygmomanometer.
- Clinical Observations:
  - Blood pressure during the PPE process is often completed by someone who does not regularly perform BPs.
  - False positive blood pressure readings are not uncommon.

Evaluation:

- All children and adolescents diagnosed with hypertension require a careful history and physical examination as well as further evaluation for a secondary etiology as clinically indicated.
  - Renal US for all children with sustained BP > 95%
- To evaluate for target organ disease:
  - Echocardiogram, as well as a retinal examination, is currently recommended for all patients with a BP > 95th percentile.
Treatment/Clearance:

– Similar to adults, any child athlete with **Stage 2 hypertension** should be restricted from participation until adequate control is obtained.

– Children with identified **target organ disease** should have participation recommendations based upon the nature of their target organ disease.
In general, student-athletes with sickle cell trait should:

- Set their own pace.

- Engage in a slow and gradual preseason conditioning regimen to be prepared for sports-specific performance testing and the rigors of competitive intercollegiate athletics.

- Build up slowly while training (e.g., paced progressions).

- Use adequate rest and recovery between repetitions, especially during “gassers” and intense station or “mat” drills.

- Not be urged to perform all-out exertion of any kind beyond two to three minutes without a breather.

- **Be excused from performance tests such as serial sprints or timed mile runs, especially if these are not normal sport activities.**

- Stop activity immediately upon struggling or experiencing symptoms such as muscle pain, abnormal weakness, undue fatigue or breathlessness.

- Stay well hydrated at all times, especially in hot and humid conditions.

- Maintain proper asthma management.

- Refrain from extreme exercise during acute illness, if feeling ill, or while experiencing a fever.

- Access supplemental oxygen at altitude as needed.

- Seek prompt medical care when experiencing unusual distress.
**Q:** Can an individual with sickle cell trait participate in athletics/exercise?

**A:** Sickle cell trait should not be an impediment for participation in athletics or physical exercise. Maintaining good hydration and understanding how to avoid injuries can make exercise safer for ALL individuals, including those with sickle cell trait.
What precautions should an individual with sickle cell trait take when participating in sports or exercise?

A: Individuals with sickle cell trait should consider the same precautions that can prevent injuries and exercise-related illnesses as people who do not have sickle cell trait. These include being mindful of heat and humidity, drinking adequate fluids, taking rest breaks as needed, and not exceeding their current level of fitness.
Final Thoughts

PPE Fifth Edition is Coming!
Conclusion

- The Preparticipation Examination (PPE) has yet to be validated as decreasing morbidity and mortality.
- At present, however, the standard of care in the United States is a carefully performed history and physical examination (PPE).
- The conscientious examination requires a trained provider, an appropriate setting, and sincere communication.

For Further Information

Please contact:

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