The 4th Pre-participation Evaluation (PPE) Monograph: Evidence in Practice

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Primary Care Sports Medicine
Excelsior Orthopaedics
Objectives

• Discuss function of PPE
  – Systems based approach for identifying limiting conditions
  – Identify most common causes of young athlete mortality and morbidity
• Review evidence for PPE
• Discuss Timing, Setting, Structure
  – Qualifications to perform
• Identify factors that determine whether to modify or restrict participation
EXAMINATION AND EVALUATION OF HIGH SCHOOL ATHLETES

THOMAS E. SHAFFER, M.D.

Competitive athletics are a conspicuous part of the American high school scene. In every community each year scores of youths are candidates for some team. Textbooks and statements about health programs in schools invariably include recommendations for health examination prior to participation in athletics. Often these medical examinations of athletes are the only contact the physicians of a community have with their schools. Very little has been written about the scope and interpretation of examination of athletes, however, and practices must very greatly from the cursory examination of the heart and skeletal system, so often carried out in public schools, to the extensive health appraisal occasionally seen in private schools.
Participation in Sports

• Multiple significant benefits obtained from exercise and sports
• Health
• Teamwork
• Confidence building
• Happiness

• When you limit participation you must weigh the potential risks versus the potential benefit of exercise
  – Adolescents rank failure to make a team worse than:
    • Death of a close friend
    • Failure to pass a grade in school
    • Separation from parents
## Sports Classification - Cardiovascular

<table>
<thead>
<tr>
<th>Increasing Static Component</th>
<th>Bobsledding/Luge*, Field events (throwing), Gymnastics*, Martial arts*, Sailing, Sport climbing, Water skiing, Weight lifting, Windsurfing</th>
<th>Body building*, Downhill skiing, Skateboarding, Snowboarding, Wrestling</th>
<th>Boxing*, Canoeing/Kayaking, Cycling†, Decathlon, Rowing, Speed-skating, Triathlon†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing Dynamic Component</td>
<td>Archery, Auto racing, Diving, Equestrian†, Motorcycling†</td>
<td>American football*, Field events (jumping), Figure skating, Rodeoing†, Rugby, Running (sprint), Surfing, Synchronized swimming†</td>
<td>Basketball*, Ice hockey*, Cross-country skiing (skating technique), Lacrosse*, Running (middle distance), Swimming, Team handball</td>
</tr>
<tr>
<td>I. Low (&lt;20% MVC)</td>
<td>Billiards, Bowling, Cricket, Curling, Golf, Riflery</td>
<td>Baseball/Softball*, Fencing, Table tennis, Volleyball</td>
<td>Badminton, Cross-country skiing (classic technique), Field hockey*, Orienteering, Race walking, Racquetball/Squash, Running (long distance), Soccer*, Tennis</td>
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<tr>
<td>II. Moderate (20-50% MVC)</td>
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<tr>
<td>III. High (&gt;50% MVC)</td>
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</tbody>
</table>

### A. Low (<40% Max O₂)  
### B. Moderate (40-70% Max O₂)  
### C. High (>70% Max O₂)  

Increasing Dynamic Component
# Sports Classification - Level of Contact

<table>
<thead>
<tr>
<th>Contact or Collision</th>
<th>Limited Contact</th>
<th>Noncontact</th>
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</thead>
<tbody>
<tr>
<td>Basketball</td>
<td>Adventure racing</td>
<td>Badminton</td>
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<tr>
<td>Boxing</td>
<td>Baseball</td>
<td>Body building</td>
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<tr>
<td>Cheerleading</td>
<td>Bicycling</td>
<td>Bowling</td>
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<tr>
<td>Diving</td>
<td>Canoeing or kayaking (white water)</td>
<td>Canoeing or kayaking (flat water)</td>
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<tr>
<td>Extreme sports</td>
<td>Fencing</td>
<td>Crew or rowing</td>
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<tr>
<td>Field hockey</td>
<td>Field events</td>
<td>Curling</td>
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<tr>
<td>Football, tackle</td>
<td>High jump</td>
<td>Dancing</td>
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<tr>
<td>Gymnastics</td>
<td>Pole vault</td>
<td>Dance</td>
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<tr>
<td>Ice hockey</td>
<td>Floor hockey</td>
<td>Field events</td>
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<tr>
<td>Lacrosse</td>
<td>Football, flag or touch</td>
<td>Discus</td>
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<tr>
<td>Martial arts</td>
<td>Handball</td>
<td>Javelin</td>
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<tr>
<td>Rodeo</td>
<td>Horseback riding</td>
<td>Shot-put</td>
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<tr>
<td>Rugby</td>
<td>Martial arts</td>
<td>Golf</td>
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<tr>
<td>Skiing, downhill</td>
<td>Racquetball</td>
<td>Orienteering</td>
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<tr>
<td>Ski jumping</td>
<td>Skating</td>
<td>Power lifting</td>
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<tr>
<td>Snowboarding</td>
<td>Ice</td>
<td>Race walking</td>
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<td>Soccer</td>
<td>In-line</td>
<td>Rifle</td>
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<tr>
<td>Team handball</td>
<td>Roller</td>
<td>Rope jumping</td>
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<tr>
<td>Ultimate Frisbee</td>
<td>Skiing</td>
<td>Running</td>
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<tr>
<td>Water polo</td>
<td>Cross-country</td>
<td>Sailing</td>
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<td>Wrestling</td>
<td>Water</td>
<td>Scuba diving</td>
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<td></td>
<td>Skateboarding</td>
<td>Swimming</td>
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<td></td>
<td>Softball</td>
<td>Table tennis</td>
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<td></td>
<td>Squash</td>
<td>Tennis</td>
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<td></td>
<td>Volleyball</td>
<td>Track</td>
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<td></td>
<td>Weight lifting</td>
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<td></td>
<td>Windsurfing or surfing</td>
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</table>
Purpose / Goals

• Purpose is not to discourage or limit participation
  – Satisfy legal and liability concerns.

• Primary Objectives – screen for “safe participation”
  – Life-threatening or disabling conditions
  – predisposition to injury or illness
    • Incompletely or improperly rehabilitated injuries
Purpose / Goals

• Secondary Objectives
  – Assess general health and fitness and appropriateness of activity
  – Serve as entry point to health system
  – Opportunity to discuss health-related topics
    • preventive medicine – tobacco, drinking and driving, STD’s, nutrition, weight control
    • performance-enhancing substance use and abuse
Qualified Individuals

- Ultimate responsibility should be with MD/DO – SOR A
- Several states allow NP/PA/DC to perform
Timing / Frequency

• 6 weeks prior to participation (SOR C)
  – Allow for proper follow up for any abnormalities while not being constrained by timing of season
  – 14% of college athletes required further evaluation based on initial PPE (Joy- CJSM, 2004)
    • Elevation blood pressure – most common medical
    • Knee – most common musculoskeletal
  – Too far in advance may miss important illnesses or injuries prior to start of the season
Timing / Frequency

• At least as often as once every two years (SORC)
  – Some sports (i.e. boxing, MMA) require PPE prior to every bout
  – 35 states require yearly exam
  – 11 states require semi-annual
  – 3 states require q 3 year evaluations
  – NCAA – comprehensive evaluation at entrance with interval / problem focused yearly re-eval
Format

Station Based Mass Screening
• Cost and time efficient
• Skill specialization
• more likely to find abnormality and refer for more testing  
  – Durant (Am J Dis Ch, 1985)
• 14% require follow up  
  – Smith (Mayo Cl Proc, 1998)
• Lack of time/privacy
• Uncomfortable environment
• Loss to follow up

Office Based Individual Examination
• Better continuity of care
• Standing patient-physician relationship
• Lack of PCP
• Limited financial means
• Differing levels of comfort making final determination of clearance
• Not the same as yearly well-child exam  
  – Different goals/objectives
Legal considerations

• HIPAA / FERPA
• Exculpatory waivers
• Informed consent
• Restriction from play
• Confidentiality and sharing of information
• Good Samaritan Laws / Volunteer Protection Act
• [Website Link](http://www.volunteersinhealthcare.org)
Who is required to have a PPE?

• 50/51 states + D.C. mandate some time of evaluation prior to scholastic sports
• No consistency as to what is included in a PPE
• Youth / non-scholastic sports?
## General questions

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

- **Every** positive finding on history or physical exam must be adequately explained and should lead to additional history taking or physical examination steps
  - Most important question – Participation limited previously?
- Impossible to achieve zero risk; generally accepted that there is small risk of illness or death in competitive sports
- Deaths are high profile in young people
- Consider separate questionnaires for parents and child
# Cardiac History

<table>
<thead>
<tr>
<th>Heart Health Questions About You</th>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
<td>5. Have you ever passed out or nearly passed out DURING or AFTER exercise?</td>
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<td>6. Have you ever had discomfort, pain, tightness, or pressure in your chest during exercise?</td>
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<td>7. Does your heart ever race or skip beats (irregular beats) during exercise?</td>
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<td>8. Has a doctor ever told you that you have any heart problems? If so, check all that apply:</td>
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<tr>
<td>- High blood pressure</td>
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<td>- High cholesterol</td>
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<td>- Kawasaki disease</td>
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<td>- A heart murmur</td>
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<td>- A heart infection</td>
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<td>- Other: __________________________</td>
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<td>9. Has a doctor ever ordered a test for your heart? (For example, ECG/EKG, echocardiogram)</td>
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<td>10. Do you get lightheaded or feel more short of breath than expected during exercise?</td>
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<td>11. Have you ever had an unexplained seizure?</td>
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<tr>
<td>12. Do you get more tired or short of breath more quickly than your friends during exercise?</td>
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<tr>
<td>Heart Health Questions About Your Family</td>
<td>Yes</td>
<td>No</td>
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<td>----------------------------------------</td>
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<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>
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<tr>
<td>14. Does anyone in your family have hypertrophic cardiomyopathy, Marfan syndrome, arrhythmogenic right ventricular cardiomyopathy, long QT syndrome, short QT syndrome, Brugada syndrome, or catecholaminergic polymorphic ventricular tachycardia?</td>
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<tr>
<td>15. Does anyone in your family have a heart problem, pacemaker, or implanted defibrillator?</td>
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<tr>
<td>16. Has anyone in your family had unexplained fainting, unexplained seizures, or near drowning?</td>
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</table>
Cardiovascular considerations

- Sudden cardiac death
- 1:75,000 athletes die suddenly during athletic events
  - In athletes under 35, 95% due to structural or electrical cardiac abnormalities
Athlete Death – Maron (Circ. 2008)
American College of Cardiologists
American Heart Association

• 2007
  – Reaffirmed position that 1996 AHA Recommendations are:
  – “the most prudent, practical, and effective screening strategies for competitive athletes in the United States”
  – Underwhelming evidence to support routine use of ECG’s in preparticipation evaluation in US
Cardiac History Evidence

- Sudden death is the first presenting sign or symptom in 60-80% of individuals
- HCM – 21% - prior cardiovascular symptoms
- Anomalous coronary artery – 44% with prodromal symptoms
- Arrhythmogenic right ventricular cardiomyopathy – 68% with prodromal symptoms
- Long QT or channelopathies – 20% have syncope
Known Cardiac Abnormalities

• 36th Bethesda conference guidelines
  – Eligibility Recommendations for Competitive Athletes With Cardiovascular Abnormalities
  – Heart Disease
    • Congenital
    • Valvular
    • Myopathic
    • Arrhythmogenic
    • Coronary artery
Exercise Related Chest Pain

• Can indicate myocardial ischemia
  – Unlikely atherosclerotic disease in the young athlete
  – Consider anomalous coronary artery
  – Exercise-induced asthma or exercise related reflux disease
  – Chest pain associated with other symptoms of cardiac disease must be investigated further
    • Atypical pain with explanation and without symptoms does not require full cardiac evaluation
Exertional Syncope

- Exertional Syncope
  - Occurs during exercise
  - RED FLAG
  - 33% have heart disease known to cause SCD
  - Cardiology Consult
  - Ecg, echo, stress test, and possibly advanced imaging

- Post-exertional collapse
  - Rarely indicates significant CV disease
  - Brought on by rapid loss of “second heart” as in crossing the finish line
Elevated Blood Pressure

• Fourth Report on Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents
• Gender, age, and height standardized BP
Hypertension

• **Normal BP**: SBP and DBP <90\textsuperscript{th} percentile
  – Recheck in 1 year.

• **Prehypertension**: SBP or DBP 90\textsuperscript{th} percentile to <95\textsuperscript{th} percentile or BP >120/80 mmHg to <95\textsuperscript{th} percentile
  – Recheck in 6 months.
  – Begin weight management (as appropriate).
Hypertension

• **Stage 1 Hypertension (HTN):** SBP and/or DBP 95th percentile to 99th percentile plus 5 mmHg
  – Recheck in 1 to 2 weeks.
  – If BP remains at this level on recheck, begin evaluation and treatment including weight management if appropriate.

• **Stage 2 HTN:** SBP and/or DBP >99th percentile plus 5 mmHg
  – Begin evaluation and treatment within 1 week, immediately if symptomatic.
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<tbody>
<tr>
<td>34. Have you ever had a head injury or concussion?</td>
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<tr>
<td>35. Have you ever had a hit or blow to the head that caused confusion, prolonged headache, or memory problems?</td>
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<tr>
<td>36. Do you have a history of seizure disorder?</td>
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<tr>
<td>37. Do you have headaches with exercise?</td>
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<tr>
<td>38. Have you ever had numbness, tingling, or weakness in your arms or legs after being hit or falling?</td>
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<tr>
<td>39. Have you ever been unable to move your arms or legs after being hit or falling?</td>
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</tbody>
</table>
History of Multiple Concussions

• Each concussion should be completely explored
  – Mechanism
  – Symptoms, especially amnesia
  – Duration, missed practices/competitions
    • How long until 100% normal feeling
  – School difficulties
  – Interval time

• 3 or more should prompt discussions about continuing contact sports
Neurologic conditions

• Stingers/Burners
  – No modification of participation generally
  – Several or frequent episodes, or symptoms lasting longer than 3-4 weeks should be investigated with x-rays/MRI

• Transient quadraplegia / Cervical Neurapraxia
  – Requires further evaluation with c-spine x-rays/MRI
  – Torg ratio

• Seizure disorder
  – No limitations if well controlled
  – No evidence of any affect on seizure frequency
  – Possible restrictions for water sports….
### Medical Questions

<table>
<thead>
<tr>
<th>Medical Questions</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>26. Do you cough, wheeze, or have difficulty breathing during or after exercise?</td>
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<tr>
<td>27. Have you ever used an inhaler or taken asthma medicine?</td>
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<tr>
<td>28. Is there anyone in your family who has asthma?</td>
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<td>29. Were you born without or are you missing a kidney, an eye, a testicle (males), your spleen, or any other organ?</td>
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<tr>
<td>30. Do you have groin pain or a painful bulge or hemia in the groin area?</td>
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<td>31. Have you had infectious mononucleosis (mono) within the last month?</td>
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<td>32. Do you have any rashes, pressure sores, or other skin problems?</td>
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<tr>
<td>33. Have you had a herpes or MRSA skin infection?</td>
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</table>
Exercise Induced Asthma / Bronchoconstriction

• Documented between 11% and 50% depending on sport and testing method
• Many athletes with EIB will have subclinical or undiagnosed chronic asthma
• More likely in athletes with environmental allergies
• Consider medications and non-pharmaceutical control – use standard definitions
• Testing to document, required at Olympic and NCAA level
• Maintain asthma treatment action plan for acute exacerbation
• Not everything that wheezes is EIB/EIA, consider vocal cord dysfunction
Single Organ

- Absence of a paired organ does not limit participation
  - Protective equipment may be advised/required
- Single kidney
  - Individualized risk
Recent Significant Illness

• Infectious Mononucleosis
  – Complete resolution of symptoms
  – 4 weeks from onset
  – Return of normal spleen size
Environmental, Hematology, Eyes, Dietary

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<table>
<thead>
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<tbody>
<tr>
<td>40. Have you ever become ill while exercising in the heat?</td>
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<tr>
<td>41. Do you get frequent muscle cramps when exercising?</td>
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<tr>
<td>42. Do you or someone in your family have sickle cell trait or disease?</td>
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<tr>
<td>43. Have you had any problems with your eyes or vision?</td>
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<tr>
<td>44. Have you had any eye injuries?</td>
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<tr>
<td>45. Do you wear glasses or contact lenses?</td>
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<tr>
<td>46. Do you wear protective eyewear, such as goggles or a face shield?</td>
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<td>47. Do you worry about your weight?</td>
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<tr>
<td>48. Are you trying to or has anyone recommended that you gain or lose weight?</td>
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<tr>
<td>49. Are you on a special diet or do you avoid certain types of foods?</td>
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<tr>
<td>50. Have you ever had an eating disorder?</td>
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<tr>
<td>51. Do you have any concerns that you would like to discuss with a doctor?</td>
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</tr>
</tbody>
</table>
Heat Illness

• Exertional heat stroke can be fatal
  – Most often seen in preseason football

• Risk Factors:
  – Hot, humid conditions, poor aerobic fitness, inadequate heat acclimatization, use of pads
  – Use of diuretics, caffeine, amphetamines, stimulants

• Previous history of heat illness, especially heat stroke

• History of heat stroke may be disqualifying for certain sports
Bleeding Diathesis

• Individualized decision based on sport and severity of disease
  – Consultation with hematologist
  – Athlete action plan – Vasopressin/Factor VIII/knowledge of hospitals in area, esp. when traveling
Sickle Cell

• Sickle cell disease
  – can become acute with catastrophic consequences with dehydration, overheating, or with internal injury
  – Recommend avoidance of all highly strenuous activities and all contact and collision sports

• Sickle cell trait
  – Approx 8% of African Americans and 0.01-0.05% of caucasians
  – Has been implicated in several deaths at the NCAA level
  – Allowed to participate in all sports
  – Alter training program to insure safe participation
Sensory deficits

• Eye
  – Eye injury and loss of vision
  – Screen for and encourage protection, esp in moderate to high risk sports
  – Vision screening included in PPE
    • Most commonly encountered abnormality
    • Poor vision can lead to poor performance and injuries
Diabetes Mellitus

- Type I vs type II
- Insulin pumps and participation
- Sugar diaries throughout practice, especially different types of practices, and games
- Oral meds
  - Risk of hypoglycemia
- Insulin
  - Changing dosing
- Sugars between 100 and 250 (fasting) or 300 (after meal) before participating
Diabetes Mellitus

- Gastroparesis can affect fluid, electrolyte, and nutrient absorption and may limit safe participation
- Risk of hypoglycemia makes rock-climbing, skydiving, and scuba diving very high risk
- Solo endurance events require careful monitoring
Women’s Health

• Female athlete triad
  – No contraindications to sport
  – Further evaluation with multi-disciplinary approach

• Pregnancy
  – Individual risk assessment, not contraindicated
    • Make decision in conjunction with OB/FP
  – Consider limiting contact/collision sports, ultraendurance events, or highly strenuous late in pregnancy
Consider Preventive Medicine

**PHYSICIAN REMINDERS**

1. Consider additional questions on more sensitive issues
   - Do you feel stressed out or under a lot of pressure?
   - Do you ever feel sad, hopeless, depressed, or anxious?
   - Do you feel safe at your home or residence?
   - Have you ever tried 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 anabolic steroids or used any other performance supplement?
   - Have you ever taken any supplements 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 5–14).
Medication use that increase risk during sport

• Coumadin / Blood thinners
• Anti-hypertensives
  – Beta-blockers
  – Diuretics
• Stimulants
Supplement / Ergogenic Aids

- Screen for potentially harmful
  - 20% of NCAA football respondents said teammates were using anabolic steroids
  - 5-10% of football players report using steroids
  - 8-12% of several men’s NCAA sports report using amphetamines
  - Many have their first exposure in high school
  - Ephedra can still be found under other names
  - Red Bull linked to deaths in Europe
Supplement / Ergogenic Aids

• Ergogenic aids
  – Some can be helpful
  – Amino Acids, proteins, creatine
  – US Pharmacopeia
  – [www.wada-ama.org](http://www.wada-ama.org)
  – [www.usantidoping.org](http://www.usantidoping.org)
## Examination – medical

<table>
<thead>
<tr>
<th>EXAMINATION</th>
<th>NORMAL</th>
<th>ABNORMAL FINDINGS</th>
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<tbody>
<tr>
<td><strong>MEDICAL</strong></td>
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<tr>
<td><strong>Appearance</strong></td>
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<tr>
<td>• Marfan stigmata (kyphoscoliosis, high-arched palate, pectus excavatum, arachnodactyly, arm span &gt; height, hyperlaxity, myopia, MVP, aortic insufficiency)</td>
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<tr>
<td><strong>Eyes/ears/nose/throat</strong></td>
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<tr>
<td>• Pupils equal</td>
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<tr>
<td>• Hearing</td>
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<tr>
<td><strong>Lymph nodes</strong></td>
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<tr>
<td><strong>Heart</strong></td>
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</tr>
<tr>
<td>• Murmurs (auscultation standing, supine, +/- Valsalva)</td>
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<td></td>
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<tr>
<td>• Location of point of maximal impulse (PMI)</td>
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<tr>
<td><strong>Pulses</strong></td>
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<td></td>
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<tr>
<td>• Simultaneous femoral and radial pulses</td>
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<tr>
<td><strong>Lungs</strong></td>
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<tr>
<td><strong>Abdomen</strong></td>
<td></td>
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<tr>
<td><strong>Genitourinary (males only)</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Skin</strong></td>
<td></td>
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<tr>
<td>• HSV, lesions suggestive of MRSA, tinea corporis</td>
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<tr>
<td><strong>Neurologic</strong></td>
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</tbody>
</table>
Cardiovascular Exam

• According to the AHA (SOR C)
  – Precordial auscultatation in both standing and supine positions, for rate, rhythm, and murmurs
  – Assessment of femoral pulses to exclude coarctation of the aorta
  – Brachial blood pressure measured in seated position in the standard manner
  – Evaluation for the physical stigmata of Marfan’s syndrome
HCM Murmur

• Harsh, loud (usually at least 3/6) systolic ejection murmur
• Loudest in right upper sternal border
• Increases with maneuvers that decrease venous return
  – Valsalva, squatting to standing
Genitourinary

• Genitalia
  – Generally deferred in female
  – Consider in males, especially when only medical care received
    • Hernias - no limitation to participation unless symptomatic
    • Testicular cancer screening – limited utility
  – Tanner staging – generally not helpful or indicated
# Musculoskeletal History

<table>
<thead>
<tr>
<th>BONE AND JOINT QUESTIONS</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>
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<tr>
<td>18. Have you ever had any broken or fractured bones or dislocated joints?</td>
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<tr>
<td>19. Have you ever had an injury that required x-rays, MRI, CT scan, injections, therapy, a brace, a cast, or crutches?</td>
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<tr>
<td>20. Have you ever had a stress fracture?</td>
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<tr>
<td>21. Have you ever been told that you have or have you had an x-ray for neck instability or atlantoaxial instability? (Down syndrome or dwarfism)</td>
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<tr>
<td>22. Do you regularly use a brace, orthotics, or other assistive device?</td>
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<tr>
<td>23. Do you have a bone, muscle, or joint injury that bothers you?</td>
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<tr>
<td>24. Do any of your joints become painful, swollen, feel warm, or look red?</td>
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<tr>
<td>25. Do you have any history of juvenile arthritis or connective tissue disease?</td>
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</table>
# Examination - Orthopedic

<table>
<thead>
<tr>
<th>MUSCULOSKELETAL</th>
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</thead>
<tbody>
<tr>
<td>Neck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back</td>
<td></td>
<td></td>
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<tr>
<td>Shoulder/arm</td>
<td></td>
<td></td>
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<tr>
<td>Elbow/forearm</td>
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<td></td>
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<tr>
<td>Wrist/hand/fingers</td>
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<td></td>
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<tr>
<td>Hip/thigh</td>
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<tr>
<td>Knee</td>
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<tr>
<td>Leg/ankle</td>
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<td></td>
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<tr>
<td>Foot/toes</td>
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<td></td>
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<tr>
<td>Functional</td>
<td></td>
<td></td>
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<tr>
<td>- Duck-walk, single leg hop</td>
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</table>
Screening Orthopedic Exam

• The “90-second orthopaedic screening examination” in conjunction with a negative history is a good screening tool for the asymptomatic athlete. (LoE 1- meta-analysis). Exam should be more intensive for sport- or position-specific conditions
  – Can check both range of motion and strength with testing, stability of certain joints
  – C-spine: look up, side to side, and down, touch ears to shoulders
  – Shoulders: shrug, abduction, internal and external rotation, scapular winging, impingement signs
  – Elbows: flexion/extension, pronation/supination (flexed at 90)
Screening Orthopedic Exam

– Wrist: flexion/extension, pronation/supination
– Hand: Spread fingers apart, make a fist
– Hip: Flexion, internal and external rotation, gluteus/piriformis stress
– Knee: Flexion, extension, alignment (varum/valgum/recurvatum and rotational, i.e. femoral anteversion/tibial torsion), stability
– Ankle: plantar- and dorsi-flexion, inversion and eversion, stability
Under – rehabilitated/treated injuries

• Certain conditions place athletes at increased risk of further injury/disability
• Individualized assessment – sport specific
• Consider functional or sport specific testing
• Consider physical therapy prior to participation
• Surgical management if indicated
Clearance / further workup

- Does the problem place the athlete at increased risk for injury or illness?
- Is another participant at risk?
- Can the athlete safely participate with treatment?
- Can limited participation be allowed while treatment/evaluation is completed?
- Is clearance denied for single sport / category of sports?
Routine Screening Tests

- EKG +/- Echo
- Neck x-rays for football
- Urinalysis
- CBC, chemistries, lipids, ferritin
- Spirometry
- Stress tests
- Sickle cell trait
- HIV, Hepatitis
Evidence – or “do they work?”

- Systematic review of 310 studies on PPE in athletes <36 years of age (J of Fam Prac)
  - no prospective cohort studies or randomized trials addressing the effectiveness
  - no medium- or better-quality evidence that demonstrated they reduce mortality or morbidity.
- Case series - reviewed 158 sudden deaths from 1985-1995 finding 115 had a standard PPE
  - 4 were suspected of having a cardiovascular abnormality
  - 1 athlete identified prospectively
- Ability to determine exercise-induced bronchospasm
  - prospective cross-sectional study of 352 adolescents
    - EIB in 9.4% of athletes tested with 7-minute exercise challenge spirometry
    - none identified by physical exam alone
    - questionnaire showed a sensitivity of 71% and a specificity of 47%.
- Cross sectional study - poorly predictive of increased risk of orthopedic injuries
  - History of knee or ankle injury and abnormal finding on exam increased likelihood of repeated injury
  - Sensitivities of history or physical exam for ankle or knee injuries less than 25%.
- <1%-2% of all athletes are disqualified (Joy-CJSM, 2004)
Universal EKG’s or Echo’s for athletes??

• Required in Europe
• 95% of individuals with HCM can be identified with ECG
• Most individuals with anomalous coronary artery can be seen on echo
• Military recruits have incidence of SCD of 1:9,000 – maybe under-recognizing in general population
• New “strict” criteria only 2% false positives

• Estimates 1:75,000 die
  – 1:500 have HCM
  – 1:2500 have long QT
  – 1:10,000 have ARVD
• At least 150/75,000 have potentially fatal cardiac conditions
• Even a test that is 100% accurate would effectively eliminate sports for 149 individuals that would not die
• Further testing required
• Number needed to harm?
Abnormal EKG’s by sport (Lawless- MSSE, 2008)