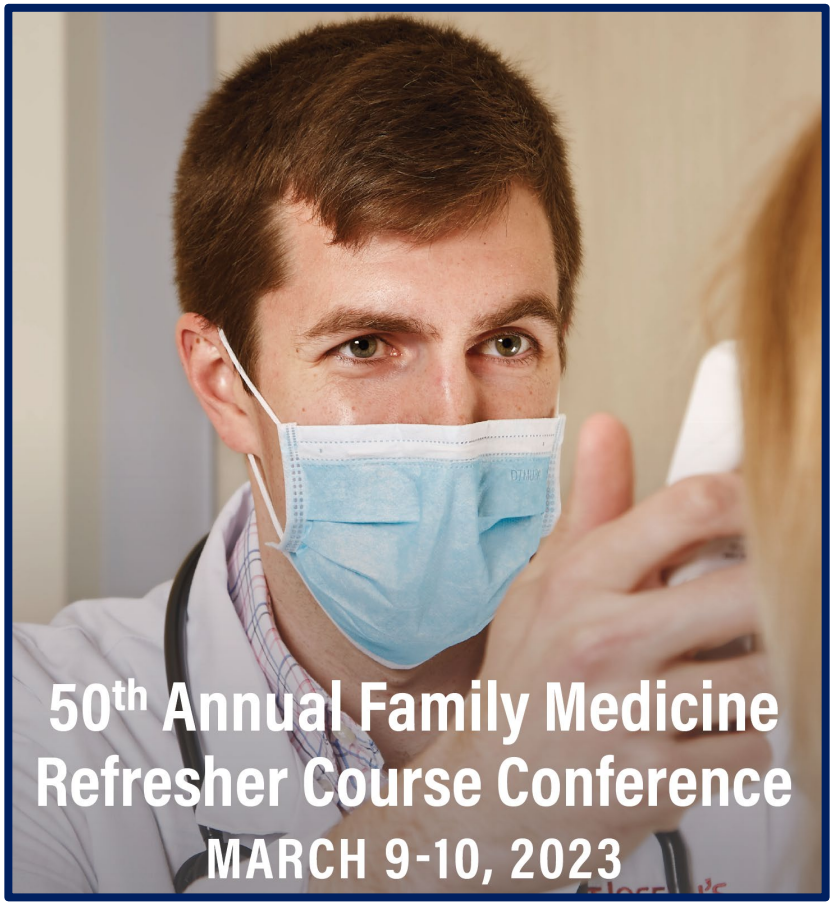
The Sports Preparticipation Examination: What You Need to Know in 2023!



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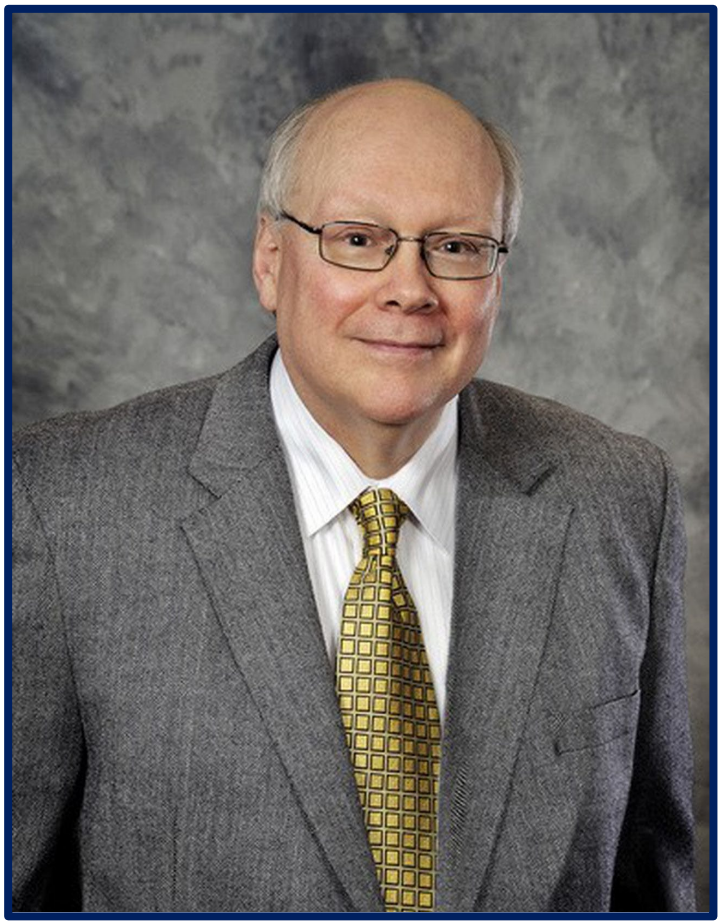
Disclosure Information

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.

Dr. Jim Tucker



1. “You Don’t Need to be fellowship trained to be a good sports medicine doc”

2. “Don’t Give Away Your Family Medicine”

O'Connor FG, Tucker JB: Boxing: The Preparticipation Evaluation. Military Medicine 1991; 156 (8):391-395.

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 **New Features** of **PPE Monograph 5**
- **Discuss** the **Purpose**, **Timing**, **Frequency** and **Setting** of the PPE
- **Identify and Discuss** history questions and physical examination findings on the PPE **Not to Miss**!
- **Discuss** the role of **Special Tests**
- **Discuss** common **Clearance** and **Return to Play** Issues

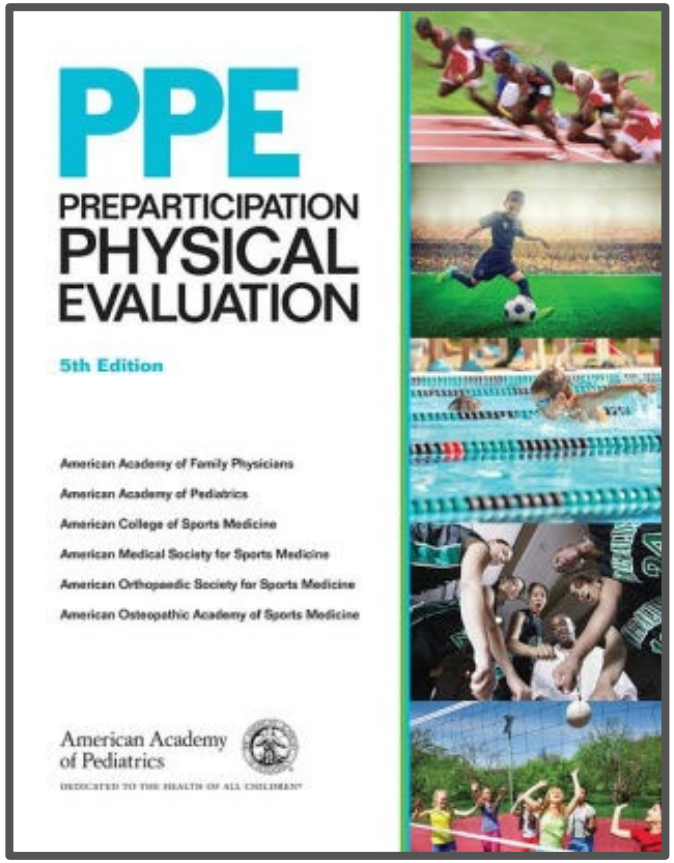
What should I Read?

- **Jason inquires as to what references or resources might be available to assist with PPEs in the future?**

Preparticipation Examination Resources

Preparticipation Evaluation Physical Evaluation Fifth Edition

- 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 _____

Name _____ 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 allergy below.
☐ Medicines ☐ Pollens ☐ Food ☐ Stinging Insects

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

GENERAL QUESTIONS	Yes	No
1. Has a doctor ever denied or restricted your participation in sports for any reason?		
2. Do you have any ongoing medical conditions? If so, please identify below: ☐ Asthma ☐ Anemia ☐ Diabetes ☐ Infections Other: _____		
3. Have you ever spent the night in the hospital?		
4. Have you ever had surgery?		
HEART HEALTH QUESTIONS ABOUT YOU	**Yes**	**No**
5. Have you ever passed out or nearly passed out DURING or AFTER exercise?		
6. Have you ever had discomfort, pain, tightness, or pressure in your chest during exercise?		
7. Does your heart ever race or skip beats (irregular beats) during exercise?		
8. Has a doctor ever told you that you have any heart problems? If so, check all that apply: ☐ High blood pressure ☐ A heart murmur ☐ High cholesterol ☐ A heart infection ☐ Kawasaki disease Other: _____		
9. Has a doctor ever ordered a test for your heart? (For example, ECG/EKG, echocardiogram)		
10. Do you get lightheaded or feel more short of breath than expected during exercise?		
11. Have you ever had an unexplained seizure?		
12. Do you get more tired or short of breath more quickly than your friends during exercise?		
HEART HEALTH QUESTIONS ABOUT YOUR FAMILY	**Yes**	**No**
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)?		
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?		
15. Does anyone in your family have a heart problem, pacemaker, or implanted defibrillator?		
16. Has anyone in your family had unexplained fainting, unexplained seizures, or near drowning?		
BONE AND JOINT QUESTIONS	**Yes**	**No**
17. Have you ever had an injury to a bone, muscle, ligament, or tendon that caused you to miss a practice or a game?		
18. Have you ever had any broken or fractured bones or dislocated joints?		
19. Have you ever had an injury that required x-rays, MRI, CT scan, injections, therapy, a brace, a cast, or crutches?		
20. Have you ever had a stress fracture?		
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)		
22. Do you regularly use a brace, orthotics, or other assistive device?		
23. Do you have a bone, muscle, or joint injury that bothers you?		
24. Do any of your joints become painful, swollen, feel warm, or look red?		
25. Do you have any history of juvenile arthritis or connective tissue disease?		

MEDICAL QUESTIONS	Yes	No
26. Do you cough, wheeze, or have difficulty breathing during or after exercise?		
27. Have you ever used an inhaler or taken asthma medicine?		
28. Is there anyone in your family who has asthma?		
29. Were you born without or are you missing a kidney, an eye, a testicle (males), your spleen, or any other organ?		
30. Do you have groin pain or a painful bulge or hernia in the groin area?		
31. Have you had infectious mononucleosis (mono) within the last month?		
32. Do you have any rashes, pressure sores, or other skin problems?		
33. Have you had a herpes or MRSA skin infection?		
34. Have you ever had a head injury or concussion?		
35. Have you ever had a hit or blow to the head that caused confusion, prolonged headache, or memory problems?		
36. Do you have a history of seizure disorder?		
37. Do you have headaches with exercise?		
38. Have you ever had numbness, tingling, or weakness in your arms or legs after being hit or falling?		
39. Have you ever been unable to move your arms or legs after being hit or falling?		
40. Have you ever become ill while exercising in the heat?		
41. Do you get frequent muscle cramps when exercising?		
42. Do you or someone in your family have sickle cell trait or disease?		
43. Have you had any problems with your eyes or vision?		
44. Have you had any eye injuries?		
45. Do you wear glasses or contact lenses?		
46. Do you wear protective eyewear, such as goggles or a face shield?		
47. Do you worry about your weight?		
48. Are you trying to or has anyone recommended that you gain or lose weight?		
49. Are you on a special diet or do you avoid certain types of foods?		
50. Have you ever had an eating disorder?		
51. Do you have any concerns that you would like to discuss with a doctor?		
FEMALES ONLY		
52. Have you ever had a menstrual period?		
53. How old were you when you had your first menstrual period?		
54. How many periods have you had in the last 12 months?		

Explain "yes" answers here

_____

_____

_____

_____

_____

_____

_____

_____

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

Signature of athlete _____ Signature of parent/guardian _____ Date _____

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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 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).

EXAMINATION		
Height _____ Weight _____ ☐ Male ☐ Female		
BP ____/____ (____/____) Pulse _____ Vision R 20/_____ L 20/_____ Corrected: ☐ Y ☐ N		
MEDICAL	**NORMAL**	**ABNORMAL FINDINGS**
Appearance • Marfan stigmata (kyphoscoliosis, high-arched palate, pectus excavatum, arachnodactyly, arm span > height, hyperlaxity, myopia, MVP, aortic insufficiency)		
Eyes/ears/nose/throat • Pupils equal • Hearing		
Lymph Nodes		
Heart[a] • Murmurs (auscultation standing, supine, +/- Valsalva) • Location of point of maximal impulse (PMI)		
Pulses • Simultaneous femoral and radial pulses		
Lungs		
Abdomen		
Genitourinary (males only)[b]		
Skin • HSV, lesions suggestive of MRSA, tinea corporis		
Neurologic[c]		
MUSCULOSKELETAL		
Neck		
Back		
Shoulder/arm		
Elbow/forearm		
Wrist/hand/fingers		
Hip/thigh		
Knee		
Leg/ankle		
Foot/toes		
Functional • Duck-walk, single leg hop		

[a]Consider ECG, echocardiogram, and referral to cardiology for abnormal cardiac history or exam.
[b]Consider GU exam if in private setting. Having third party present is recommended.
[c]Consider cognitive evaluation or baseline neuropsychiatric testing if a history of significant concussion.

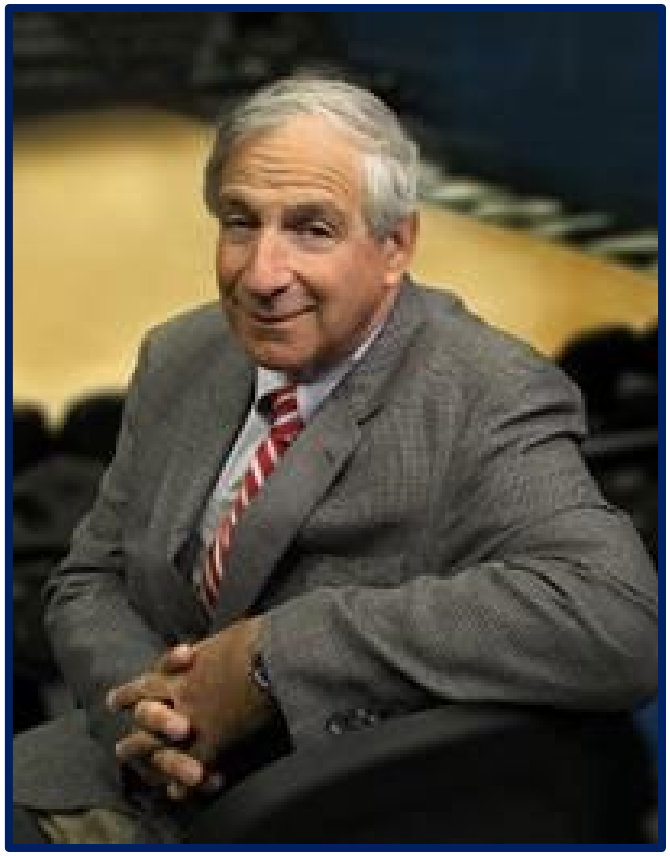
I certify that the above student has been medically evaluated for participation in athletics and deemed:

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: _____

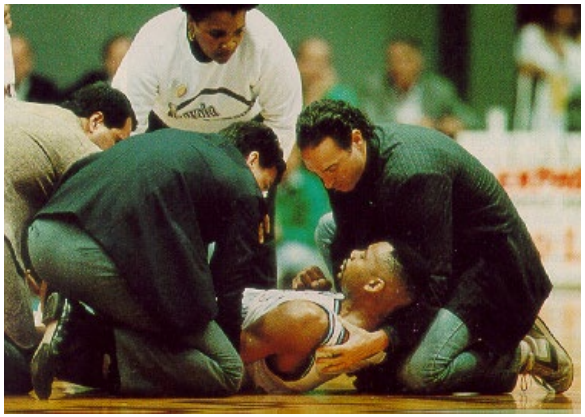
46th Bethesda Conference: Recommendations for Determining Eligibility for Competition in Athletes with Cardiovascular Abnormalities



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. ELIGIBILITY AND DISQUALIFICATION RECOMMENDATIONS FOR COMPETITIVE ATHLETES WITH CARDIOVASCULAR ABNORMALITIES: Preamble, Principles, and General Considerations: A Scientific Statement From the American Heart Association and American College of Cardiology. Circulation. 2015 Dec 1;132(22):e256-61.

46th Bethesda Conference Guidelines

- **Recommendations for Determining Eligibility for Competition in Athletes with Cardiovascular Abnormalities 2015**
  - 15 Distinct Task Force Reports



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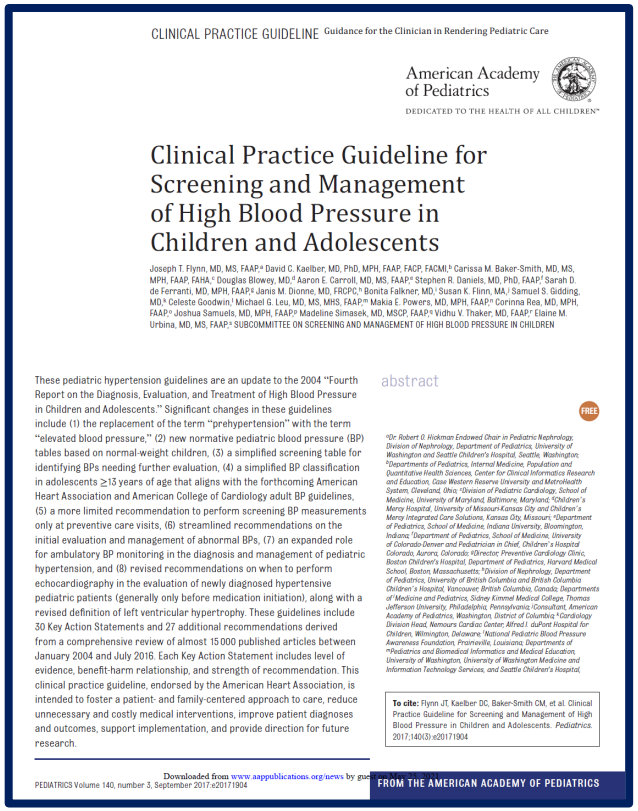
Hypertension



CLINICAL PRACTICE GUIDELINE Guidance for the Clinician in Rendering Pediatric Care

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents

Joseph T. Flynn, MD, MS, FAAP,[a] David C. Kaelber, MD, PhD, MPH, FAAP, FACP, FACMI,[b] Carissa M. Baker-Smith, MD, MS, MPH, FAAP, FAHA,[c] Douglas Blowey, MD,[d] Aaron E. Carroll, MD, MS, FAAP,[e] Stephen R. Daniels, MD, PhD, FAAP,[f] Sarah D. de Ferranti, MD, MPH, FAAP,[g] Janis M. Dionne, MD, FRCPC,[h] Bonita Falkner, MD,[i] Susan K. Flinn, MA,[j] Samuel S. Gidding, MD,[k] Celeste Goodwin,[l] Michael G. Leu, MD, MS, MHS, FAAP,[m] Makia E. Powers, MD, MPH, FAAP,[n] Corinna Rea, MD, MPH, FAAP,[o] Joshua Samuels, MD, MPH, FAAP,[p] Madeline Simasek, MD, MSCP, FAAP,[q] Vidhu V. Thaker, MD, FAAP,[r] Elaine M. Urbina, MD, MS, FAAP,[s] SUBCOMMITTEE ON SCREENING AND MANAGEMENT OF HIGH BLOOD PRESSURE IN CHILDREN

These pediatric hypertension guidelines are an update to the 2004 "Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents." Significant changes in these guidelines include (1) the replacement of the term "prehypertension" with the term "elevated blood pressure," (2) new normative pediatric blood pressure (BP) tables based on normal-weight children, (3) a simplified screening table for identifying BPs needing further evaluation, (4) a simplified BP classification in adolescents ≥13 years of age that aligns with the forthcoming American Heart Association and American College of Cardiology adult BP guidelines, (5) a more limited recommendation to perform screening BP measurements only at preventive care visits, (6) streamlined recommendations on the initial evaluation and management of abnormal BPs, (7) an expanded role for ambulatory BP monitoring in the diagnosis and management of pediatric hypertension, and (8) revised recommendations on when to perform echocardiography in the evaluation of newly diagnosed hypertensive pediatric patients (generally only before medication initiation), along with a revised definition of left ventricular hypertrophy. These guidelines include 30 Key Action Statements and 27 additional recommendations derived from a comprehensive review of almost 15 000 published articles between January 2004 and July 2016. Each Key Action Statement includes level of evidence, benefit-harm relationship, and strength of recommendation. This clinical practice guideline, endorsed by the American Heart Association, is intended to foster a patient- and family-centered approach to care, reduce unnecessary and costly medical interventions, improve patient diagnoses and outcomes, support implementation, and provide direction for future research.

abstract

FREE

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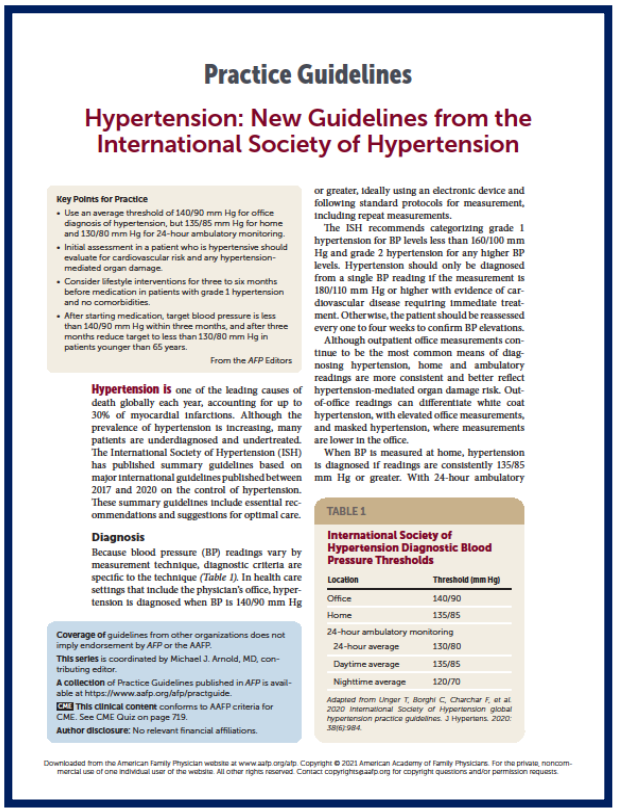

Practice Guidelines

Hypertension: New Guidelines from the International Society of Hypertension

Key Points for Practice

- Use an average threshold of 140/90 mm Hg for office diagnosis of hypertension, but 135/85 mm Hg for home and 130/80 mm Hg for 24-hour ambulatory monitoring.
- Initial assessment in a patient who is hypertensive should evaluate for cardiovascular risk and any hypertension-mediated organ damage.
- Consider lifestyle interventions for three to six months before medication in patients with grade 1 hypertension and no comorbidities.
- After starting medication, target blood pressure is less than 140/90 mm Hg within three months, and after three months reduce target to less than 130/80 mm Hg in patients younger than 65 years.

From the *AFP* Editors

Hypertension is one of the leading causes of death globally each year, accounting for up to 30% of myocardial infarctions. Although the prevalence of hypertension is increasing, many patients are underdiagnosed and undertreated. The International Society of Hypertension (ISH) has published summary guidelines based on major international guidelines published between 2017 and 2020 on the control of hypertension. These summary guidelines include essential recommendations and suggestions for optimal care.

Diagnosis

Because blood pressure (BP) readings vary by measurement technique, diagnostic criteria are specific to the technique *(Table 1)*. In health care settings that include the physician's office, hypertension is diagnosed when BP is 140/90 mm Hg or greater, ideally using an electronic device and following standard protocols for measurement, including repeat measurements.

The ISH recommends categorizing grade 1 hypertenston for BP levels less than 160/100 mm Hg and grade 2 hypertension for any higher BP levels. Hypertension should only be diagnosed from a single BP reading if the measurement is 180/110 mm Hg or higher with evidence of cardiovascular disease requiring immediate treatment. Otherwise, the patient should be reassessed every one to four weeks to confirm BP elevations.

Although outpatient office measurements continue to be the most common means of diagnosing hypertenston, home and ambulatory readings are more consistent and better reflect hypertenston-mediated organ damage risk. Out-of-office readings can differentiate white coat hypertension, with elevated office measurements, and masked hypertension, where measurements are lower in the office.

When BP is measured at home, hypertension is diagnosed if readings are consistently 135/85 mm Hg or greater. With 24-hour ambulatory

TABLE 1

International Society of Hypertension Diagnostic Blood Pressure Thresholds

Location	Threshold (mm Hg)
Office	140/90
Home	135/85
24-hour ambulatory monitoring	
24-hour average	130/80
Daytime average	135/85
Nighttime average	120/70

Adapted from Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension global hypertension practice guidelines. J Hypertens. 2020; 38(6):984.

Coverage of guidelines from other organizations does not imply endorsement by *AFP* or the AAFP.

This series is coordinated by Michael J. Arnold, MD, contributing editor.

A collection of Practice Guidelines published in *AFP* is available at https://www.aafp.org/afp/practguide.

This clinical content conforms to AAFP criteria for CME. See CME Quiz on page 719.

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Flynn JT, Kaelber DC, Baker-Smith CM, et al; Subcommittee on Screening and Management of High Blood Pressure in Children. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics.* 2017;140(3):e20171904. Pediatrics. 2018 Sep;142(3):e20181739.

Buelt A, Richards A, Jones AL. Hypertension: New Guidelines from the International Society of Hypertension. Am Fam Physician. 2021 Jun 15;103(12):763-765.

PPE Next Steps

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 information provided is easily utilized for both question sets.

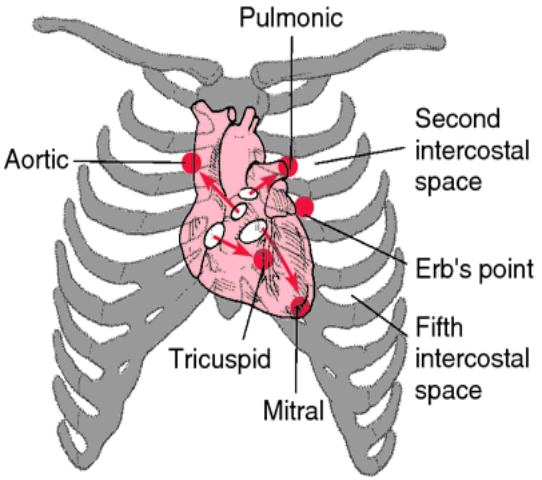
History and Application of the AHA 12 Points for Assessing Cardiovascular Risk in Athletes

Abhimanyu (Manu) Uberoi, MD, MS and William O. Roberts, MD, MS

The cardiovascular (CV) evaluation, one important part of the preparticipation physical examination (PPE), is 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 strata. 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 unveils 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 25-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 was based on input from parent and high school athlete focus group sessions to enhance the "understandability" of the questions for the end users. Of note, the question sets are based on expert opinion and have not been subjected to scientific study.

In the late 1990s, after surveys showed poor compliance with both the use of consensus-based forms and the AHA question set, some high schools and colleges across the country incorporated the elements of the PPE and the AHA



Current Sports Medicine Reports. 2015 May-Jun;14(3):254-6

American Family Physician Article

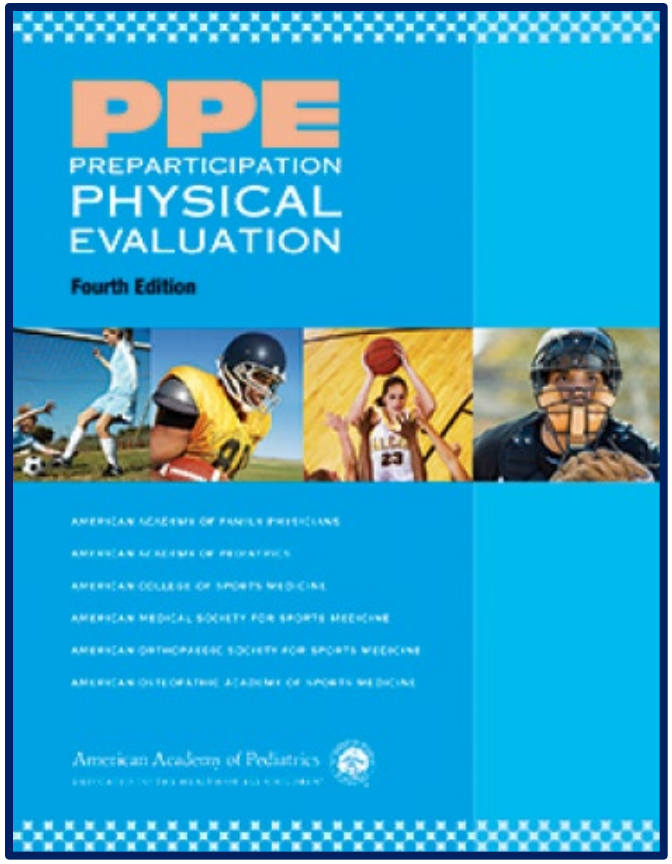
SORT: KEY RECOMMENDATIONS FOR PRACTICE

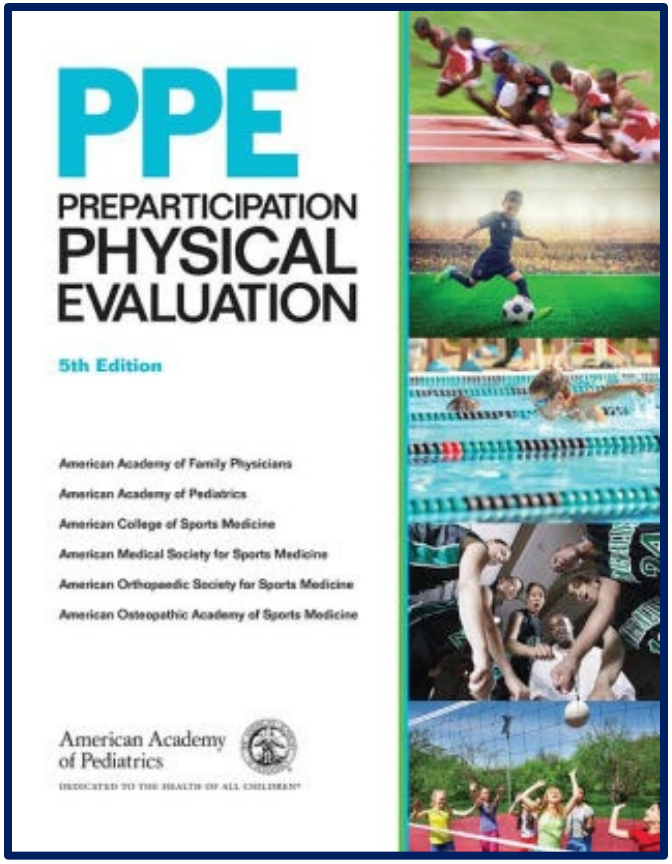
Clinical recommendation	*Evidence rating*	*References*
Preparticipation physical evaluations should occur approximately six weeks before activity to allow for further evaluation, treatment, or rehabilitation as needed.	C	4
All persons undergoing preparticipation physical evaluations should be questioned about exertional symptoms, the presence of a heart murmur, symptoms of Marfan syndrome, and family history of premature serious cardiac conditions or sudden death.	C	13, 16
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.	C	25
Athletes with well-controlled asthma who are asymptomatic at rest and with exertion can be safely cleared to play sports.	C	26
Screening blood and urine tests are not recommended for asymptomatic athletes.	C	37

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/afpsort.

Mirabelli MH, Devine MJ, Singh J, Mendoza M:The Preparticipation Sports Evaluation. Am Fam Physician. 2015 Sep 1;92(5):371-6.

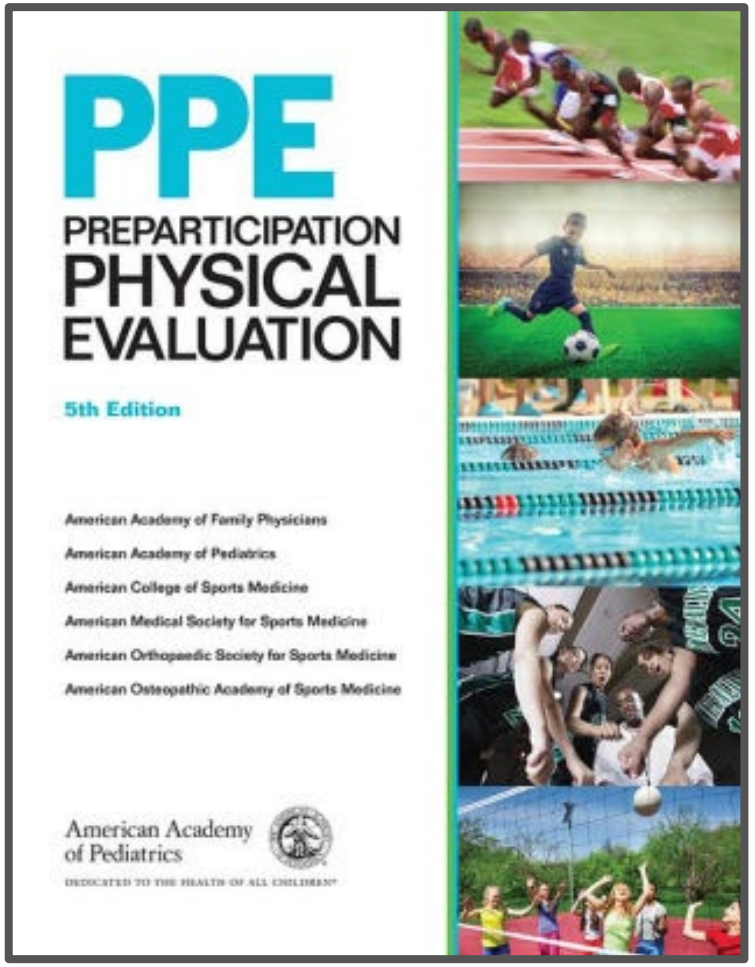
Jason Inquires as to What's New?





Amazon's Comments on the Fifth Edition

- New chapter on **transgender athlete**
- New chapter on the **female athlete**
- New section on **mental health**
- Incorporating PPE into routine health supervision care
- **Updated content** based on the most current practice guidelines, consensus statements, and expert opinions
- Developed to enhance the health and safety of all athletes and establish a standardized approach to PPE
- **English and Spanish versions of the History Form**



The Senior Editors' Thoughts: Key Points of Emphasis

PPE Goals…

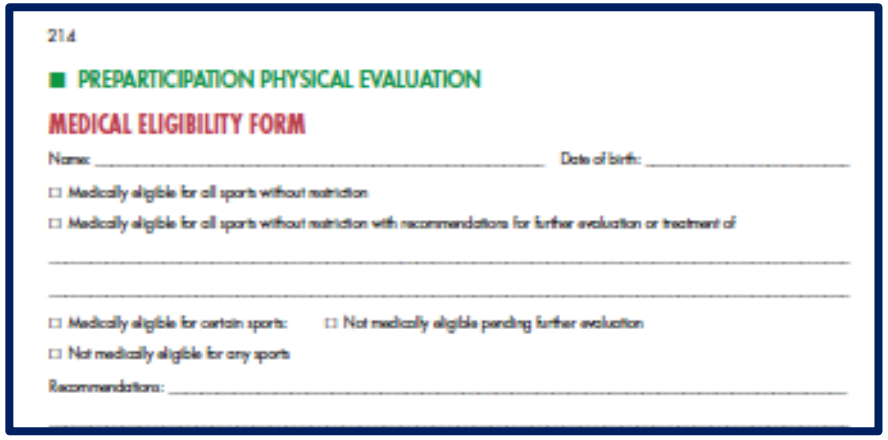
- Determine **general physical & PSYCHOLOGICAL HEALTH**
- Evaluate for conditions that predispose to injury or illness
- Evaluate for **life-threatening** or disabling conditions
- Opportunity for discussion of health & lifestyle issues
- **Entry point into A HEALTH CARE HOME**

PPE5 Emphasis…

- Incorporate the PPE into **routine health supervision care visits** for all children
  - **Start at age 6**
  - Every 2-3 years
- Integrating the PPE into the **health care home** may be more easily achieved if the **PPE portion of the examination is addressed every 2 to 3 years**, rather than annually, to allow a different focus each year for evolving child & adolescent risk.

The PPE…

- Provides medical background for **shared medical decision-making**
- Determine **medical eligibility & potential physical activity limitations**
- **Help athletes participate "safely"**



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PREPARTICIPATION PHYSICAL EVALUATION

MEDICAL ELIGIBILITY FORM

Name: _____ Date of birth: _____

☐ Medically eligible for all sports without restriction

☐ Medically eligible for all sports without restriction with recommendations for further evaluation or treatment of

_____

_____

☐ Medically eligible for certain sports: ☐ Not medically eligible pending further evaluation

☐ Not medically eligible for any sports

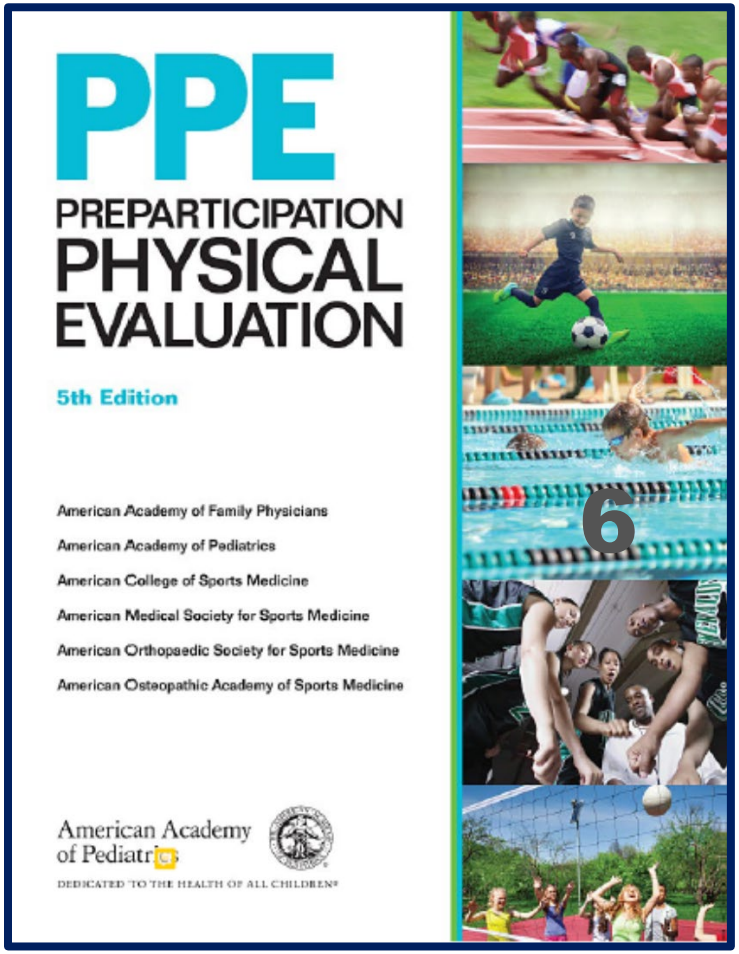
Recommendations: _____

Qualifications of Examiners…

- **MD, DO, or advanced practice providers (NP & PA)**
- Essential to have clinical training
  - Knowledge & expertise to conduct the evaluation
  - Address the broad range of problems
  - Determine medical eligibility
- Clinical training for problems encountered during PPE
- Individual state laws vary (NP, PA, DC)
- Seek consultation when appropriate

Coding & PPE Outcomes

- **ICD-10-CM code for sport PPE is Z02.5**
- Coding the PPE (1° or 2° position) allows EMR tracking
- Diligent coding
  - Research into short- & long-term PPE outcomes
- Large systems - “big data” in relatively short time
- Help determine PPE outcomes & address gaps
  - Utility of the current exam
  - Predictive value of the exams
  - Reasonable exam frequency
  - Shape the future PPE



Why are we doing these PPEs?

- **Jason inquires as to why are we doing these PPEs, in particular on a Friday night, in the HS Gym, 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**.

American Academy of Family Physicians, American Academy of Pediatrics, American College of Sports Me. Preparticipation Physical Evaluation, 4th ed, Bernhardt D, Roberts W (Eds), American Academy of Pediatrics, Elk Grove Village, IL 2010.

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**.

Maron BJ, Thompson PD, Puffer JC, et al. Cardiovascular preparticipation screening of competitive athletes. A statement for health professionals from the Sudden Death Committee (clinical cardiology) and Congenital Cardiac Defects Committee (cardiovascular disease in the young), American Heart Association. Circulation 1996; 94:850.

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**.

Setting of the PPE

- **Office setting: (A Push in PPE!)**
  - 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.

Exertional Sudden Death in Athletes

- **Jason inquires as to what are the more common causes of exertional illness we are screening for?**

Epidemiology of Sudden Death in Young Athletes

- 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.

THE NATION'S NEWSPAPER 50 CENTS

USA TODAY

NO. 1 IN THE USA . . . FIRST IN DAILY READERS

WHEN IS AN AVERAGE KID NOT GOOD ENOUGH?

WHEN YOU'RE A BOOMER PARENT WHO BUYS BOOKS LIKE 'TOILET TRAINING IN A DAY'; CHILLING OUT, 1D

MEL BROOKS PUTS THE MERRY MEN IN ★★ 'TIGHTS' 8D

WEDNESDAY

20th Century Fox

TRACEY ULLMAN: Crone Latrine, 8D

Boston star Lewis collapses, dies at 27

by Jack Carey
USA TODAY

Boston Celtics captain Reggie Lewis, 27, who passed out during an NBA playoff game in April, died Tuesday night after collapsing while shooting baskets.

"It's a time of incredible grief," said Celtics executive Dave Gavitt late Tuesday.

After Lewis' April collapse, team doctor Arnold Scheller said he had a life-threatening heart ailment like the one that killed college basketball star Hank Gathers in 1990, and probably would not play again.

"You can die from this," Scheller said he told Lewis, a 1987 first-round draft pick.

But Lewis, against team wishes, sought a second opinion and was told he had a nerve condition that could be controlled.

Lewis arrived at Brandeis University at about 4 p.m. ET Tuesday and was shooting baskets, said Brandeis' Jack Molloy.

Witnesses said Lewis fell to the court about 5 p.m., was limp and shaking, stopped breathing and had no pulse.

Lewis "wasn't doing anything too strenuous," said Amir Weiss, who was at the gym.

Local paramedics said they found Lewis in complete cardiac arrest; he was pronounced dead at 7:30 p.m. ET at Waltham-Weston Hospital.

Celtics' president Red Auerbach, who is recovering from heart bypass surgery, called Lewis "a warm, kind, gentle and generous man."

He is survived by his wife, Donna Harris, and a son, Reggie Jr.

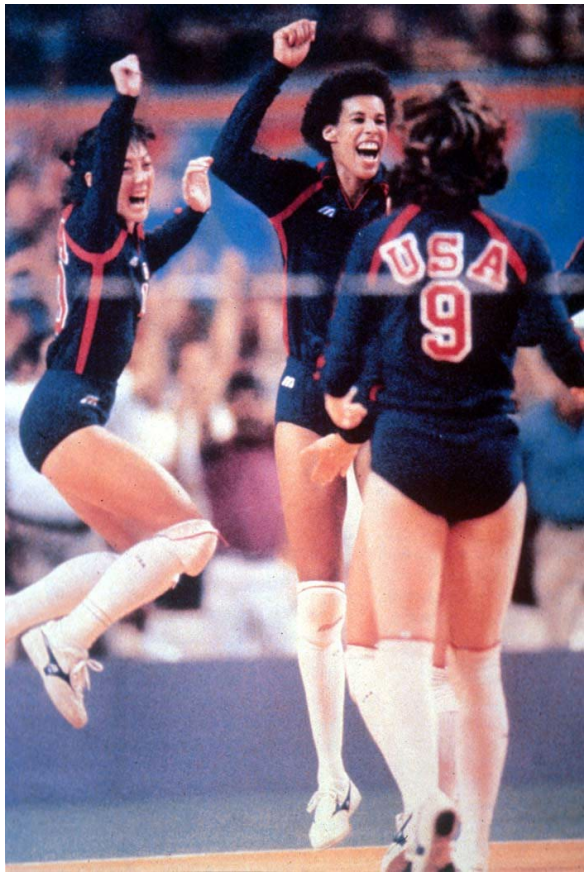
▶ 'Hearts are very heavy,' 1,9C

REGGIE LEWIS USA TODAY

Sudden cardiac arrest is the leading cause of EXERTIONAL death in Young Athletes!

Epidemiology of Exertional Sudden Death

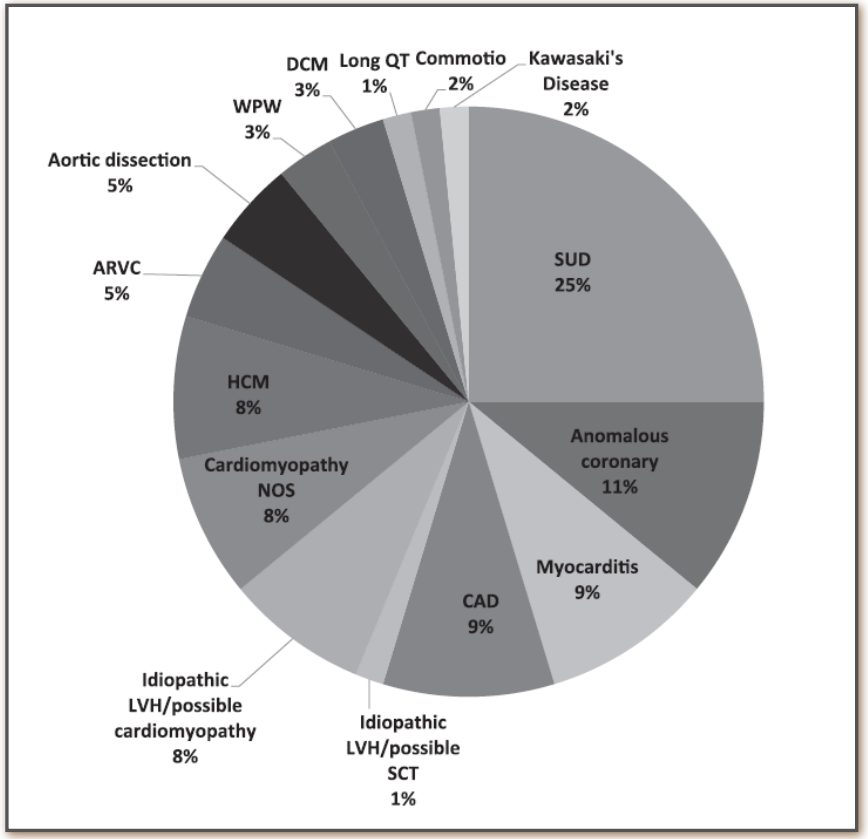
- Estimated death rates in **male athletes are 5X higher than in female** athletes.
- Estimated death rates in **college athletes are 2X higher than in high school** athletes.
- Non-cardiac deaths account for 22% of deaths.
- **Football and basketball** account for the majority of sudden deaths.
- **African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



VanCamp SP et al: Nontraumatic sports deaths in high school and college athletes. MSSE 1992;24(3):279-80.

Sudden Unexplained Cardiac Death (SUD)

- The incidence of SCD in Division 1 male basketball athletes was 1:5200 AY.
- The most common findings at autopsy were a**utopsy-negative sudden unexplained death** in 16 (25%), and definitive evidence for hypertrophic cardiomyopathy was seen in 5 (8%).



Harmon KG et al: Incidence, Cause, and Comparative Frequency of Sudden Cardiac Death in National Collegiate Athletic Association Athletes: A Decade in Review. Circulation. 2015 Jul 7;132(1):10-9.

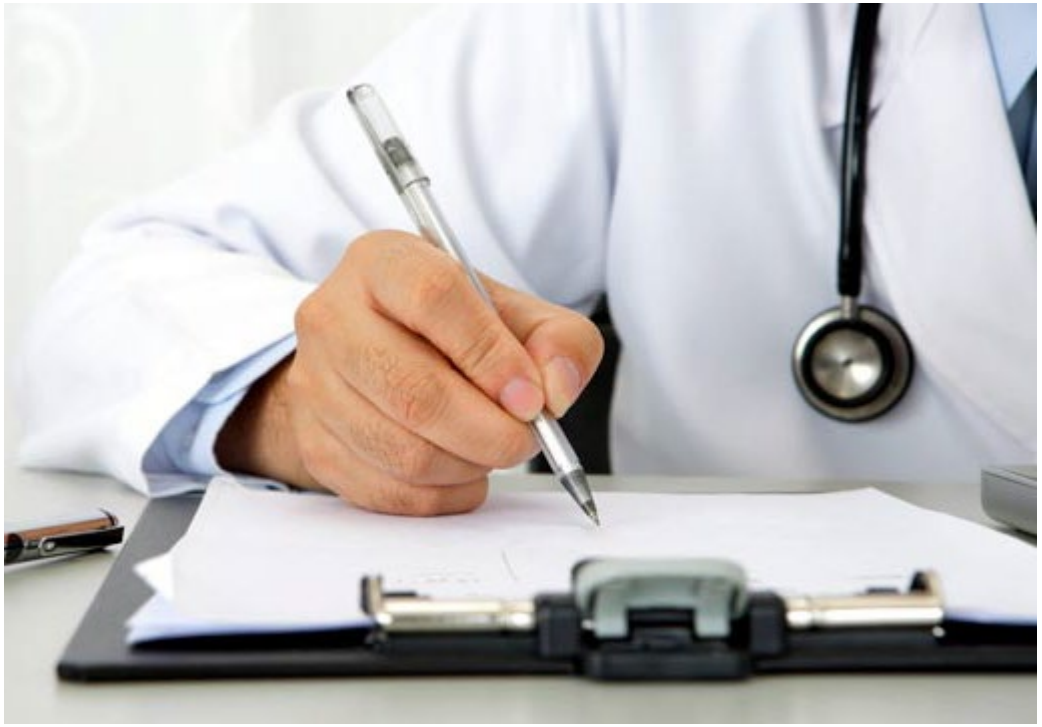
“Big Picture” Perspective

- **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.

Asif IM, Harmon KG, Klossner D : Motor vehicle accidents: the leading cause of death in collegiate athletes. Clin J Sport Med. 2013 Nov;23(6):439-43.

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.)

Date of Exam _____

Name _____ 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 allergy below.

☐ Medicines ☐ Pollens ☐ Food ☐ Stinging Insects

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

GENERAL QUESTIONS	Yes	No
1. Has a doctor ever denied or restricted your participation in sports for any reason?		
2. Do you have any ongoing medical conditions? If so, please identify below: ☐ Asthma ☐ Anemia ☐ Diabetes ☐ Infections Other: _____		
3. Have you ever spent the night in the hospital?		
4. Have you ever had surgery?		
HEART HEALTH QUESTIONS ABOUT YOU	**Yes**	**No**
5. Have you ever passed out or nearly passed out DURING or AFTER exercise?		
6. Have you ever had discomfort, pain, tightness, or pressure in your chest during exercise?		
7. Does your heart ever race or skip beats (irregular beats) during exercise?		
8. Has a doctor ever told you that you have any heart problems? If so, check all that apply: ☐ High blood pressure ☐ A heart murmur ☐ High cholesterol ☐ A heart infection ☐ Kawasaki disease Other: _____		
9. Has a doctor ever ordered a test for your heart? (For example, ECG/EKG, echocardiogram)		
10. Do you get lightheaded or feel more short of breath than expected during exercise?		
11. Have you ever had an unexplained seizure?		
12. Do you get more tired or short of breath more quickly than your friends during exercise?		
HEART HEALTH QUESTIONS ABOUT YOUR FAMILY	**Yes**	**No**
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)?		
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?		
15. Does anyone in your family have a heart problem, pacemaker, or implanted defibrillator?		
16. Has anyone in your family had unexplained fainting, unexplained seizures, or near drowning?		
BONE AND JOINT QUESTIONS	**Yes**	**No**
17. Have you ever had an injury to a bone, muscle, ligament, or tendon that caused you to miss a practice or a game?		
18. Have you ever had any broken or fractured bones or dislocated joints?		
19. Have you ever had an injury that required x-rays, MRI, CT scan, injections, therapy, a brace, a cast, or crutches?		
20. Have you ever had a stress fracture?		
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)		
22. Do you regularly use a brace, orthotics, or other assistive device?		
23. Do you have a bone, muscle, or joint injury that bothers you?		
24. Do any of your joints become painful, swollen, feel warm, or look red?		
25. Do you have any history of juvenile arthritis or connective tissue disease?		

MEDICAL QUESTIONS	Yes	No
26. Do you cough, wheeze, or have difficulty breathing during or after exercise?		
27. Have you ever used an inhaler or taken asthma medicine?		
28. Is there anyone in your family who has asthma?		
29. Were you born without or are you missing a kidney, an eye, a testicle (males), your spleen, or any other organ?		
30. Do you have groin pain or a painful bulge or hernia in the groin area?		
31. Have you had infectious mononucleosis (mono) within the last month?		
32. Do you have any rashes, pressure sores, or other skin problems?		
33. Have you had a herpes or MRSA skin infection?		
34. Have you ever had a head injury or concussion?		
35. Have you ever had a hit or blow to the head that caused confusion, prolonged headache, or memory problems?		
36. Do you have a history of seizure disorder?		
37. Do you have headaches with exercise?		
38. Have you ever had numbness, tingling, or weakness in your arms or legs after being hit or falling?		
39. Have you ever been unable to move your arms or legs after being hit or falling?		
40. Have you ever become ill while exercising in the heat?		
41. Do you get frequent muscle cramps when exercising?		
42. Do you or someone in your family have sickle cell trait or disease?		
43. Have you had any problems with your eyes or vision?		
44. Have you had any eye injuries?		
45. Do you wear glasses or contact lenses?		
46. Do you wear protective eyewear, such as goggles or a face shield?		
47. Do you worry about your weight?		
48. Are you trying to or has anyone recommended that you gain or lose weight?		
49. Are you on a special diet or do you avoid certain types of foods?		
50. Have you ever had an eating disorder?		
51. Do you have any concerns that you would like to discuss with a doctor?		
FEMALES ONLY		
52. Have you ever had a menstrual period?		
53. How old were you when you had your first menstrual period?		
54. How many periods have you had in the last 12 months?		

Explain "yes" answers here

_____

_____

_____

_____

_____

_____

_____

_____

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

Signature of athlete _____ Signature of parent/guardian _____ Date _____

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HE0503 9-2681/0410

History Questions on the PPE Not to Miss!

14 Point AHA Update

TABLE. The 12-Element AHA Recommendations for Preparticipation Cardiovascular Screening of Competitive Athletes

Medical history*

Personal history

1. Exertional chest pain/discomfort
2. Unexplained syncope/near-syncope†
3. Excessive exertional and unexplained dyspnea/fatigue, associated with exercise
4. Prior recognition of a heart murmur
5. Elevated systemic blood pressure

Family history

6. Premature death (sudden and unexpected, or otherwise) before age 50 years due to heart disease, in ≥1 relative
7. Disability from heart disease in a close relative <50 years of age
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

Physical examination

9. Heart murmur‡
10. Femoral pulses to exclude aortic coarctation
11. Physical stigmata of Marfan syndrome
12. Brachial artery blood pressure (sitting position)§

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

Medical history*

Personal history

1. Chest pain/discomfort/tightness/pressure related to exertion
2. Unexplained syncope/near-syncope†
3. Excessive and unexplained dyspnea/fatigue or palpitations, associated with exercise
4. Prior recognition of a heart murmur
5. Elevated systemic blood pressure
6. Prior restriction from participation in sports
7. Prior testing for the heart, ordered by a physician

Family history

8. Premature death (sudden and unexpected, or otherwise) before 50 y of age attributable to heart disease in ≥1 relative
9. Disability from heart disease in close relative <50 y of age
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

Physical examination

11. Heart murmur‡
12. Femoral pulses to exclude aortic coarctation
13. Physical stigmata of Marfan syndrome
14. Brachial artery blood pressure (sitting position)§

Maron BJ, Levine BD, Washington RL, et al. Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 2: Preparticipation Screening for Cardiovascular Disease in Competitive Athletes: A Scientific Statement From the American Heart Association and American College of Cardiology. Circulation 2015; 132:e267.

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 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).

EXAMINATION		
Height Weight ☐ Male ☐ Female		
BP / (/) Pulse Vision R 20/ L 20/ Corrected: ☐ Y ☐ N		
MEDICAL	**NORMAL**	**ABNORMAL FINDINGS**
Appearance • Marfan stigmata (kyphoscoliosis, high-arched palate, pectus excavatum, arachnodactyly, arm span > height, hyperlaxity, myopia, MVP, aortic insufficiency)		
Eyes/ears/nose/throat • Pupils equal • Hearing		
Lymph Nodes		
Heart[a] • Murmurs (auscultation standing, supine, +/- Valsalva) • Location of point of maximal impulse (PMI)		
Pulses • Simultaneous femoral and radial pulses		
Lungs		
Abdomen		
Genitourinary (males only)[b]		
Skin • HSV, lesions suggestive of MRSA, tinea corporis		
Neurologic[c]		
MUSCULOSKELETAL		
Neck		
Back		
Shoulder/arm		
Elbow/forearm		
Wrist/hand/fingers		
Hip/thigh		
Knee		
Leg/ankle		
Foot/toes		
Functional • Duck-walk, single leg hop		

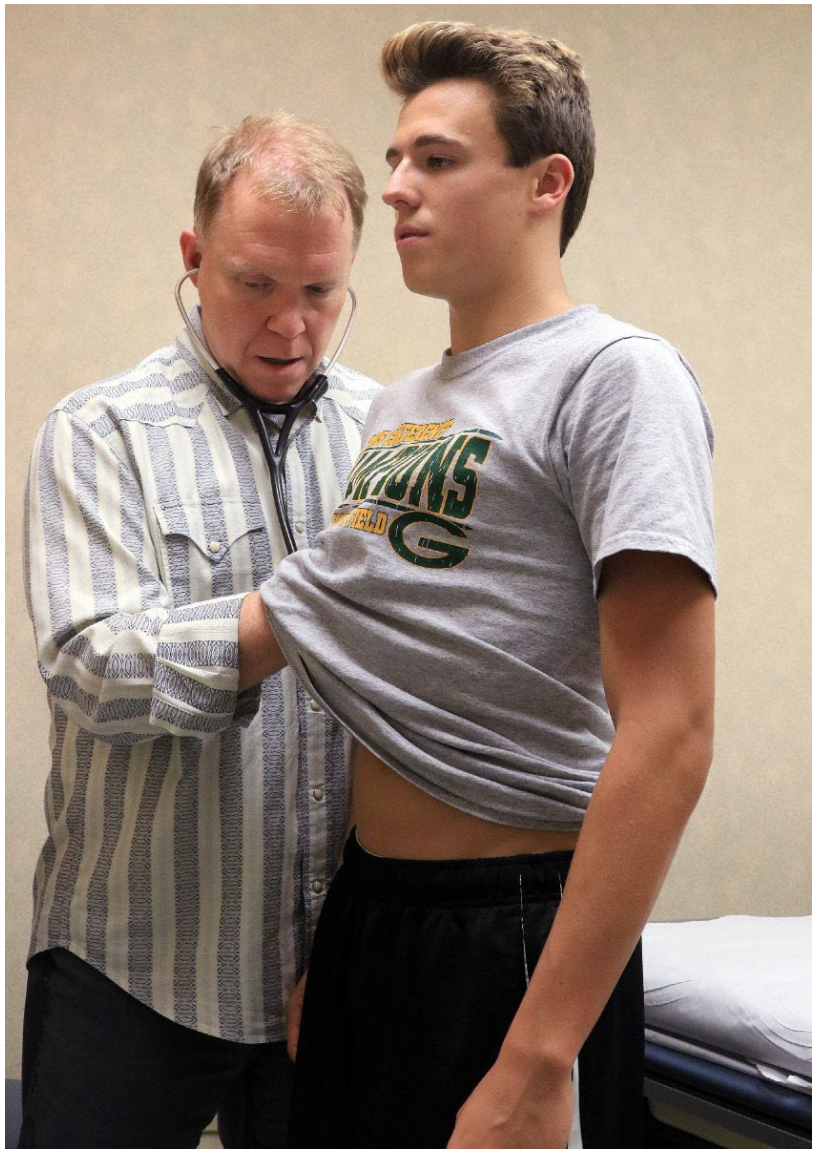
[a]Consider ECG, echocardiogram, and referral to cardiology for abnormal cardiac history or exam.
[b]Consider GU exam if in private setting. Having third party present is recommended.
[c]Consider cognitive evaluation or baseline neuropsychiatric testing if a history of significant concussion.

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: _____

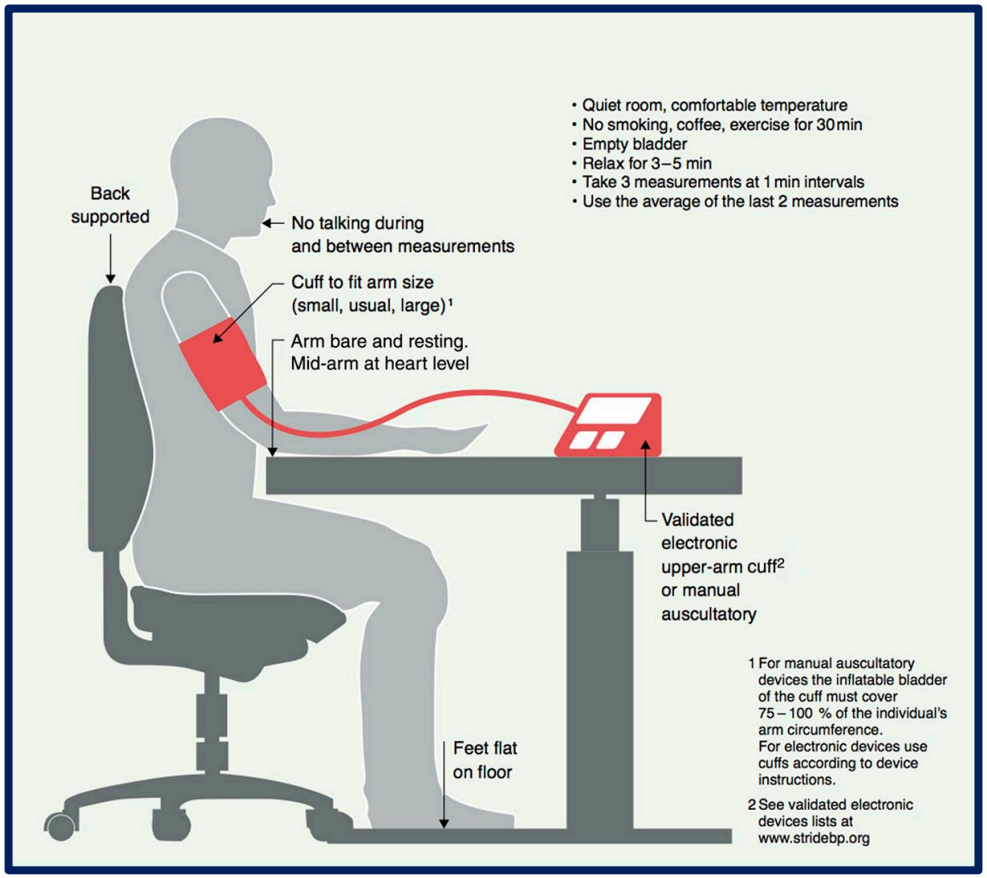


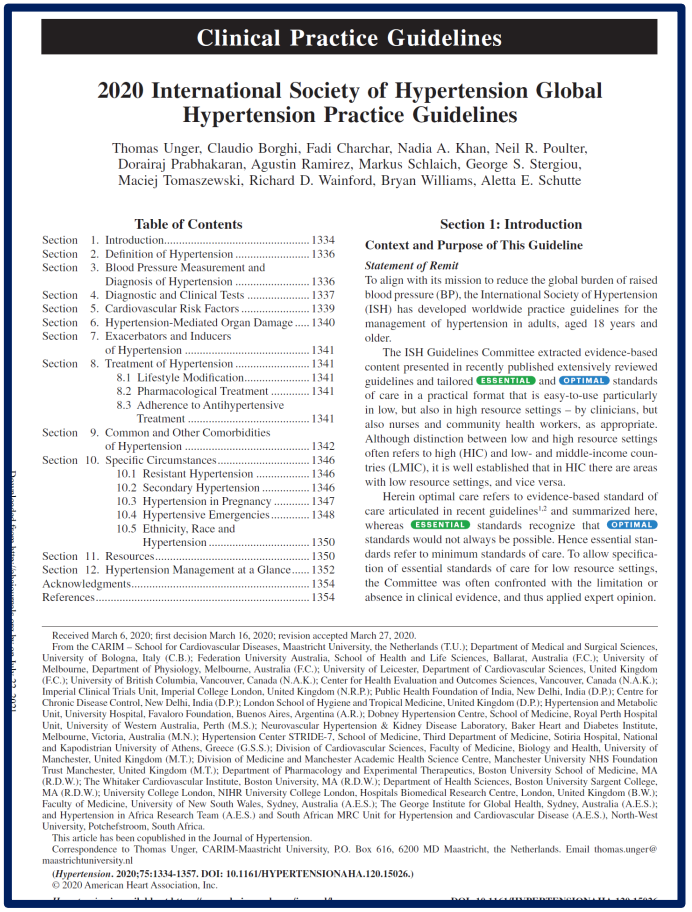
Performing the Cardiovascular Preparticipation Examination

14 Element AHA Recommendations

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

Blood Pressure Assessment





Clinical Practice Guidelines

2020 International Society of Hypertension Global Hypertension Practice Guidelines

Thomas Unger, Claudio Borghi, Fadi Charchar, Nadia A. Khan, Neil R. Poulter, Dorairaj Prabhakaran, Agustin Ramirez, Markus Schlaich, George S. Stergiou, Maciej Tomaszewski, Richard D. Wainford, Bryan Williams, Aletta E. Schutte

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Section 1: Introduction

Context and Purpose of This Guideline

Statement of Remit

To align with its mission to reduce the global burden of raised blood pressure (BP), the International Society of Hypertension (ISH) has developed worldwide practice guidelines for the management of hypertension in adults, aged 18 years and older.

The ISH Guidelines Committee extracted evidence-based content presented in recently published extensively reviewed guidelines and tailored ESSENTIAL and OPTIMAL standards of care in a practical format that is easy-to-use particularly in low, but also in high resource settings – by clinicians, but also nurses and community health workers, as appropriate. Although distinction between low and high resource settings often refers to high (HIC) and low- and middle-income countries (LMIC), it is well established that in HIC there are areas with low resource settings, and vice versa.

Herein optimal care refers to evidence-based standard of care articulated in recent guidelines[1,2] and summarized here, whereas ESSENTIAL standards recognize that OPTIMAL standards would not always be possible. Hence essential standards refer to minimum standards of care. To allow specification of essential standards of care for low resource settings, the Committee was often confronted with the limitation or absence in clinical evidence, and thus applied expert opinion.

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Blood Pressure Assessment: Young Athlete

- **Diagnosis:**

TABLE 3 Updated Definitions of BP Categories and Stages

For Children Aged 1–13 y	For Children Aged ≥13 y
Normal BP: <90th percentile	Normal BP: <120/<80 mm Hg
Elevated BP: ≥90th percentile to <95th percentile or 120/80 mm Hg to <95th percentile (whichever is lower)	Elevated BP: 120/<80 to 129/<80 mm Hg
Stage 1 HTN: ≥95th percentile to <95th percentile + 12 mmHg, or 130/80 to 139/89 mm Hg (whichever is lower)	Stage 1 HTN: 130/80 to 139/89 mm Hg
Stage 2 HTN: ≥95th percentile + 12 mm Hg, or ≥140/90 mm Hg (whichever is lower)	Stage 2 HTN: ≥140/90 mm Hg

CLINICAL PRACTICE GUIDELINE Guidance for the Clinician in Rendering Pediatric Care

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents

Joseph T. Flynn, MD, MS, FAAP,[a] David C. Kaelber, MD, PhD, MPH, FAAP, FACP, FACMI,[b] Carissa M. Baker-Smith, MD, MS, MPH, FAAP, FAHA,[c] Douglas Blowey, MD,[d] Aaron E. Carroll, MD, MS, FAAP,[e] Stephen R. Daniels, MD, PhD, FAAP,[f] Sarah D. de Ferranti, MD, MPH, FAAP,[g] Janis M. Dionne, MD, FRCPC,[h] Bonita Falkner, MD,[i] Susan K. Flinn, MA,[j] Samuel S. Gidding, MD,[k] Celeste Goodwin,[l] Michael G. Leu, MD, MS, MHS, FAAP,[m] Makia E. Powers, MD, MPH, FAAP,[n] Corinna Rea, MD, MPH, FAAP,[o] Joshua Samuels, MD, MPH, FAAP,[p] Madeline Simasek, MD, MSCP, FAAP,[q] Vidhu V. Thaker, MD, FAAP,[r] Elaine M. Urbina, MD, MS, FAAP,[s] SUBCOMMITTEE ON SCREENING AND MANAGEMENT OF HIGH BLOOD PRESSURE IN CHILDREN

These pediatric hypertension guidelines are an update to the 2004 "Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents." Significant changes in these guidelines include (1) the replacement of the term "prehypertension" with the term "elevated blood pressure," (2) new normative pediatric blood pressure (BP) tables based on normal-weight children, (3) a simplified screening table for identifying BPs needing further evaluation, (4) a simplified BP classification in adolescents ≥13 years of age that aligns with the forthcoming American Heart Association and American College of Cardiology adult BP guidelines, (5) a more limited recommendation to perform screening BP measurements only at preventive care visits, (6) streamlined recommendations on the initial evaluation and management of abnormal BPs, (7) an expanded role for ambulatory BP monitoring in the diagnosis and management of pediatric hypertension, and (8) revised recommendations on when to perform echocardiography in the evaluation of newly diagnosed hypertensive pediatric patients (generally only before medication initiation), along with a revised definition of left ventricular hypertrophy. These guidelines include 30 Key Action Statements and 27 additional recommendations derived from a comprehensive review of almost 15 000 published articles between January 2004 and July 2016. Each Key Action Statement includes level of evidence, benefit-harm relationship, and strength of recommendation. This clinical practice guideline, endorsed by the American Heart Association, is intended to foster a patient- and family-centered approach to care, reduce unnecessary and costly medical interventions, improve patient diagnoses and outcomes, support implementation, and provide direction for future research.

abstract

FREE

[a]Dr Robert D. Hickman Endowed Chair in Pediatric Nephrology, Division of Nephrology, Department of Pediatrics, University of Washington and Seattle Children's Hospital, Seattle, Washington; [b]Departments of Pediatrics, Internal Medicine, Population and Quantitative Health Sciences, Center for Clinical Informatics Research and Education, Case Western Reserve University and MetroHealth System, Cleveland, Ohio; [c]Division of Pediatric Cardiology, School of Medicine, University of Maryland, Baltimore, Maryland; [d]Children's Mercy Hospital, University of Missouri-Kansas City and Children's Mercy Integrated Care Solutions, Kansas City, Missouri; [e]Department of Pediatrics, School of Medicine, Indiana University, Bloomington, Indiana; [f]Department of Pediatrics, School of Medicine, University of Colorado-Denver and Pediatrician in Chief, Children's Hospital Colorado, Aurora, Colorado; [g]Director, Preventive Cardiology Clinic, Boston Children's Hospital, Department of Pediatrics, Harvard Medical School, Boston, Massachusetts; [h]Division of Nephrology, Department of Pediatrics, University of British Columbia and British Columbia Children's Hospital, Vancouver, British Columbia, Canada; [i]Departments of Medicine and Pediatrics, Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, Pennsylvania; [j]Consultant, American Academy of Pediatrics, Washington, District of Columbia; [k]Cardiology Division Head, Nemours Cardiac Center, Alfred I. duPont Hospital for Children, Wilmington, Delaware; [l]National Pediatric Blood Pressure Awareness Foundation, Prairieville, Louisiana; Departments of [m]Pediatrics and Biomedical Informatics and Medical Education, University of Washington, University of Washington Medicine and Information Technology Services, and Seattle Children's Hospital,

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Flynn JT, Kaelber DC, Baker-Smith CM, et al; Subcommittee on Screening and Management of High Blood Pressure in Children. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics.* 2017;140(3):e20171904. Pediatrics. 2018 Sep;142(3):e20181739.

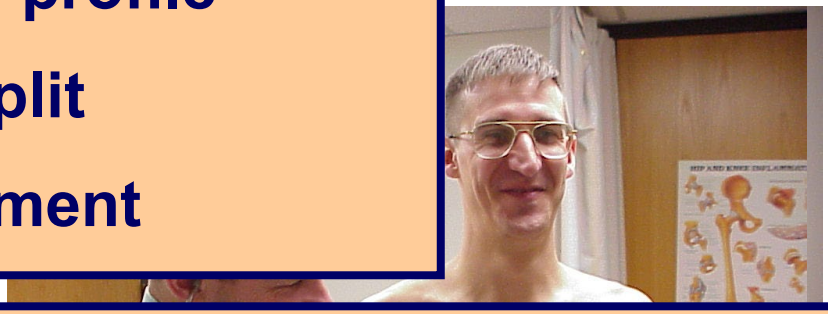
Blood Pressure Assessment: Adult

Other Risk Factors, HMOD, or Disease	High-Normal SBP 130–139 DBP 85–89		Grade 1 SBP 140–159 DBP 90–99	Grade 2 SBP ≥160 DBP ≥100	
No other risk factors	Low		Low	Moderate	High
1 or 2 risk factors	Low		Moderate	High	
≥3 risk factors	Low	Moderate	High	High	
HMOD, CKD grade 3, diabetes mellitus, CVD	High		High	High	

Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, Prabhakaran D, Ramirez A, Schlaich M, Stergiou GS, Tomaszewski M, Wainford RD, Williams B, Schutte AE. 2020 International Society of Hypertension global hypertension practice guidelines. J Hypertens. 2020 Jun;38(6):982-1004.

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



- Palpation – PMI, thrills
- Splitting
- Dynamic
- Patholog

Suspicious:

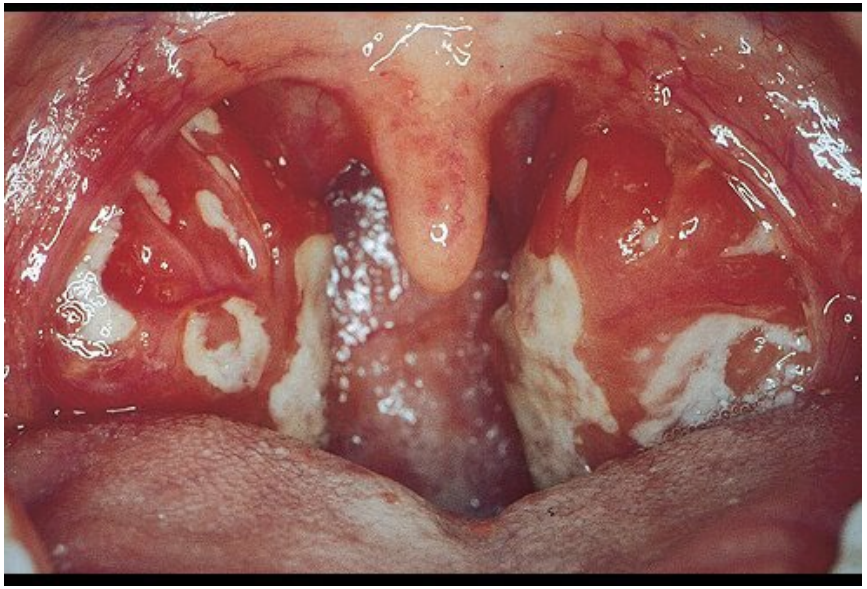
- diastolic, holosystolic, or continuous
- grade III or greater in intensity
- abnormal S2 splitting
- abnormal dynamic assessment

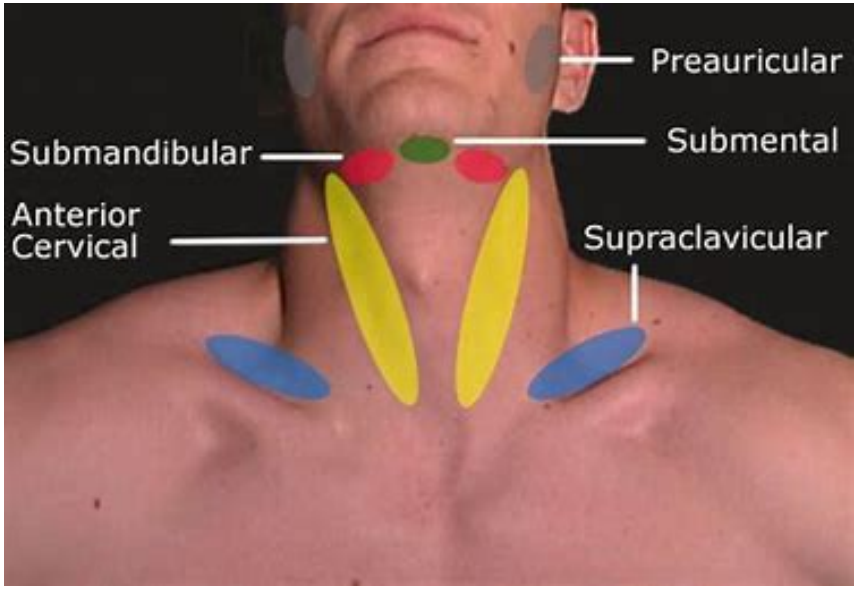
Not to be Forgotten!

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

HEENT

E
F P
T O Z

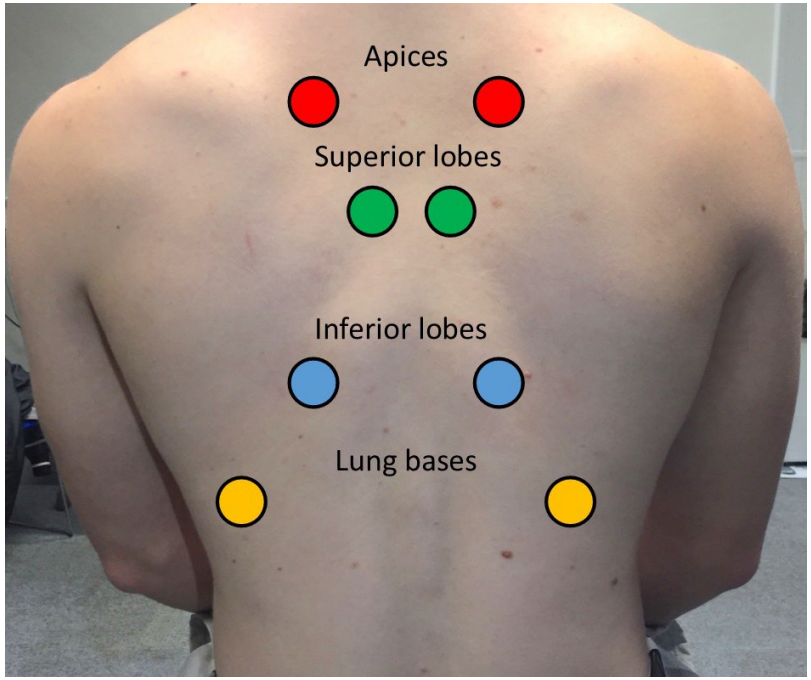


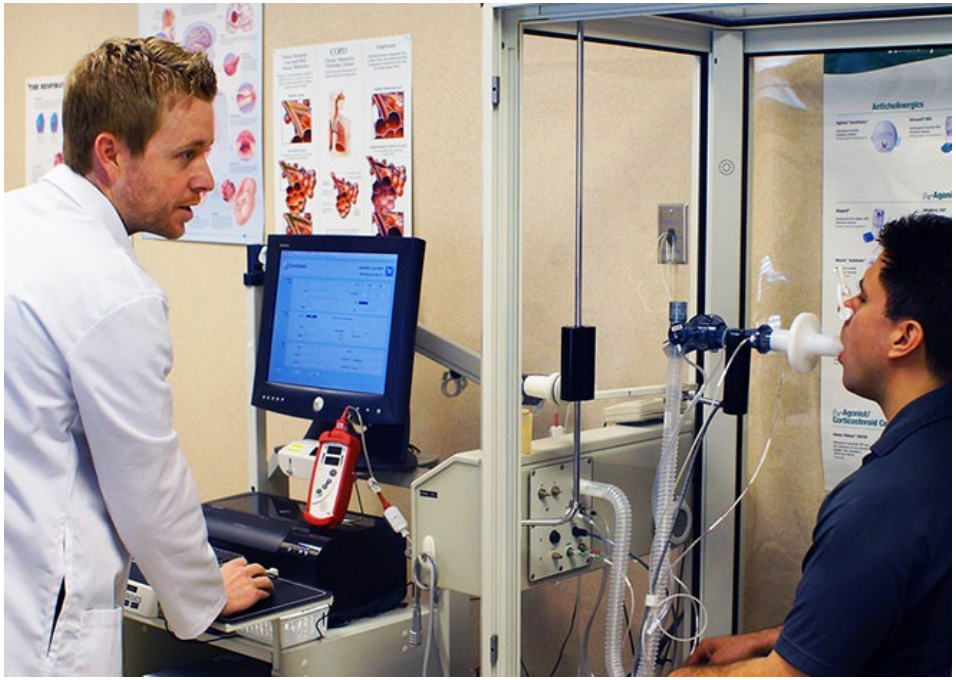

Preauricular
Submandibular
Submental
Anterior
Cervical
Supraclavicular

Skin

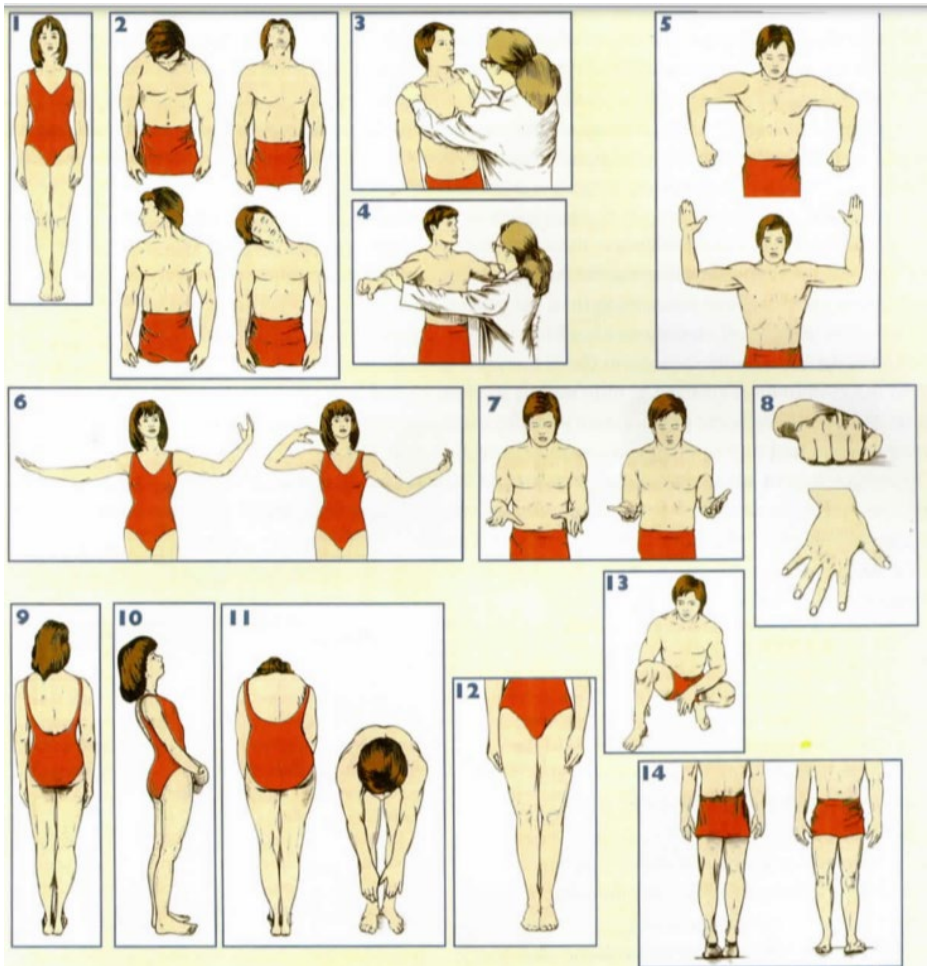
Abdominal/Genitourinary

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

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.

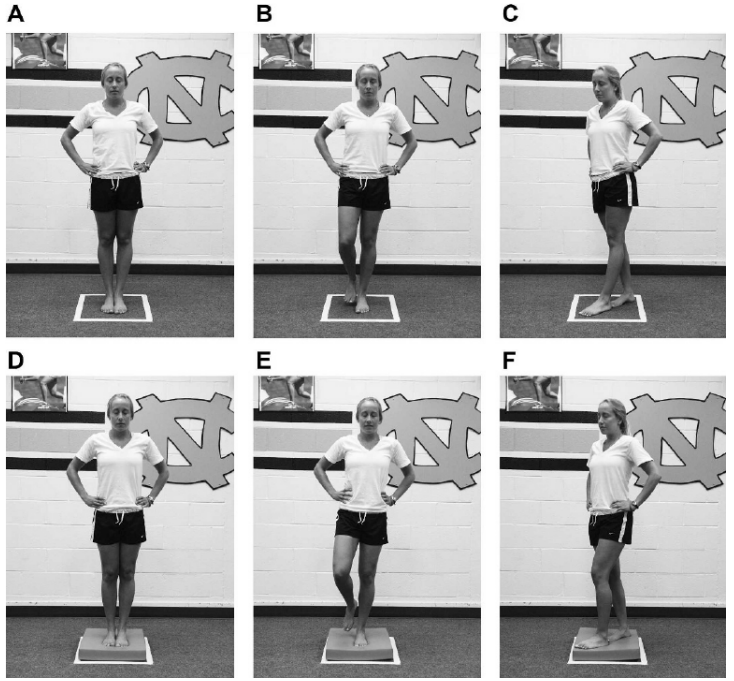
Routine Blood Tests and UA

- Routine laboratory testing is not recommended as part of the preparticipation physical evaluation (PPE) in the absence of symptoms.

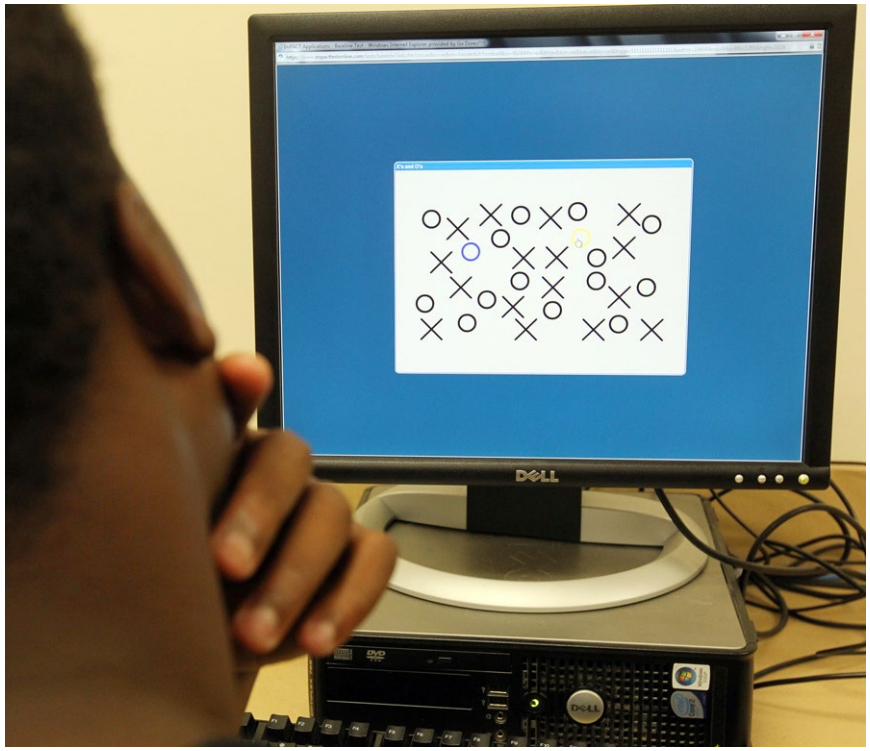
American Academy of Family Physicians, American Academy of Pediatrics, American College of Sports Me. Preparticipation Physical Evaluation, 4th ed, Bernhardt D, Roberts W (Eds), American Academy of Pediatrics, Elk Grove Village, IL 2010.

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



BJSM Online First, published on April 26, 2017 as 10.1136/bjsports-2017-097506SCAT5

To download a clean version of the SCAT tools please visit the journal online (http://dx.doi.org/10.1136/bjsports-2017-097506SCAT5)

SCAT5© SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION

DEVELOPED BY THE CONCUSSION IN SPORT GROUP

FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by

FIFA

Patient details

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date of Injury: _____ Time: _____

WHAT IS THE SCAT5?

The SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals[1]. 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 13 years and older. For children aged 12 years or younger, please use the Child SCAT5.

Preseason 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 italics. The only equipment required for the tester is a watch or timer.

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Recognise and Remove

A head impact by either a direct blow or indirect transmission of force 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 1, then activation of emergency procedures and urgent transport to the nearest hospital should be arranged.

Key points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If an athlete is 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, use recreational drugs and should not drive a motor vehicle until cleared to do so 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 (danger, 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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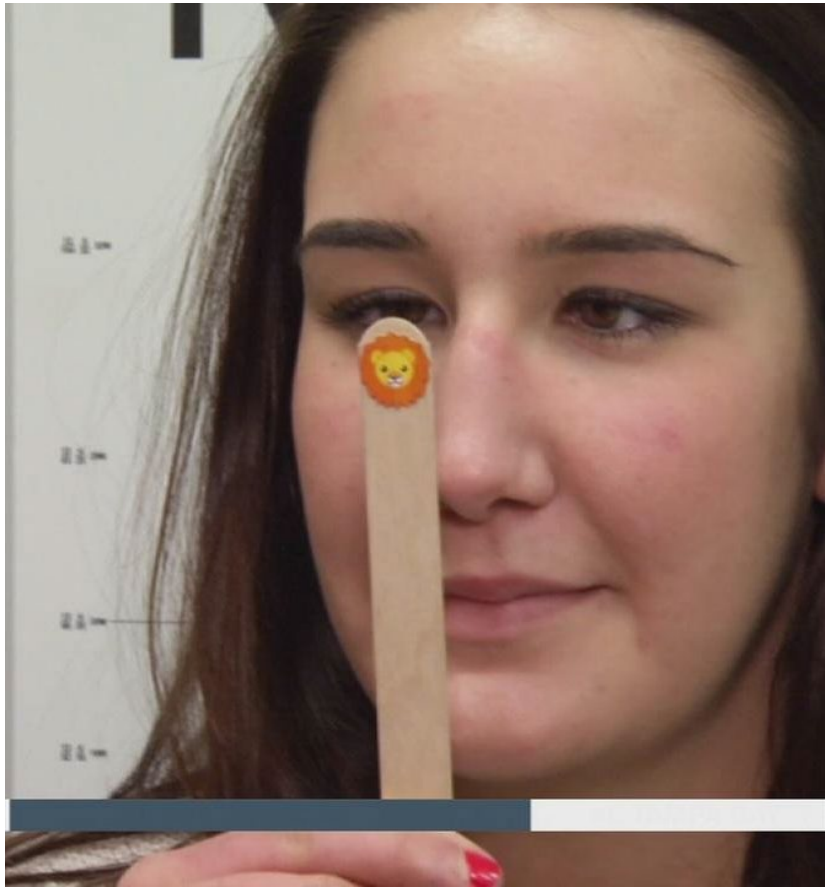
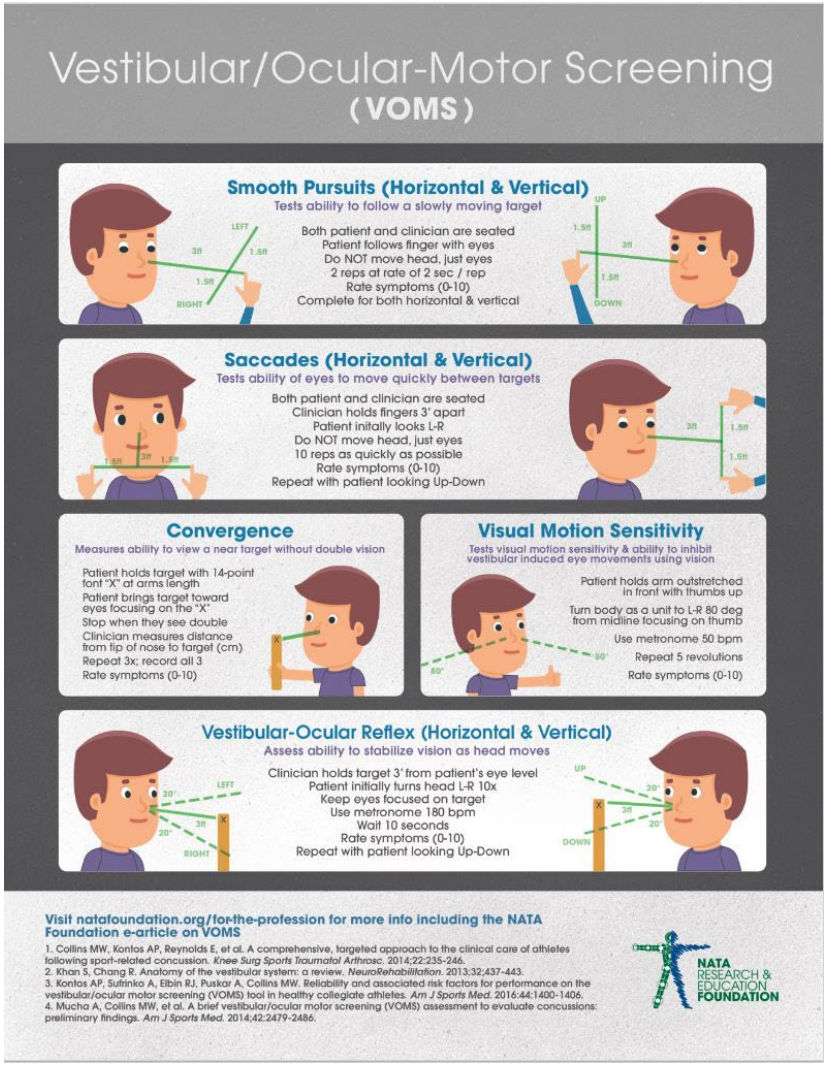
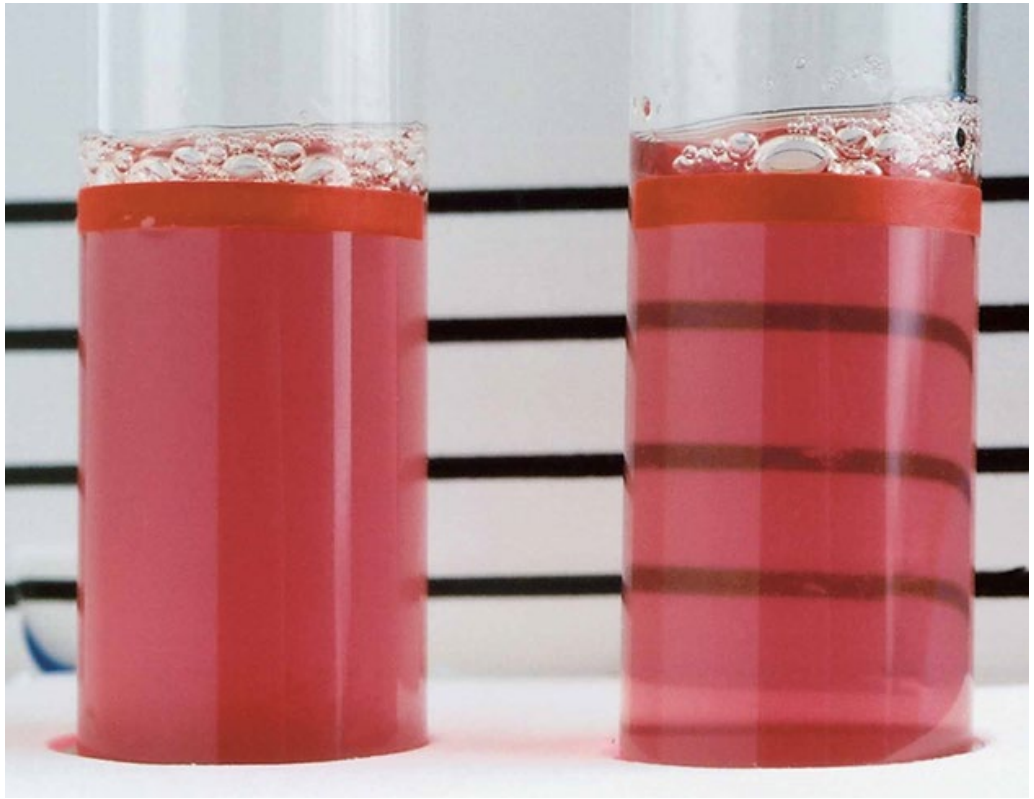
Visual Ocular-Motor Testing (VOMS)



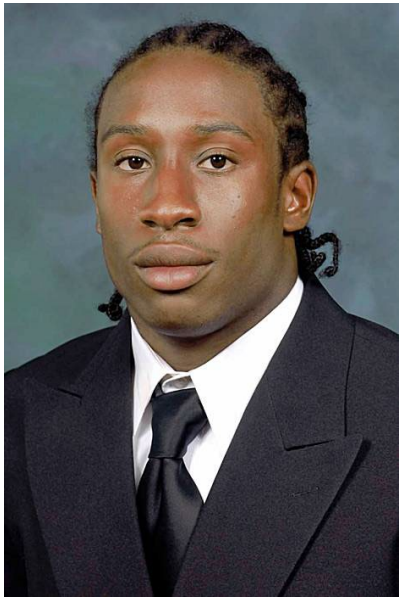


Sickle Cell Screening



Primary Prevention

- 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**.

Statement on Screening for Sickle Cell Trait and Athletic Participation. (2012). *ASH Policy* Retrieved January 2012, from http://www.hematology.org/advocacy/policy-statements/7704.aspx

Advanced Cardiac Screening

NCAA Guidance 2016

Consensus statement and guidelines: Interassociation consensus statement on cardiovascular care of college student-athletes

Brian Hainline,[1] Jonathan Drezner,[2] Aaron Baggish,[3] Kimberly G Harmon,[2] Michael S Emery,[4] Robert J Myerburg,[5] Eduardo Sanchez,[6] Silvana Molossi,[7] John T Parsons,[1] Paul D Thompson[8]

► Additional material is published online only. To view

ABSTRACT
Cardiovascular evaluation and care of college student-

F. to educate student-athletes regarding health risks, health-related behaviour, and perfin-

Pediatrics, Baylor College of Medicine, Houston, Texas, USA
[8]Division of Cardiology, Hartford Hospital, Hartford, Connecticut, USA

Correspondence to
D. Brian Hainline, Sport Science Institute, National Collegiate Athletic Association, P.O. Box 6222, Indianapolis, IN 46206-6222, USA;
bhainline@ncaa.org

This paper is co-published with the *Journal of the American College of Cardiology*

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CARDIOVASCULAR CARE OF COLLEGE STUDENT-ATHLETES

The preparticipation evaluation

1. The purpose of the preparticipation evaluation is to identify conditions that may put the student-athlete at unreasonable risk of death or catastrophic injury, with the potential to modify and reduce risk through individualised management. In addition, the preparticipation evaluation provides the following opportunities:
   - A. to ensure that current health problems are managed appropriately;
   - B. to identify conditions that serve as barriers to performance;
   - C. to allow the student-athlete an opportunity to establish a relationship with the team physician, athletic trainer and other members of the medical team who may be involved in providing continuing medical care;
   - D. to assess for characteristics that may place the student-athlete at risk for future injury or disease;
   - E. to review medications and/or supplements, including addressing possible requests for therapeutic use exemption; and

cine level (most likely the head team physician) and one clinician provider at the athletic trainer level (most likely the head athletic trainer) who will be charged with the responsibility for ensuring that the preparticipation cardiac screening is conducted with the necessary components, as documented in the following text. Medical records of the examination should be kept in an accessible, secure file for at least the duration of the student-athlete's college career, and should accompany the athlete during any school transfers.

4. As afforded by local resources, cardiac screening on campus is encouraged in an effort to maintain a consistent and high-quality level of care.
   - A. For member institutions that choose to rely on external care providers to provide preparticipation evaluations, an on-campus mechanism should be established to confirm that the preparticipation evaluations are thoroughly reviewed. The goal of the review is to ensure follow-up and completion of any potential abnormal finding (either confirmed or dismissed) prior to organised athletic participation.

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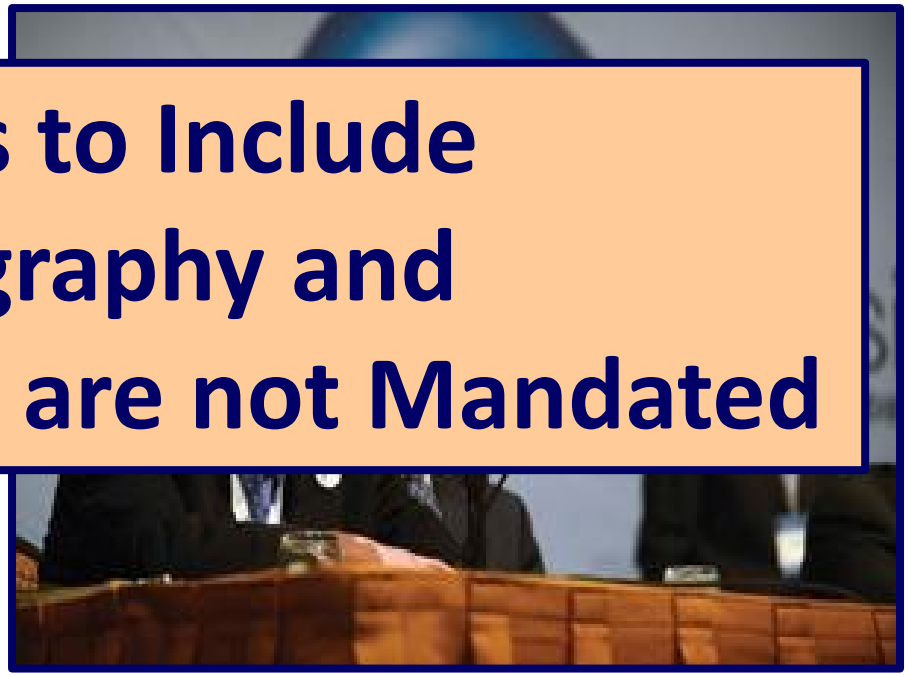


Special Tests to Include Echocardiography and Electrocardiography are not Mandated

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?
- He would like to discuss other common clearance dilemmas!

Athletic Clearance Decision

PREPARTICIPATION PHYSICAL EVALUATION 159

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 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?

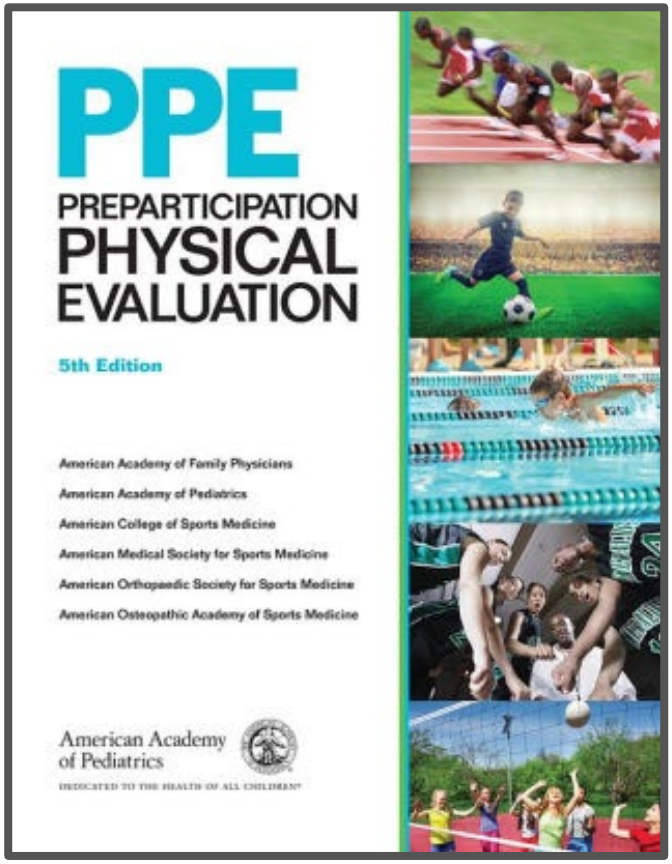
I certify that the above student has been medically evaluated for participation in athletics and deemed:

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: _____

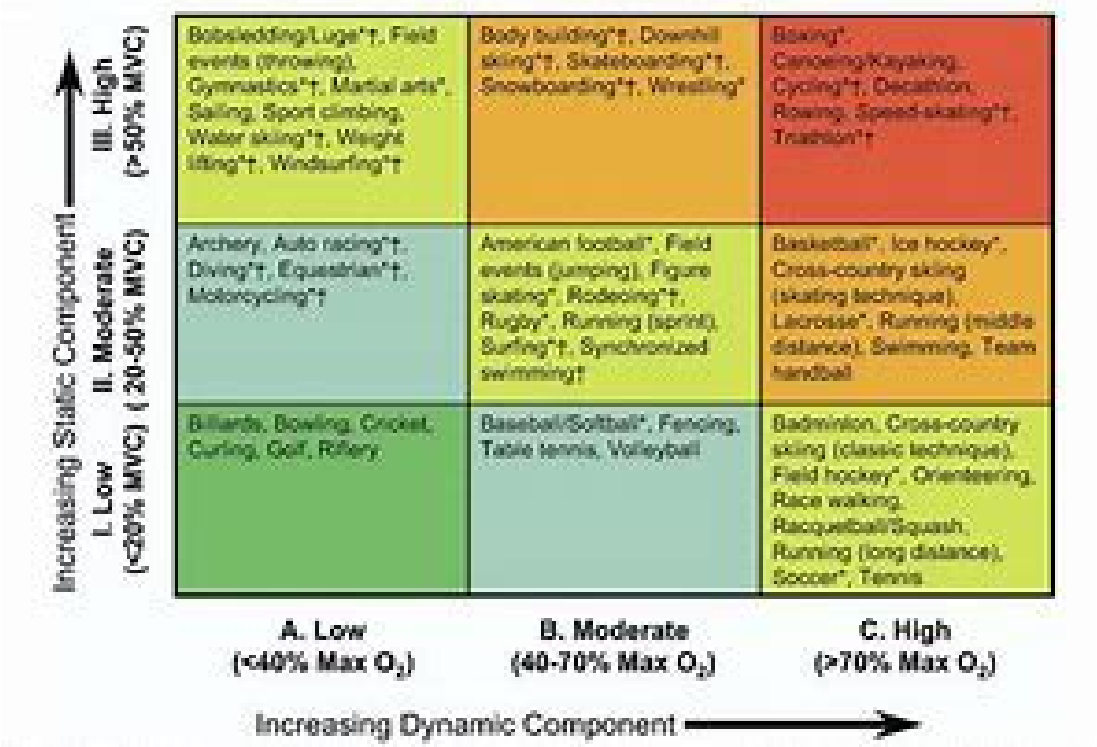
Signature of physician: _____

Resource Documents



2015
ACC/AHA Guidelines
-
Competitive Athletes with
Cardiovascular Abnormalities

Sports Classification



Zips DP, Link MS, Ackerman MJ, Kovacs RJ, Myerburg RJ, Estes NA 3rd. Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 9: Arrhythmias and Conduction Defects: A Scientific Statement From the American Heart Association and American College of Cardiology. J Am Coll Cardiol. 2015 Dec 1;66(21):2412-23.

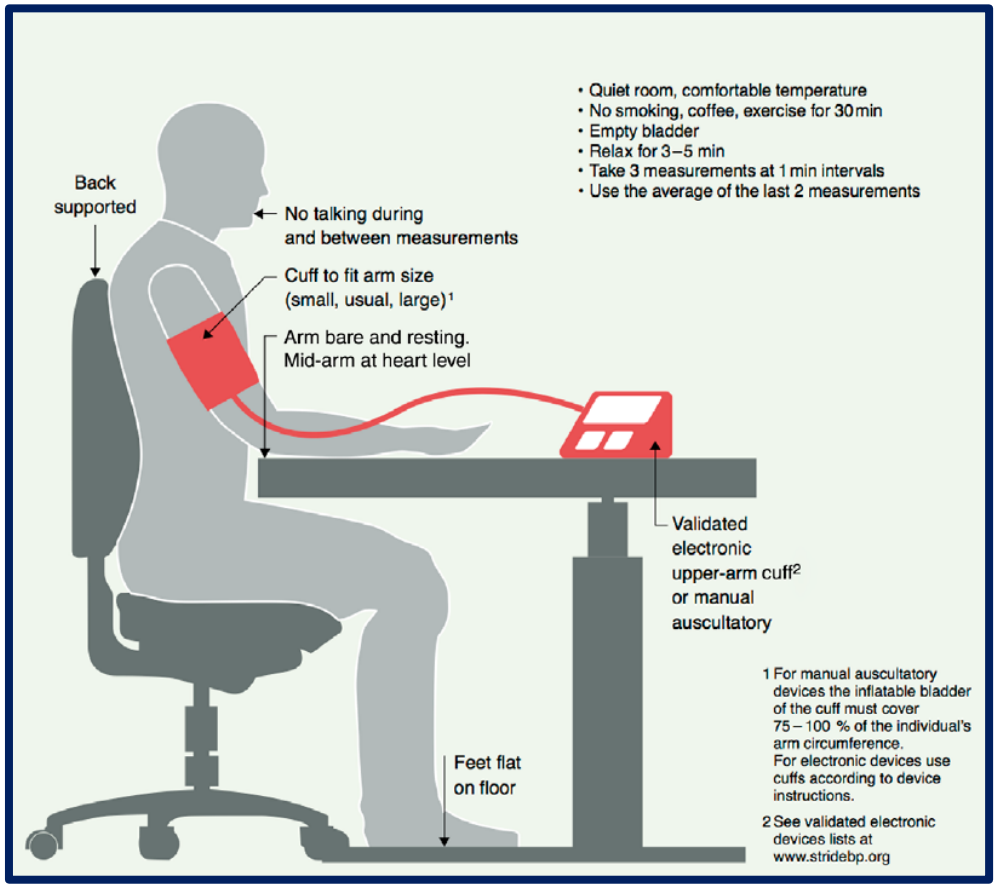
Hypertension in the Athlete

- 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.

ISH Guidelines for Evaluation

TABLE Guidelines for Clinic (or Office) BP Measurement

Posture
BP obtained in the seated position is recommended. The subject should sit quietly for 5 min, with the back supported in a chair, with feet on the floor and the arm supported at the level of the heart, before BP is recorded.
Circumstances
No caffeine should be ingested during the hour preceding the reading, and no smoking during the 30 min preceding the reading.
A quiet, warm setting should be available for BP measurements.
Equipment
Cuff size
The bladder should encircle and cover at least 80% of the length of the arm; if it does not, use a larger cuff. If bladder is too short, misleadingly high readings may result.
Manometer
Use a validated electronic (digital) device, a recently calibrated aneroid or mercury column sphygmomanometer.
Technique
Number of readings
On each occasion, take at least 2 readings, separated by as much time as is practical. If readings vary by >10 mm Hg, take additional readings until 2 consecutive readings are within 10 mm Hg.
If the arm pressure is elevated, take the measurement in 1 leg to rule out aortic coarctation (particularly in patients <30 y of age).
Initially, take pressures in both arms; if the blood pressures differ, use the arm with the higher pressure.
If the initial values are elevated, obtain 2 other sets of readings at least 1 wk apart.
Performance
Inflate the bladder quickly to a pressure 20 mm Hg above the systolic BP, as recognized by the disappearance of the radial pulse; deflate the bladder at 2 mm Hg/s.
Record the Korotkoff phase I (appearance) and phase V (disappearance) sounds. If the Korotkoff sounds are weak, have the patient raise the arm, then open and close the hand 5-10 times, and then reinflate the bladder quickly.



Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, Prabhakaran D, Ramirez A, Schlaich M, Stergiou GS, Tomaszewski M, Wainford RD, Williams B, Schutte AE. 2020 International Society of Hypertension global hypertension practice guidelines. J Hypertens. 2020 Jun;38(6):982-1004.

Brachial Blood Pressure Assessment: Adult

Practice Guidelines

Hypertension: New Guidelines from the International Society of Hypertension

Key Points for Practice

- Use an average threshold of 140/90 mm Hg for office diagnosis of hypertension, but 135/85 mm Hg for home and 130/80 mm Hg for 24-hour ambulatory monitoring.
- Initial assessment in a patient who is hypertensive should evaluate for cardiovascular risk and any hypertension-mediated organ damage.
- Consider lifestyle interventions for three to six months before medication in patients with grade 1 hypertension and no comorbidities.
- After starting medication, target blood pressure is less than 140/90 mm Hg within three months, and after three months reduce target to less than 130/80 mm Hg in patients younger than 65 years.

From the *AFP* Editors

Hypertension is one of the leading causes of death globally each year, accounting for up to 30% of myocardial infarctions. Although the prevalence of hypertension is increasing, many patients are underdiagnosed and undertreated. The International Society of Hypertension (ISH) has published summary guidelines based on major international guidelines published between 2017 and 2020 on the control of hypertension. These summary guidelines include essential recommendations and suggestions for optimal care.

Diagnosis

Because blood pressure (BP) readings vary by measurement technique, diagnostic criteria are specific to the technique *(Table 1)*. In health care settings that include the physician's office, hypertension is diagnosed when BP is 140/90 mm Hg or greater, ideally using an electronic device and following standard protocols for measurement, including repeat measurements.

The ISH recommends categorizing grade 1 hypertension for BP levels less than 160/100 mm Hg and grade 2 hypertension for any higher BP levels. Hypertension should only be diagnosed from a single BP reading if the measurement is 180/110 mm Hg or higher with evidence of cardiovascular disease requiring immediate treatment. Otherwise, the patient should be reassessed every one to four weeks to confirm BP elevations.

Although outpatient office measurements continue to be the most common means of diagnosing hypertension, home and ambulatory readings are more consistent and better reflect hypertension-mediated organ damage risk. Out-of-office readings can differentiate white coat hypertension, with elevated office measurements, and masked hypertension, where measurements are lower in the office.

When BP is measured at home, hypertension is diagnosed if readings are consistently 135/85 mm Hg or greater. With 24-hour ambulatory

TABLE 1

International Society of Hypertension Diagnostic Blood Pressure Thresholds

Location	Threshold (mm Hg)
Office	140/90
Home	135/85
24-hour ambulatory monitoring	
24-hour average	130/80
Daytime average	135/85
Nighttime average	120/70

Adapted from Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension global hypertension practice guidelines. J Hypertens. 2020; 38(6):984.

Coverage of guidelines from other organizations does not imply endorsement by *AFP* or the AAFP.

This series is coordinated by Michael J. Arnold, MD, contributing editor.

A collection of Practice Guidelines published in *AFP* is available at https://www.aafp.org/afp/practguide.

CME This clinical content conforms to AAFP criteria for CME. See CME Quiz on page 719.

Author disclosure: No relevant financial affiliations.

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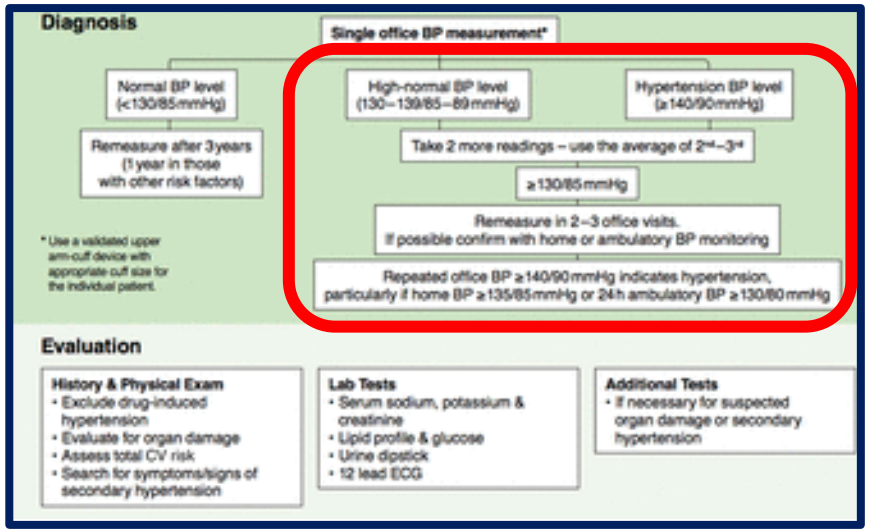
Table 1. Classification of Hypertension Based on Office Blood Pressure (BP) Measurement

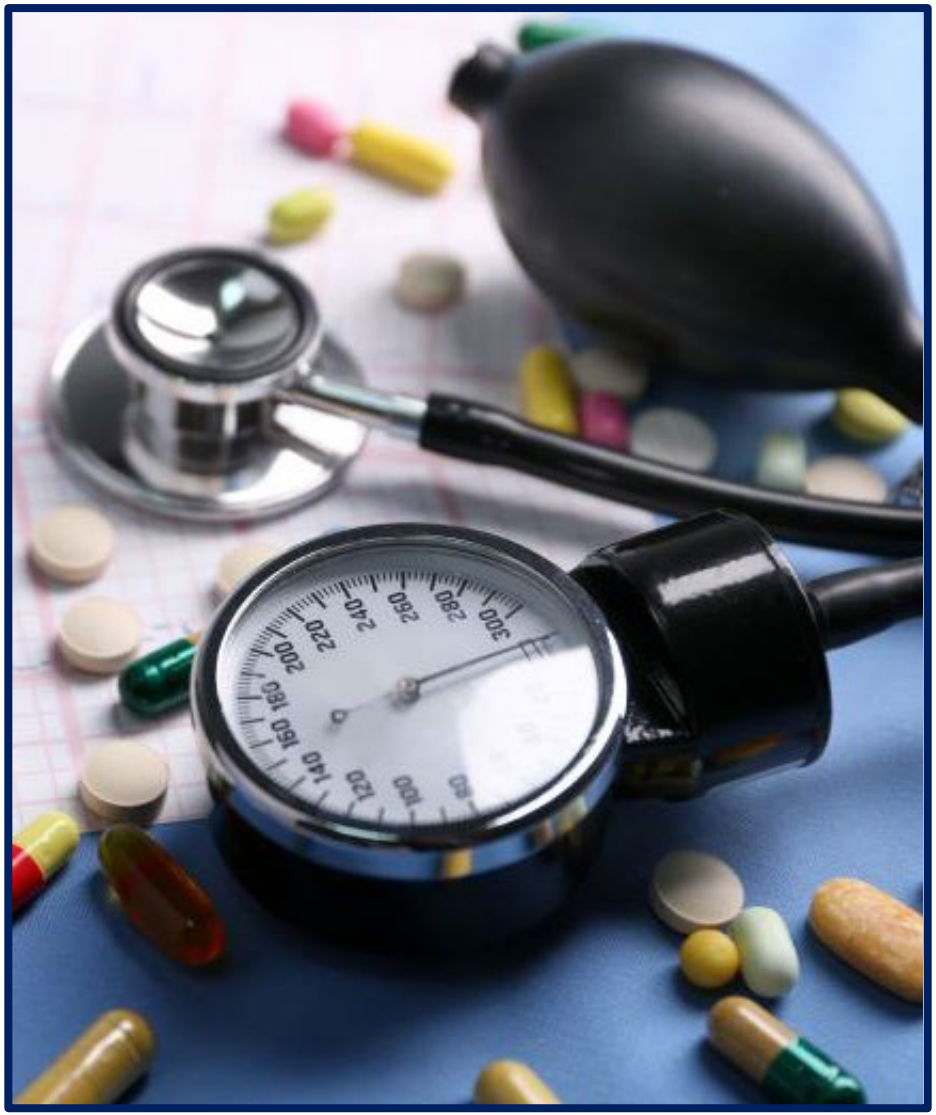
Category	Systolic (mm Hg)		Diastolic (mm Hg)
Normal BP	<130	and	<85
High-normal BP	130–139	and/or	85–89
Grade 1 hypertension	140–159	and/or	90–99
Grade 2 hypertension	≥160	and/or	≥100

Buelt A, Richards A, Jones AL. Hypertension: New Guidelines from the International Society of Hypertension. Am Fam Physician. 2021 Jun 15;103(12):763-765.

ISH Guidelines for Management



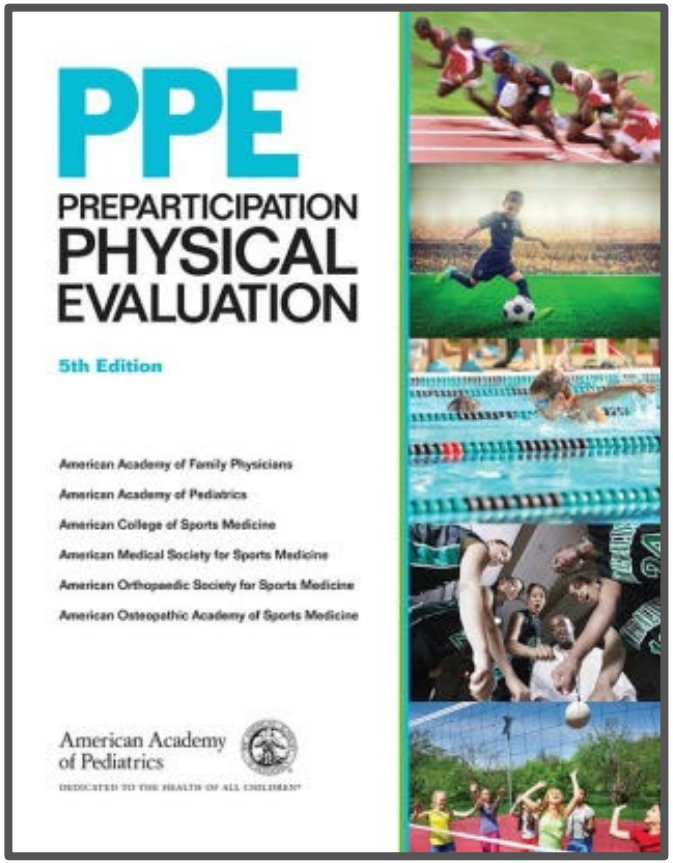
Other Risk Factors, HMOD, or Disease	High-Normal SBP 130–139 DBP 85–89	Grade 1 SBP 140–159 DBP 90–99	Grade 2 SBP ≥160 DBP ≥100
No other risk factors	Low	Low	Moderate / High
1 or 2 risk factors	Low	Moderate	High
≥3 risk factors	Low / Moderate	High	High
HMOD, CKD grade 3, diabetes mellitus, CVD	High	High	High



Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, Prabhakaran D, Ramirez A, Schlaich M, Stergiou GS, Tomaszewski M, Wainford RD, Williams B, Schutte AE. 2020 International Society of Hypertension global hypertension practice guidelines. J Hypertens. 2020 Jun;38(6):982-1004.

Implications for the Family Physician

- **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.



Making a Prudent Recommendation

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AHA/ACC SCIENTIFIC STATEMENT

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 6: Hypertension

A Scientific Statement from the American Heart Association and the American College of Cardiology

Henry R. Black, MD, FAHA, *Chair**

Domenic Sica, MD*
Keith Ferdinand, MD, FAHA, FACC*
William B. White, MD*

An elevation of blood pressure (BP) in the systemic circulation (hypertension) is the most common cardiovascular condition in the general population and considered to be the most ubiquitous cardiovascular risk factor in competitive athletes. Competitive athletes include those athletes involved in organized sports that typically occur in schools, communities, and professional leagues, including but not limited to intramural and league sports in which medical supervision is typically required. Although most competitive athletes are between the ages of 20 and 40 years, many younger people now participate in competitive athletics. The 2013 update from the American Heart Association using the National Health and Nutrition Examination (NHANES) data from 2007 to 2010 estimates that 9.1% of men aged 20 to 34 years and 6.7% of women of that age are hypertensive, based on having an elevated BP measurement or answering "yes" to the question, "Are you taking antihypertensive medication or were you told that you had hypertension?" (1) The prevalence in children and adolescents is estimated to be ≈3.5%, with higher percentages in older and obese children (2). The diagnosis of hypertension is based on the subject

*On behalf of the American Heart Association Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and the American College of Cardiology.

The American Heart Association and the American College of Cardiology make every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest. The Preamble and other Task Force reports for these proceedings are available online at www.onlinejacc.org (J Am Coll Cardiol 2015;66:2343-9; 2350-5; 2356-61; 2362-71; 2372-84; 2385-92; 2398-405; 2406-11; 2412-23; 2424-8; 2429-33; 2434-8; 2439-43; 2444-6; and 2447-50).

This statement was approved by the American Heart Association Science Advisory and Coordinating Committee on June 24, 2015, and the American Heart Association Executive Committee on July 22, 2015, and by the American College of Cardiology Board of Trustees and Executive Committee on June 3, 2015.

The American College of Cardiology requests that this document be cited as follows: Black HR, Sica D, Ferdinand K, White WB; on behalf of the American Heart Association Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and the American College of Cardiology. Eligibility and disqualification recommendations for competitive athletes with cardiovascular abnormalities: Task Force 6: hypertension: a scientific statement from the American Heart Association and the American College of Cardiology. J Am Coll Cardiol 2015;66:2393-7.

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Black HR, Sica D, Ferdinand K, White WB. Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 6: Hypertension: A Scientific Statement from the American Heart Association and the American College of Cardiology. J Am Coll Cardiol. 2015 Dec 1;66(21):2393-2397.

AHA Hypertension Recommendations

Recommendations

1. It is reasonable that the presence of stage 1 hypertension in the absence of target-organ damage should not limit the eligibility for any competitive sport. Once having begun a training program, the hypertensive athlete should have BP measured every 2 to 4 months (or more frequently, if indicated) to monitor the impact of exercise *(Class I; Level of Evidence B)*.
2. Before people begin training for competitive athletics, it is reasonable that they undergo careful assessment of BP, and those with initially high levels (>140 mm Hg systolic or >90 mm Hg diastolic) should have comprehensive out-of-office measurements to exclude errors in diagnosis. Ambulatory BP monitoring with proper cuff and bladder size would be the most precise means of measurement *(Class I; Level of Evidence B)*.
3. Those with prehypertension (BP of 120/80 mm Hg-139/89 mm Hg) should be encouraged to modify their lifestyles but should not be restricted from physical activity. Those with sustained hypertension should have screening echocardiography performed. Athletes with LVH beyond that seen with "athlete's heart" should limit participation until BP is normalized by appropriate antihypertensive drug therapy *(Class IIa; Level of Evidence B)*.
4. It is reasonable that athletes with stage 2 hypertension (a systolic BP >160 mm Hg or a diastolic BP >100 mm Hg), even without evidence of target-organ damage, should be restricted, particularly from high static sports, such as weight lifting, boxing, and wrestling, until hypertension is controlled by either lifestyle modification or drug therapy *(Class IIa; Level of Evidence B)*.
5. When prescribing antihypertensive drugs, particularly diuretic agents, for competitive athletes, it is reasonable for clinicians to use drugs already registered with appropriate governing bodies and if necessary obtain a therapeutic exemption *(Class IIa; Level of Evidence B)*.
6. When hypertension coexists with another cardiovascular disease, it is reasonable that eligibility for participation in competitive athletics is based on the type and severity of the associated condition *(Class IIa; Level of Evidence C)*.

Black HR, Sica D, Ferdinand K, White WB. Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 6: Hypertension: A Scientific Statement from the American Heart Association and the American College of Cardiology. J Am Coll Cardiol. 2015 Dec 1;66(21):2393-2397.

Guidance from ASH

- **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.*

Guidance from ASH

- **Q: 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.*

SCT Guidance from the NCAA

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.

However, SCT can get Complicated!

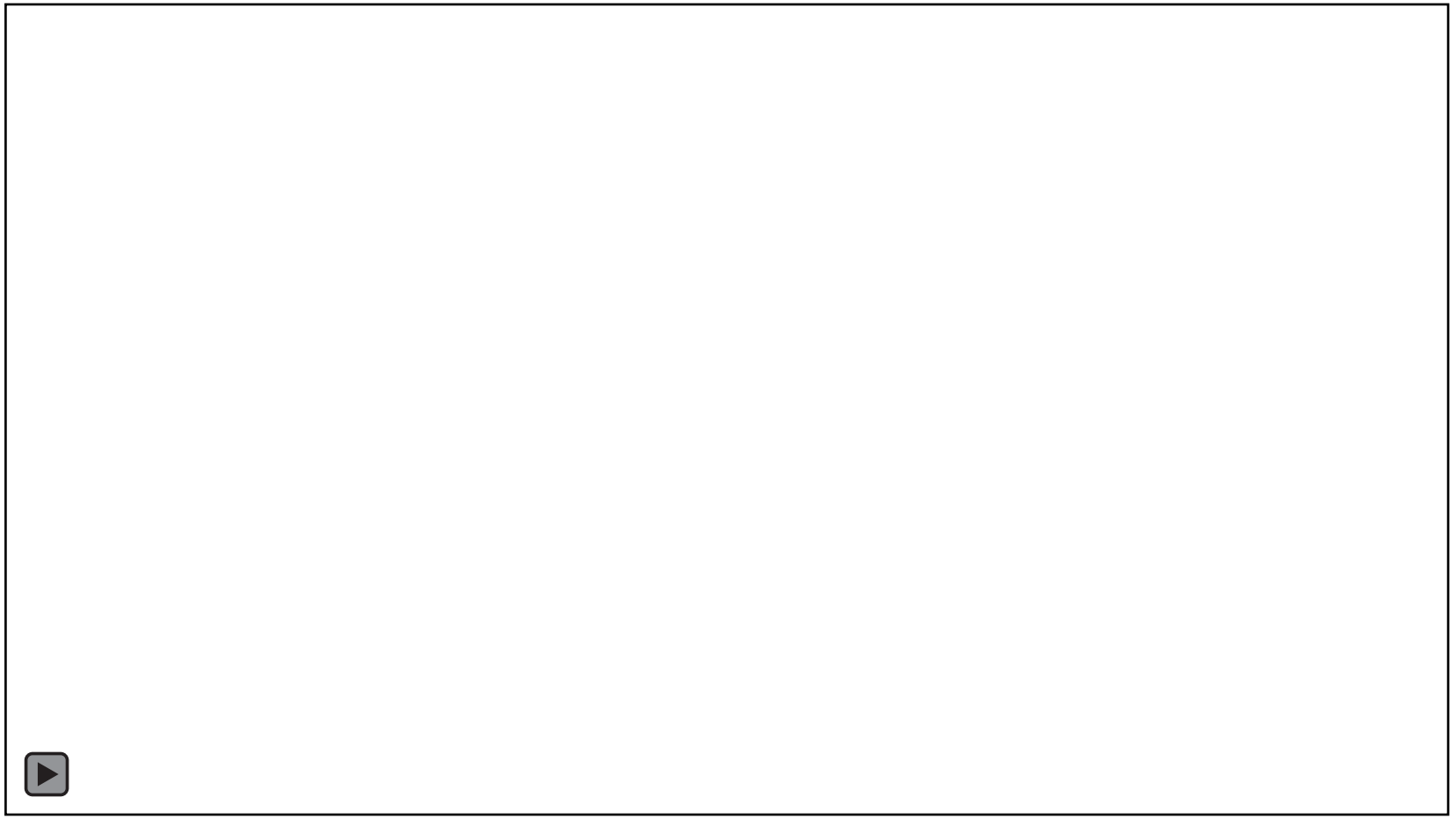
- During PPEs a member of the track team with SCT notes:
  - "This summer while preparing for the preseason, my legs became painful and weak while sprinting. I was unable to continue"
- The athlete reports no prior episodes.
- How do you proceed?

Differential Diagnosis

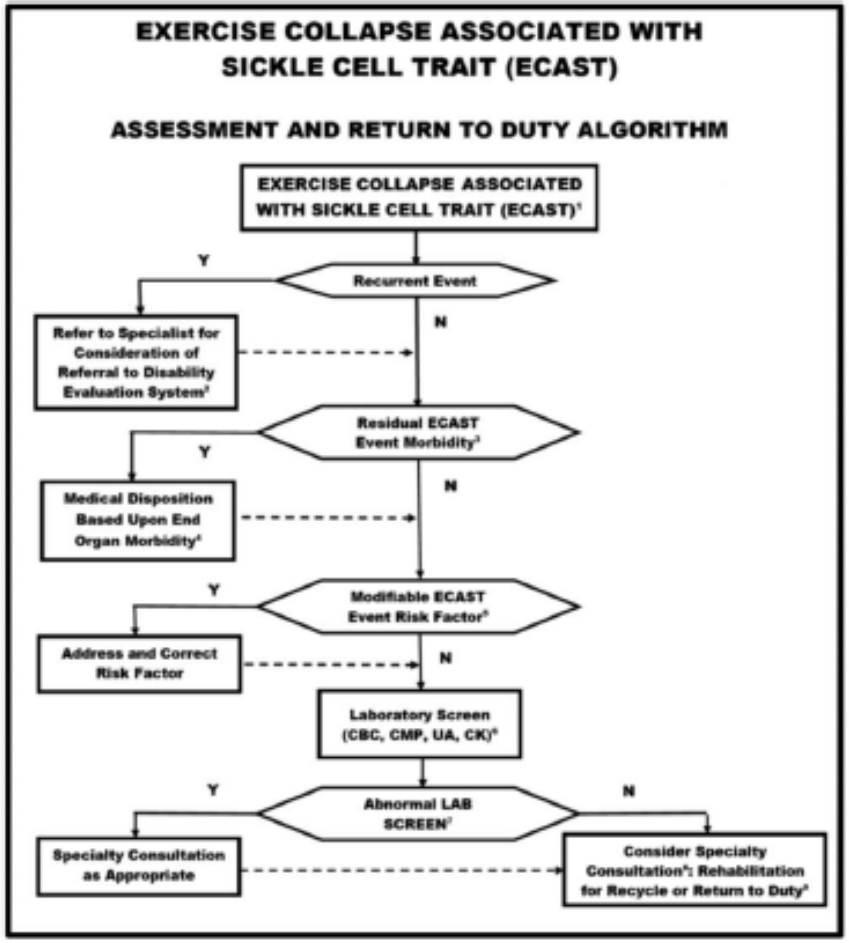
TABLE 9.2 Differentiating Features Among Common Causes of On-Field Collapse

Sickling	Heat Cramping	Cardiac	Heat Stroke
Weakness > pain	Pain > weakness	No cramping	Fuzzy thinking
Slumps to ground	Hobbles to a halt	Falls like a rock	Bizarre behavior
Can talk at first	Yelling from pain	Unconscious	Incoherent
Muscles "normal"	Muscles locked up	Limp or seizing	Can be in coma
Temp <103°F	Temp <103°F	Temp irrelevant	Temp usually >105°F
Can occur early in exercise	Usually occurs later in exercise	No warning	Usually occurs later in exercise

Exercise Collapse Associated with Sickle Cell Trait



Return to Duty Considerations



EXERCISE COLLAPSE ASSOCIATED WITH SICKLE CELL TRAIT (ECAST)

ANNOTATIONS

1. **ECAST:** The etiology of collapse and exertional death with SCT remains to be fully elucidated, however, several authors describe fulminant exertional rhabdomyolysis with exertional sickling. Warfighters experiencing ECAST may have the following signs and/ or symptoms: unusual muscle weakness (greater than muscle pain, though significant pain can also be present); slumping to the ground, generally, but not always, in a conscious state; and rapid breathing. ECAST differs from other causes of exercise collapse in several ways. Warfighters with muscle cramps will have tight, hard muscles (not infrequently with fasciculations), rather than normal muscles to palpation by the observer in ECAST. Those with cardiac causes often will generally have an abrupt collapse with unconsciousness. Warfighters with exertional heat stroke will have a core body temperature above 104 degrees Fahrenheit, and altered consciousness. In ECAST, core body temperature is often normal or only slightly elevated, and athletes will usually initially speak and think normally.
2. **DES Assessment:** Medical specialty consultation to include hematology to determine ability to perform duties consistent with MOS.
3. **ECAST Morbidity:** two-week assessment for persistent end organ dysfunction e.g. renal dysfunction, neuromuscular injury (resting CK >1,000).
4. **Medical Disposition:** referral is based upon end organ morbidity, and may involve referral to nephrology, hematology, neuromuscular or sports medicine specialists as appropriate.
5. **ECAST Event Risk Factors:** extraordinary exertional effort for the affected individual; dehydration; infection; inadequate exercise or environmental acclimatization; dietary supplements.
6. **Laboratory Screen:** UA should be done in conjunction with 12-hour fast to test urine specific gravity to assess urinary concentrating ability and include microalbumin.
7. **Abnormal Screen:** CK>1000; evidence of anemia; abnormal renal function to include lack of ability to concentrate urine, or elevated transaminases warrant referral as appropriate.
8. **Specialty Consultation:** Prior to return to duty, specialty consultation should be considered. Consultation can be obtained with the Consortium for Health and Military Performance (CHAMP) at CHAMP@USUHS.EDU; in addition, the patient can be enrolled in an ongoing genomic trial to further elucidate the mechanisms of ECAST.
9. **Recycle/Return to Duty:** Each case requires individualization, with consideration for temporary profile for a variable duration of weeks/months to avoid maximum effort physical fitness, and optimize exercise and environmental acclimatization prior to full return to duty.

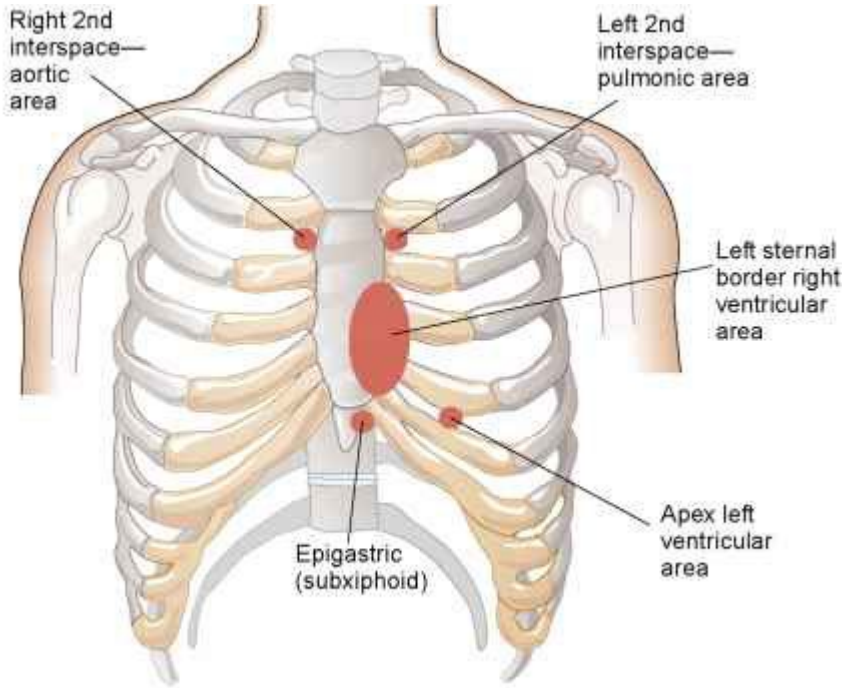
O'Connor FG, Franzos MA, Nye NS, Nelson DA, Shell D, Voss JD, Anderson SA, Coleman NJ, Thompson AA, Harmon KG, Deuster PA. Summit on Exercise Collapse Associated with Sickle Cell Trait: Finding the "Way Ahead". Curr Sports Med Rep. 2021 Jan 1;20(1):47-56.

New Heart Murmur

- During clinical examination of a member of the football team, you note a loud systolic murmur.
- The athlete reports no prior knowledge of murumur detection.
- How do you proceed?
- Can he practice with team later today?

Normal Cardiac Clinical Findings in an Athlete

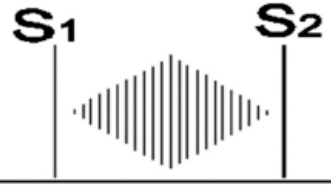
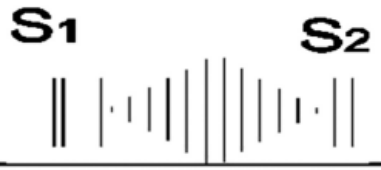
- Bradycardia
- Lateral displacement of point of maximal impulse (PMI)
- Systolic ejection murmur
  - Upper left sternal border
- Second heart sound splitting
- Third heart sound
- Hyperdynamic carotid pulse



Abnormal Systolic Murmur

- Greater than grade 2/6 intensity
- Lateral rather than upward radiation
- Occurrence in mid-systole or late systole rather than in early systole
- Accompanied by a click in mid-systole or late systole
- Any murmur that becomes louder with the Valsalva maneuver

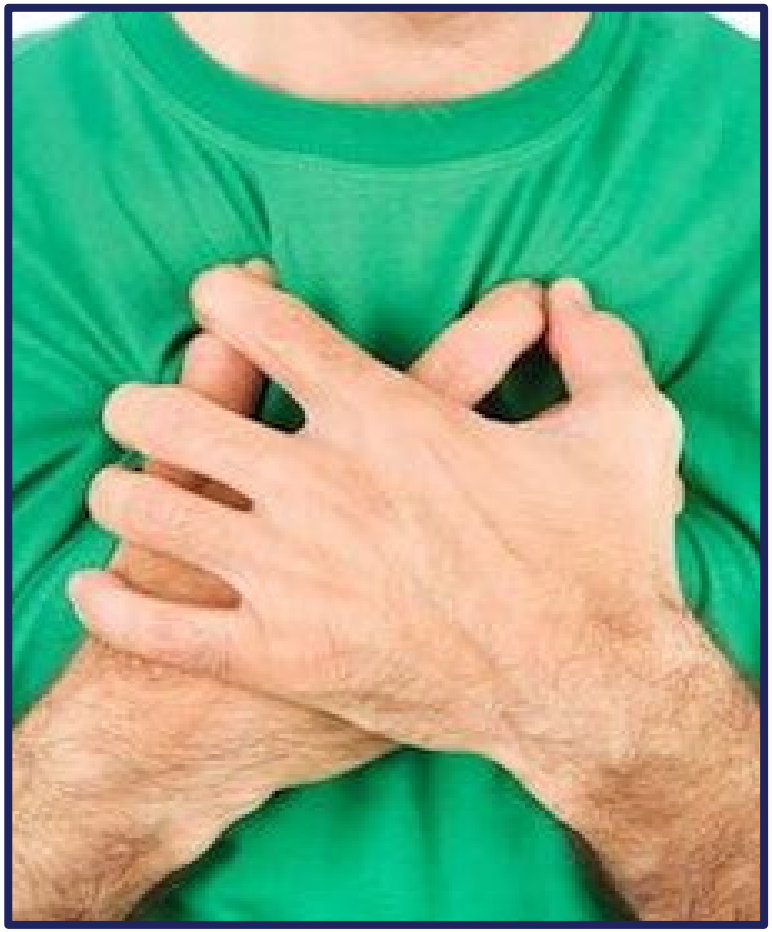
Pathologic Systolic Murmurs

Type	Description	Location	Associated CV Findings	Characteristics
Major Systolic Murmurs				
Aortic Stenosis		• Aortic area diagonal to apical area	• radiates to carotids • decreased carotid pulses (slow upstroke) • PMI laterally displaced	• Cresendo, decresendo
Mitral Regurgitation		• Apical area to lower left sternal border	• radiates to axilla	• Holosystolic
Mitral Valve Prolapse		• Apical area to lower left sternal border	• radiates to axilla • carotids normal • clicks	• Late systolic
Hypertrophic Cardiomyopathy with obstruction		• Lower left sternal border	• Radiates to carotids • PMI laterally displaced • S_4 • Quick carotid upstroke, fast drop off	• Increase with Valsalva in lying position and standing

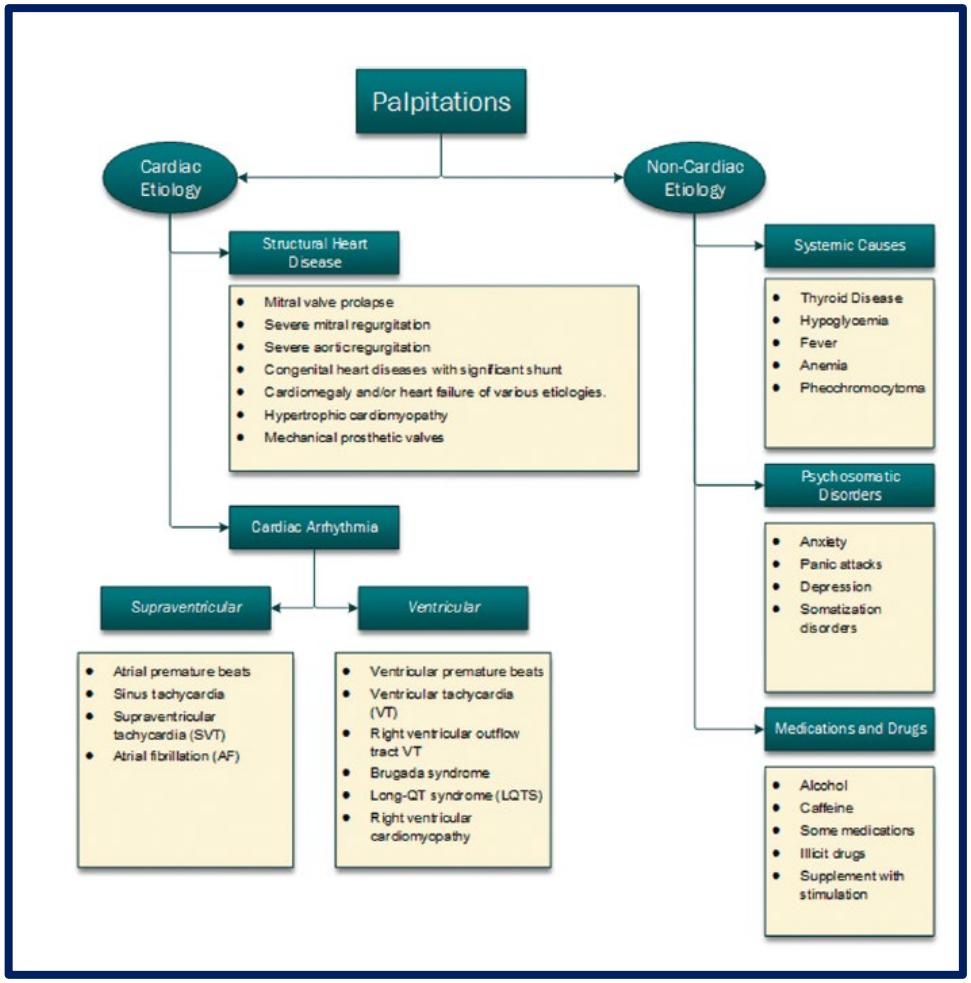
Abnormal Heart Murmur Requires a Strategic Pause and an Echocardiogram

“I have Intermittent Pounding in My Chest”

- During clinical examination of a member of the soccer team, an athlete complains of “pounding and racing” in chest while practicing.
- The athlete reports no prior knowledge of cardiac problems.
- How do you proceed?



Palpitations: Etiology



Palpitations: Evaluation

Key history questions.

Analysis of the complaint

1) Tell me more about your "palpitations." Could you describe them for me?

2) When they occur, do the heartbeats feel regular or irregular? Fast or slow? Weak or strong?

3) How often do you get palpitations? How long does each episode last? What brings them on?

4) Do the palpitations start and stop gradually? Suddenly?

5) Is there anything that can stop these palpitations when they occur? Have you noticed anything that brings them back?

6) When usually do they occur? During exercise? After effort? At rest?

7) Have you noticed any associated symptoms? Visual? Lightheadedness? Falling? Loss of consciousness?

Family history

8) Is there any family history of cardiac diseases, arrhythmias, drowning, unexplained accidental deaths, or SCD?

Identification of noncardiac cause

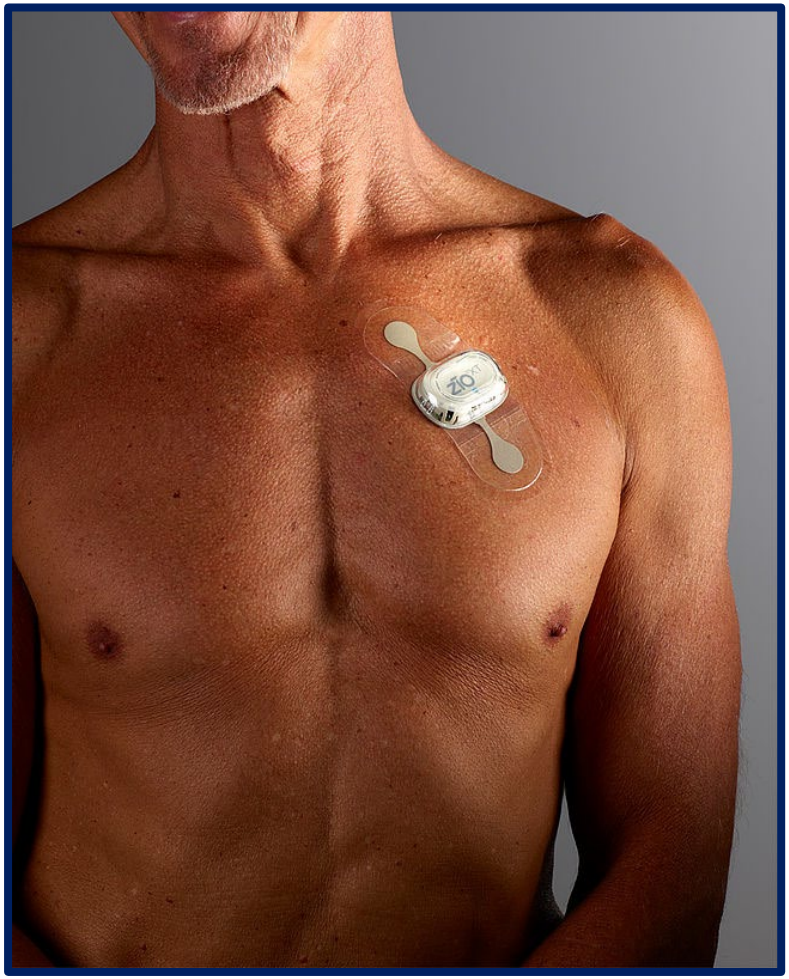
9) Do you feel that you are nervous or anxious by nature?

10) Any history prior to the palpitations of alcohol consumption or caffeine intake? Illicit drugs?

11) Are you currently taking any antianxiety or other medications? Supplements? PEA? Weight-reducing agents?

Palpitations: Management

- 12 Lead Electrocardiogram
- Restriction?
- Referral?
- ECG Monitoring
- Echocardiogram
- Cardiac Stress Test



Palpitations: Management

AHA/ACC Scientific Statement

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 9: Arrhythmias and Conduction Defects

A Scientific Statement From the American Heart Association and American College of Cardiology

Douglas P. Zipes, MD, FAHA, MACC, Chair; Mark S. Link, MD, FACC; Michael J. Ackerman, MD, PhD, FACC; Richard J. Kovacs, MD, FAHA, FACC; Robert J. Myerburg, MD, FACC; N.A. Mark Estes III, MD, FACC; on behalf of the American Heart Association Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and the American College of Cardiology

A broad range of variations in heart rates and rhythms, specific cardiac arrhythmias, and atrioventricular (AV) and intraventricular conduction disturbances are observed in athletes. Although most are common among nonathletes as well, the special circumstances and pressures related to athletic performance demand a high level of attention. The distinction between normal variants, often exaggerated by the specific physiology of the conditioned athlete, and arrhythmias that may be symptomatic or life-threatening may be significant challenges.

Bradycardia

Sinus Bradycardia

Sinus bradycardia, defined as a sinus rate <60 beats per minute (bpm), is common in the athlete.[1] Generally, it is attributed to enhanced vagal tone caused by conditioning and is thus physiological. Occasionally, heart rates can be as slow as 30 to 40 bpm at rest in the highly conditioned athlete and decrease to <30 bpm during sleep. Some athletes with marked sinus bradycardia will exhibit periods of low atrial or junctional escape rhythms with rates of 40 to 60 bpm. This is a normal phenomenon, and these will become suppressed with exercise-induced increases in the sinus rate.

Evaluation of the athlete with sinus bradycardia includes a careful history to determine whether the athlete has symptoms related to the bradycardia. In addition, physical examination and an ECG are warranted, with selective use of additional tests such as an echocardiogram and exercise stress test if underlying structural heart disease is suggested. Stress testing can also be used to verify a normal rate response to exercise, if judged to be necessary. The same approach applies to the sinus arrhythmia commonly observed in the athlete. Generally, asymptomatic sinus pauses or sinus arrest (<3 seconds) are not considered clinically significant unless accompanied by symptoms. Pauses of longer duration may fall within the spectrum of physiological responses to athletic conditioning; however, when accompanied by symptoms, sinus bradycardia,

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Circulation is available at http://circ.ahajournals.org DOI: 10.1161/CIR.0000000000000245

Recommendations

1. Athletes with single PVCs and complex forms no greater than couplets at rest and during exercise testing without structural heart disease can participate in all competitive sports. The exercise testing protocol should be based on maximal performance rather than achieving 80% to 100% of the target heart rate to come as close as possible to the level of exertion achieved during their competitive sport *(Class I; Level of Evidence C)*.
2. Athletes with PVCs at rest that increase in frequency during exercise or exercise testing and convert to repetitive forms should have further evaluation by appropriate imaging or monitoring strategies before clearance for participation in high-intensity sports. If uncontrollable exercise-induced arrhythmias produce symptoms of lightheadedness or near-syncope, fatigue, or dyspnea, the athlete should be limited to competitive sports below the level at which marked frequency increase or symptoms evolved during testing *(Class I; Level of Evidence C)*.

Suspicious Family History

- During clinical examination of a member of the basketball team, an athlete relates the following:
  - "I had an older brother die while playing basketball."
- The athlete reports no personal history of cardiac complaints.
- How do you proceed?

Family History of Exertional Sudden Death

A Clinical Approach to Common Cardiovascular Disorders When There Is a Family History

A Clinical Approach to a Family History of Sudden Death

Boon Yew Tan, MD; Daniel P. Judge, MD

Sir William Osler reportedly once said, "Varicose veins are the result of an improper selection of grandparents." Indeed, our family history strongly influences many aspects of our cardiovascular system, with the magnitude of effect ranging from very strong for autosomal dominant genetic disorders to more subtle in the setting of complex multigenic diseases like coronary atherosclerosis and hypertension. Accordingly, the standard evaluation of any new patient who presents to a physician includes assessment of their family history. Unfortunately, the family history may sometimes be discounted as noncontributory without detailed review. This can be exacerbated by busy office schedules with declining amounts of time available for comprehensive evaluations. A few minutes saved might seem to justify the lack of focus on an aspect of history that is sometimes deemed not to be particularly useful. However, a thorough assessment of family history also may provide the key diagnostic information to determine the cause of an illness, to determine who else is at risk of disease within the family, to add useful prognostic information, and to help for family planning and reproductive decisions.

A family history of sudden death should prompt consideration of a wide range of heritable cardiovascular conditions, including many monogenic disorders (Table). However, the terms used by the lay public to describe sudden death may not adequately explain the cause of death on initial consideration. For instance, the phrase "heart attack" may be used to describe sudden death of any etiology. Further questioning may help one to discern whether there was a history of heart failure, cardiomyopathy, coronary artery disease (or its risk factors), aortic aneurysm, or features of syndromic disorders that are associated with sudden death.

Typical Case

A 40-year-old man presents to a physician for evaluation of palpitations. These occur briefly about once per month without dizziness or lightheadedness, and he is otherwise without symptoms. He exercises twice weekly, running approximately 2 miles, and he is not limited by unexpected dyspnea or chest discomfort. His past medical history is negative. On discussion of his family history, he notes that his father died suddenly at age 41 years without antecedent medical history (Figure 1A). His mother is well at age 63 years of age. He has a younger brother and sister who are well, and 2 children 5 and 7 years of age who are well. He consumes approximately 4 alcoholic beverages weekly and does not use tobacco.

This scenario is seen commonly in medical practice. This 40-year-old man undoubtedly is considering strongly his father's sudden death at a similar age, but healthcare providers do not always recognize the significance, the range of potential contributing factors, and the latest technologies that are impacting the approach to improve the diagnosis. His palpitations are nonspecific, and his paucity of other symptoms does not exclude coronary disease, cardiomyopathy, inherited arrhythmic disease, or aortic aneurysm. Although genetic analysis in a clearly affected proband would be ideal, DNA is usually not available from people who died in the remote past. As such, clues to target the phenotypic assessment of subsequent generations may be obtained from a carefully obtained family history.

From an extended discussion of his father's sudden death, it would be clear that he had heart failure prior to his sudden death in the absence of coronary atherosclerosis risk factor (Figure 1B). The proband's paternal grandmother has unexplained dilated cardiomyopathy (DCM), and 3 of her 4 siblings also had unexplained DCM, 2 of whom died suddenly at younger ages. This additional historical information helps target the proband's assessment now and serially for his risk of inheriting the genetic predisposition for DCM that runs in his family, and importantly it also helps to identify other family members who are at risk of sudden cardiac death (SCD) or DCM. In such a family, all offspring of an affected individual carry a 50% chance of inheriting a genetic predisposition to DCM.

Adequate Family History

When possible, one should obtain at least 3 generations of antecedent family history. Several factors may complicate its assessment. An autosomal dominant pattern of inheritance of sudden death due to a monogenic disorder in a large family cannot be recognized with only limited questioning. Age-dependent phenotypes, small families, and the inability to track down accurate antecedent family history can limit the

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Circ Cardiovasc Genet is available at http://circgenetics.ahajournals.org DOI: 10.1161/CIRCGENETICS.110.959437

Table. Monogenic Disorders Associated With Sudden Death

Long QT syndrome	Noonan syndrome
Brugada syndrome	Fabry disease
Short QT syndrome	Danon disease
Timothy syndrome	Marfan syndrome
Andersen-Tawil syndrome	Loeys-Dietz syndrome
Catecholaminergic polymorphic VT	Ehlers Danlos syndrome (notably type IV)
Dilated cardiomyopathy	Nonsyndromic familial thoracic aortic aneurysm
Hypertrophic cardiomyopathy	Limb-girdle muscular dystrophies
Restrictive cardiomyopathy	Dystrophin-related muscular dystrophies
Noncompaction cardiomyopathy	Friedreich ataxia
Arrhythmogenic right ventricular cardiomyopathy	Mitochondrial myopathies
Naxos syndrome	Myofibrillar myopathies
Carvajal syndrome	Cavernous cranial malformations

VT indicates ventricular tachycardia.

Tan BY, Judge DP. A clinical approach to a family history of sudden death. Circ Cardiovasc Genet. 2012 Dec;5(6):697-705.

Family History of Exertional Sudden Death Management

Tan BY, Judge DP. A clinical approach to a family history of sudden death. Circ Cardiovasc Genet. 2012 Dec;5(6):697-705.

“I passed out this summer during Training.”

- When reviewing the AHA cardiac questions with a cadet, he notes that over the summer he had an exertional collapse during the ruck march at the end of Air Assault.
- The athlete reports no prior history of a previous syncopal event.
- They have soccer practice tomorrow.
- How do you proceed?

History

- True Syncope vs “collapse”
- Post event state: postictal, incontinence, rapid recovery vs prolonged unconsciousness
- Vital signs at scene
- During vs after exercise
- Prodromal events: palpitations, nausea, pruritus, wheezing, chest pain
- Body position and precipitating events
- Occurrence at other times vs only exercise
- Family history of sudden death
- Medications
- High risk Behaviors

Exercise-Related Syncope: Prudent Recommendations

AHA/ACC Scientific Statement

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 9: Arrhythmias and Conduction Defects

A Scientific Statement From the American Heart Association and American College of Cardiology

Douglas P. Zipes, MD, FAHA, MACC, Chair; Mark S. Link, MD, FACC; Michael J. Ackerman, MD, PhD, FACC; Richard J. Kovacs, MD, FAHA, FACC; Robert J. Myerburg, MD, FACC; N.A. Mark Estes III, MD, FACC; on behalf of the American Heart Association Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and the American College of Cardiology

A broad range of variations in heart rates and rhythms, specific cardiac arrhythmias, and atrioventricular (AV) and intraventricular conduction disturbances are observed in athletes. Although most are common among nonathletes as well, the special circumstances and pressures related to athletic performance demand a high level of attention. The distinction between normal variants, often exaggerated by the specific physiology of the conditioned athlete, and arrhythmias that may be symptomatic or life-threatening may be significant challenges.

Bradycardia

Sinus Bradycardia

Sinus bradycardia, defined as a sinus rate <60 beats per minute (bpm), is common in the athlete.[1] Generally, it is attributed to enhanced vagal tone caused by conditioning and is thus physiological. Occasionally, heart rates can be as slow as 30 to 40 bpm at rest in the highly conditioned athlete and decrease to <30 bpm during sleep. Some athletes with marked sinus bradycardia will exhibit periods of low atrial or junctional escape rhythms with rates of 40 to 60 bpm. This is a normal phenomenon, and these will become suppressed with exercise-induced increases in the sinus rate.

Evaluation of the athlete with sinus bradycardia includes a careful history to determine whether the athlete has symptoms related to the bradycardia. In addition, physical examination and an ECG are warranted, with selective use of additional tests such as an echocardiogram and exercise stress test if underlying structural heart disease is suggested. Stress testing can also be used to verify a normal rate response to exercise, if judged to be necessary. The same approach applies to the sinus arrhythmia commonly observed in the athlete. Generally, asymptomatic sinus pauses or sinus arrest (<3 seconds) are not considered clinically significant unless accompanied by symptoms. Pauses of longer duration may fall within the spectrum of physiological responses to athletic conditioning; however, when accompanied by symptoms, sinus bradycardia,

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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)*.
5. Athletes with syncope of unknown cause, based on a ruling out of structural or molecular pathogenesis, should not participate in athletics in which transient loss of consciousness can be hazardous *(Class III; Level of Evidence C)*.

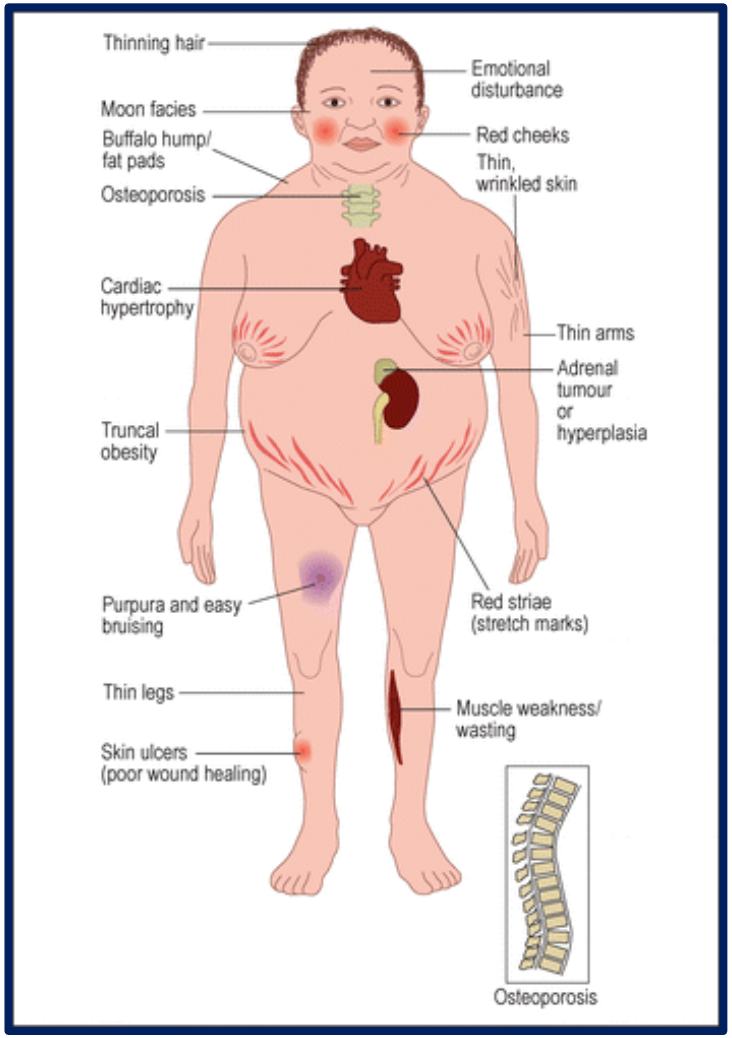
Skin Findings

- During clinical examination of a female cadet on the tennis team, you note the accompanying skin lesions during the abdominal examination.
- The athlete reports she has had them for sometime, and the are also on her legs and axilla.
- How do you proceed?

Striae: Differential Diagnosis

Conditions associated with striae distensae

General
Family history (genetic)
Obesity
Sudden weight gain or loss
Bodybuilding exercise
Smoking
Adolescents during or after growth spurt
Medical conditions
Marfan syndrome
Cushing's syndrome
Anorexia nervosa
Typhoid fever
Rheumatic fever
Chronic liver disease
Medications
Systemic and topical corticosteroids
HIV therapy
Chemotherapy
Tuberculosis therapy
Contraceptives
Neuroleptics
Surgery
Breast augmentation
Tissue expanders
Tension-requiring skin sutures
Organ transplantation
Cardiac surgery
Pregnancy
Family history
Younger age
Higher birthweight
Increased gestational age
Weight gained
Prepregnancy body mass index (BMI)
Lack of chronic diseases
Polyhydramnios
Prepregnancy presence of breast striae (but not thigh striae)



Ehlers Danlos Syndrome

The Ehlers Danlos Society.

THE BEIGHTON SCORING SYSTEM

Measuring joint hypermobility

A. 5th FINGER / 'PINKIES'

Test **both sides:** Rest palm of the hand and forearm on a **flat surface** with palm side down and fingers out straight.

Can the **fifth finger** be bent/lifted upwards at the knuckle to go back **beyond 90 degrees?**

B. THUMBS

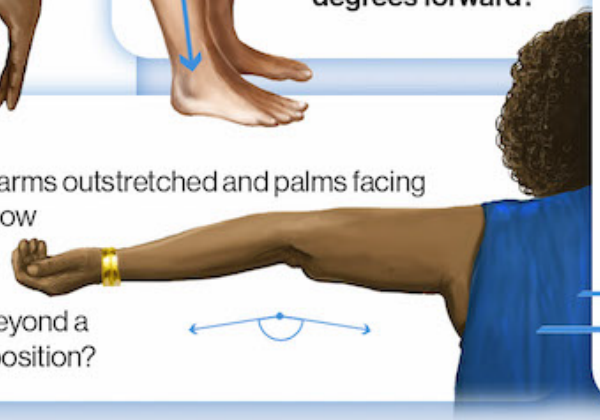
Test **both sides:** with the arm out straight, the palm facing down, and the wrist then fully bent downward, can the thumb be pushed back to touch the forearm?

D. KNEES

Test **both sides:** While standing with knees locked (bent backwards as far as possible), does the lower part of leg extend **more than 10 degrees forward?**

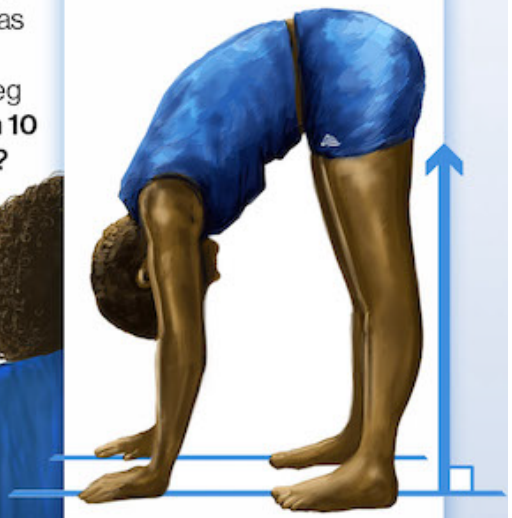
C. ELBOWS

Test **both sides:** With arms outstretched and palms facing upwards, does the elbow extend (bend too far) upwards more than an extra 10 degrees beyond a normal outstretched position?



E. SPINE

Bend forward, can you place the palms of your hands **flat on the floor in front of your feet without bending your knees?**



Ehlers Danlos Syndrome

Hypermobile Ehlers-Danlos Syndrome and Hypermobility Spectrum Disorders

Kenneth S. Yew, MD, MPH; Kara A. Kamps-Schmitt, MD; and Robyn Borge, MD
Gundersen Medical Foundation Family Medicine Residency, La Crosse, Wisconsin

Hypermobile Ehlers-Danlos syndrome (EDS) and hypermobility spectrum disorders are the most common symptomatic joint hypermobility conditions seen in clinical practice. The 2017 International Classification of the Ehlers-Danlos syndromes replaced previous terms for symptomatic joint hypermobility with hypermobile EDS and introduced the term hypermobility spectrum disorders for patients not meeting diagnostic criteria for hypermobile EDS. Both are diagnosed by applying the 2017 diagnostic criteria, which also excludes other less common conditions presenting with joint hypermobility such as other forms of EDS and heritable connective tissue disorders. Hypermobile EDS is inherited in an autosomal dominant pattern, but it does not have a known genetic mutation to help with diagnosis. Clinical features of hypermobile EDS include joint hypermobility, skin findings, and joint pains or recurrent dislocations. Hypermobile EDS and, less commonly, hypermobility spectrum disorders may also be associated with several extra-articular symptoms, including anxiety disorders, chronic pain, fatigue, orthostatic intolerance, functional gastrointestinal disorders, and pelvic and bladder dysfunction. The central goals of therapy are managing symptoms, preventing joint injury, and educating patients about their condition. Based on limited evidence, patients with hypermobile EDS/hypermobility spectrum disorders may benefit from physical and occupational therapy, psychological support, and self-management. Primary care physicians play a key role not only in initial recognition, diagnosis, and patient education, but by virtue of their ongoing relationship they can also help oversee and coordinate the multidisciplinary team many of these patients require. (*Am Fam Physician*. 2021;103(8):481-492. Copyright © 2021 American Academy of Family Physicians.)

Hypermobile Ehlers-Danlos syndrome (EDS) and hypermobility spectrum disorders are the most common symptomatic joint hypermobility conditions seen in clinical practice.[1,2] Family physicians play a vital role in the care of patients with these conditions, from initial diagnosis to ongoing care.

Definitions

"Ehlers-Danlos syndromes (EDS) … are a group of inherited connective tissue disorders caused by abnormalities in the structure, production, and/or processing of collagen. The new classification, from 2017, includes 13 subtypes of EDS."[3] *Table 1* describes these subtypes.[1,4,5] Joint hypermobility is a feature common among many EDS subtypes and other heritable connective tissue disorders. Joint hypermobility is defined as the ability of a joint to move "beyond normal limits along physiological axes."[4] Joint hypermobility can involve a few or many joints and may be entirely

Additional content at https://www.aafp.org/afp/2021/0415/p481.html.

CME **This clinical content** conforms to AAFP criteria for CME. See CME Quiz on page 460.

Author disclosure: No relevant financial affiliations.

Patient information: A handout on this topic, written by the authors of this article, is available at https://www.aafp.org/afp/2021/0415/p481-s1.html.

WHAT'S NEW ON THIS TOPIC

Hypermobility Spectrum Disorders

The 2017 International Classification of the Ehlers-Danlos syndromes replaced prior terms for symptomatic joint hypermobility with hypermobile Ehlers-Danlos syndrome and introduced the term hypermobility spectrum disorder for patients not meeting hypermobile Ehlers-Danlos syndrome diagnostic criteria.

A 2013 U.K. population survey found that 3.4% of adults endorsed hypermobility and chronic widespread pain using validated instruments.

Generalized joint hypermobility is more common than hypermobile Ehlers-Danlos syndrome/hypermobility spectrum disorders because patients with generalized joint hypermobility may be asymptomatic. When assessed in student population samples using the 2017 criteria, 4% to 11% of children three to 19 years of age had generalized joint hypermobility.

FIGURE 2

The International Consortium on Ehlers-Danlos Syndromes & Related Disorders

Diagnostic Criteria for Hypermobile Ehlers-Danlos Syndrome (hEDS)
This diagnostic checklist is for doctors across all disciplines to be able to diagnose EDS

Distributed by The Ehlers Danlos Society.

Patient name: _____ Date of birth: _____ Date of visit: _____ Evaluator: _____

For clinical diagnosis of hypermobile EDS, criteria 1 *and* 2 *and* 3 must be present simultaneously

Criterion 1: generalized joint hypermobility

☐ Beighton score: _____/9 (see Table 5)

One of the following selected:

☐ Beighton score ≥ 6 in prepubertal children and adolescents
☐ Beighton score ≥ 5 from puberty up to 50 years of age
☐ Beighton score ≥ 4 in persons older than 50 years

If Beighton score is one point below age- and sex-specific cutoff, two or more of the following must also be selected to meet criterion 1:

☐ Can you now (or could you ever) place your hands flat on the floor without bending your knees?
☐ Can you now (or could you ever) bend your thumb to touch your forearm?
☐ As a child, did you amuse your friends by contorting your body into strange shapes or could you do the splits?
☐ As a child or teenager, did your shoulder or kneecap dislocate on more than one occasion?
☐ Do you consider yourself double-jointed?

Criterion 2: two or more of the following features (A, B, or C) must be present

Feature A *(five of the following must be present)*

☐ Unusually soft or velvety skin
☐ Mild skin hyperextensibility
☐ Unexplained striae distensae or rubrae at the back, groin, thighs, breasts, and/or abdomen in adolescents, men, or prepubertal girls without a history of significant gain or loss of body fat or weight
☐ Bilateral piezogenic papules of the heel
☐ Recurrent or multiple abdominal hernias
☐ Atrophic scarring involving at least two sites and without the formation of truly papyraceous and/or hemosideric scars as seen in classical EDS
☐ Pelvic floor, rectal, and/or uterine prolapse in children, men, or nulliparous women without a history of morbid obesity or other known predisposing medical condition
☐ Dental crowding and high or narrow palate
☐ Arachnodactyly, as defined in one or more of the following: (1) positive wrist sign (Walker sign) on both sides or (2) positive thumb sign (Steinberg sign) on both sides
☐ Ratio of arm span to height ≥ 1.05
☐ Mitral valve prolapse mild or greater based on strict echocardiography criteria
☐ Aortic root dilation with Z-score > +2
☐ Feature A total: _____/12

Feature B

☐ Positive family history: one or more first-degree relatives independently meeting the current criteria for hypermobile EDS

Feature C *(must have at least one)*

☐ Musculoskeletal pain in two or more limbs, recurring daily for ≥ 3 months
☐ Chronic, widespread pain for ≥ 3 months
☐ Recurrent joint dislocations or frank joint instability in the absence of trauma

Criterion 3: all of the following prerequisites MUST be met

☐ 1. Absence of unusual skin fragility, which should prompt consideration of other types of EDS
☐ 2. Exclusion of other heritable and acquired connective tissue disorders, including autoimmune rheumatologic conditions. In patients with an acquired connective tissue disorder (e.g., lupus, rheumatoid arthritis), additional diagnosis of hypermobile EDS requires meeting both features A and B of criterion 2. Feature C of criterion 2 (chronic pain and/or instability) cannot be counted toward a diagnosis of hypermobile EDS in this situation.
☐ 3. Exclusion of alternative diagnoses that may also include joint hypermobility by means of hypotonia and/or connective tissue laxity. Alternative diagnoses and diagnostic categories include, but are not limited to, neuromuscular disorders (e.g., Bethlem myopathy), other hereditary disorders of the connective tissue (e.g., other types of EDS, Loeys-Dietz syndrome, Marfan syndrome), and skeletal dysplasias (e.g., osteogenesis imperfecta). Exclusion of these considerations may be based on history, physical examination, and/or molecular genetic testing, as indicated.

Diagnosis: _____

EDS = Ehlers-Danlos syndrome.

Diagnostic criteria for hypermobile EDS.

Adapted with permission from The International Consortium on Ehlers-Danlos Syndromes & Related Disorders in association with the Ehlers-Danlos Society. Diagnostic criteria for hypermobile Ehlers-Danlos syndrome. Accessed March 2, 2020. https://www.ehlers-danlos.com/wp-content/uploads/hEDS-Dx-Criteria-checklist-1.pdf

Hand Finding on Clinical Examination

- During clinical examination of a member of the volleyball team, you note the following during the musculoskeletal examination.
- The athlete is asymptomatic, and has no other clinical findings.
- How do you proceed?

PPE 5th Monograph

Table 6A-1. Systemic Score Suggestive of Marfan Syndrome

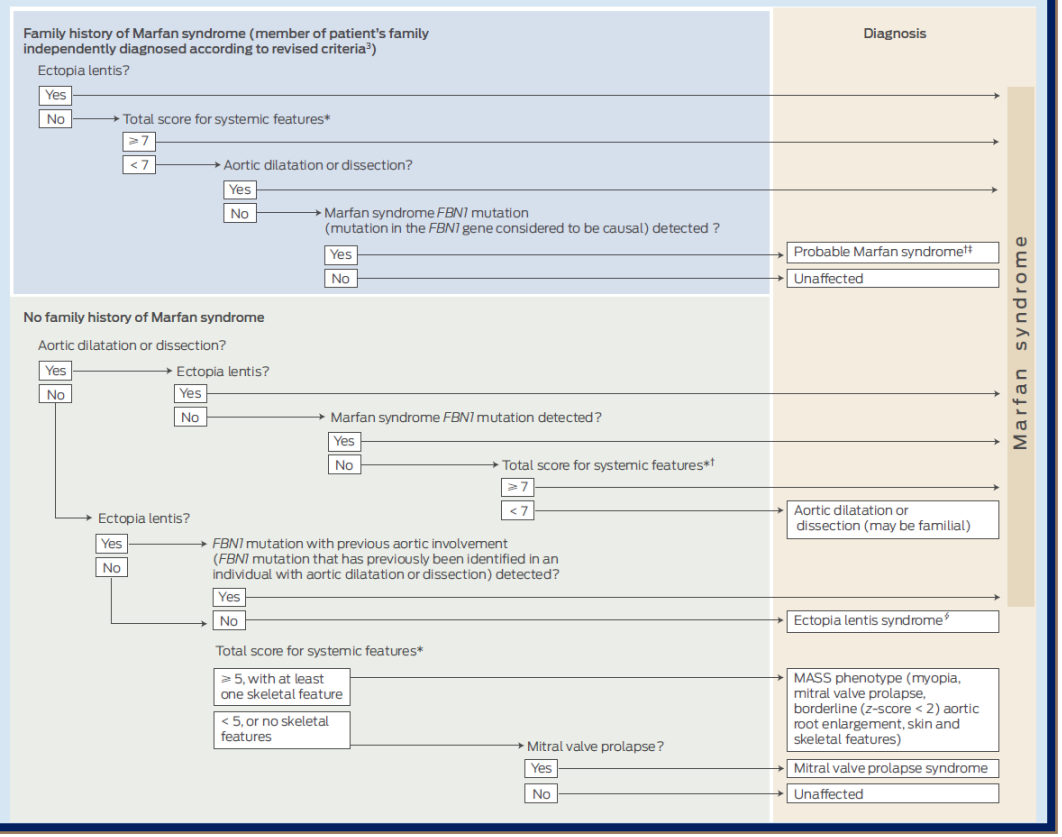
Feature	Score
Wrist AND thumb sign	+3
Wrist OR thumb sign	+1
Pectus Carinatum Deformity	+2
Pectus Excavatum or Chest Asymmetry	+1
Hindfoot Deformity	+2
Plain Flat Foot	+1
Spontaneous Pneumothorax	+2
Dural Ectasia	+2
Protucia Acetabulae	+2
Scoliosis or Thoracolumbar Kyphosis	+1
Reduced Elbow Extension	+1
3 of 5 Facial Features	+1
Skin Striae	+1
Severe Myopia	+1
Mitral Valve Prolapse	+1
Reduced Upper Segment / Lower Segment & Increased Arm Span to Height Ratio	+1

Marfan Syndrome Diagnosis

2 Scoring of systemic features for the diagnosis of Marfan syndrome*

Feature	Score
Wrist OR thumb sign†	1
Wrist AND thumb signs†	3
Pectus carinatum deformity	2
Hindfoot deformity	2
Plain pes planus	1
Pectus excavatum or chest asymmetry	1
Pneumothorax	2
Dural ectasia	2
Protrusio acetabulae	2
Reduced upper segment to lower segment ratio,‡ AND increased ratio of arm span to height§ AND no severe scoliosis	1
Scoliosis or thoracolumbar kyphosis	1
Reduced elbow extension	1
Three of the five typical facial features (dolichocephaly, enophthalmos, downward slanting palpebral fissures, malar hypoplasia, retrognathia)	1
Skin striae	1
Myopia of > 3 dioptres	1
Mitral valve prolapse	1

1 Decision tree for diagnosing Marfan syndrome using revised criteria[3]



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Interesting Eye Examination

- During clinical examination of a member of the women's soccer team, you note the following on ocular examination.
- The athlete reports no prior knowledge of any eye complaints or abnormalities on examination.
- How do you proceed?

Anisocoria

REVIEW

An approach to anisocoria

Jordan R. Gross, Collin M. McClelland, and Michael S. Lee

Purpose of review
Anisocoria is a finding seen on a daily basis in nearly every eye clinic. Although often benign, it can also represent the sole sign of a life-threatening disease making an up-to-date understanding of pathophysiology and diagnosis essential for anyone practicing medicine.

Recent findings
Many aspects of the traditional approach to anisocoria still hold true today, but advancements in imaging technology and changing trends in pharmacologic diagnosis and localization have led many to rethink that approach. In addition, the differential diagnosis for anisocoria continuously expands with identification and improved understanding of causal disease processes.

Summary
The present article discusses an approach to the classic anisocoria diagnostic algorithm modified by current knowledge from the most recent literature.

Keywords
anisocoria, apraclonidine, autoimmune autonomic ganglionopathy, Horner syndrome, third nerve palsy

INTRODUCTION

The average ophthalmologist will see multiple patients with physiologic anisocoria on a typical clinic day. Although most patients are unaware of it, some come specifically for evaluation. Anisocoria can represent vision or life-threatening disorders, and the ophthalmologist must distinguish between benign anisocoria and dangerous disease while simultaneously avoiding unnecessary and costly evaluations. Essential to this task is a sound knowledge of the causes of anisocoria, their pathophysiology, and efficient, effective diagnostic strategies. This review is not exhaustive, but instead focuses on a practical approach to anisocoria including differential diagnosis, techniques to narrow or confirm a diagnosis in the clinic, imaging modalities, and management of specific disease processes.

NEUROANATOMY RELEVANT TO ANISOCORIA

Anisocoria, unless caused by a mechanical abnormality affecting the iris dilator or sphincter muscles, is a neurologic phenomenon because of an imbalance of the efferent autonomics. The parasympathetic pathway causes miosis via activation of the iris sphincter, and the sympathetic pathway causes mydriasis through activation of the iris dilator.

The efferent parasympathetic pathway (Fig. 1 [1]) arises from bilateral Edinger–Westphal nuclei that each receive bilateral input from the pretectal nuclei. Parasympathetic fibers then exit anteriorly from the midbrain as a portion of the third cranial nerve. From there the fibers follow the inferior division of the oculomotor nerve until synapsing in the ciliary ganglion between the optic nerve and lateral rectus. The postganglionic fibers then travel to the iris sphincter (and ciliary body) as the short ciliary nerves.

The sympathetic pathway (Fig. 2 [1]) is a three-neuron chain with the first-order neuron arising from the hypothalamus and traveling to and synapsing in the ciliospinal center of Budge at the C8-T2 level within the intermediolateral cell column of the spinal cord. The second-order neuron then travels through the sympathetic chain, passing the adjacent lung apex, before synapsing with the third (postganglionic) neuron at the superior cervical ganglion. From there the third-order neuron

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Curr Opin Ophthalmol 2016, 27:486–492
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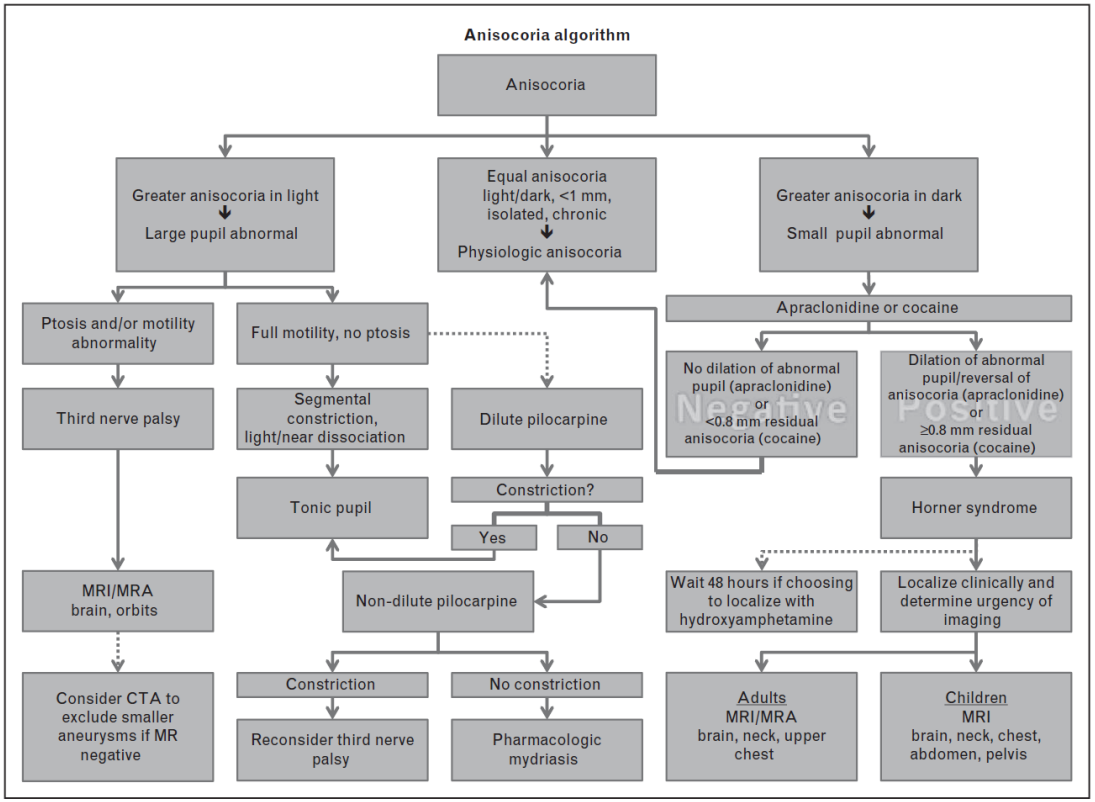

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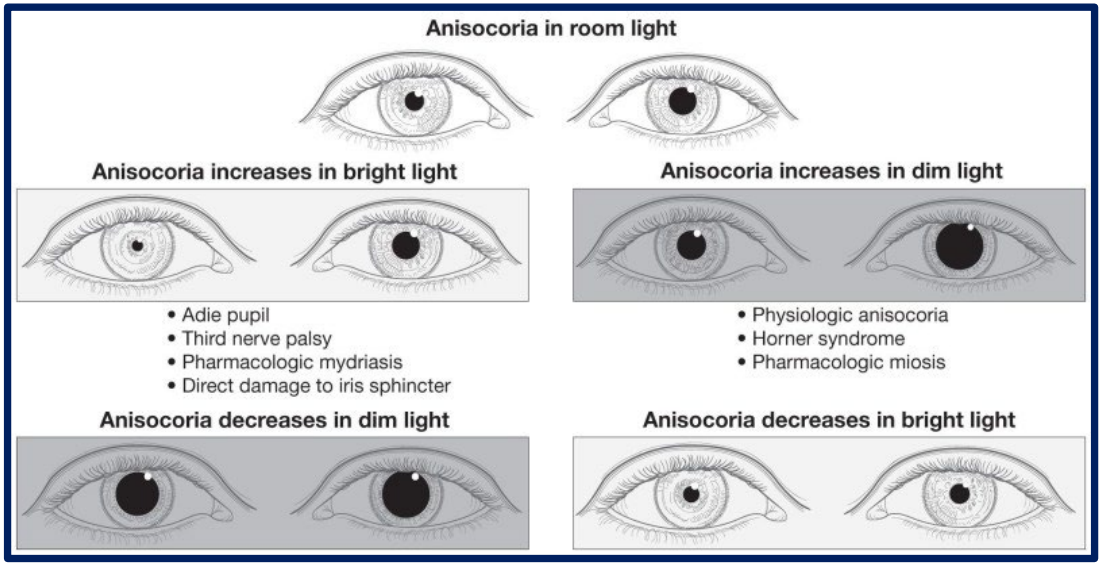
Assessing Anisocoria

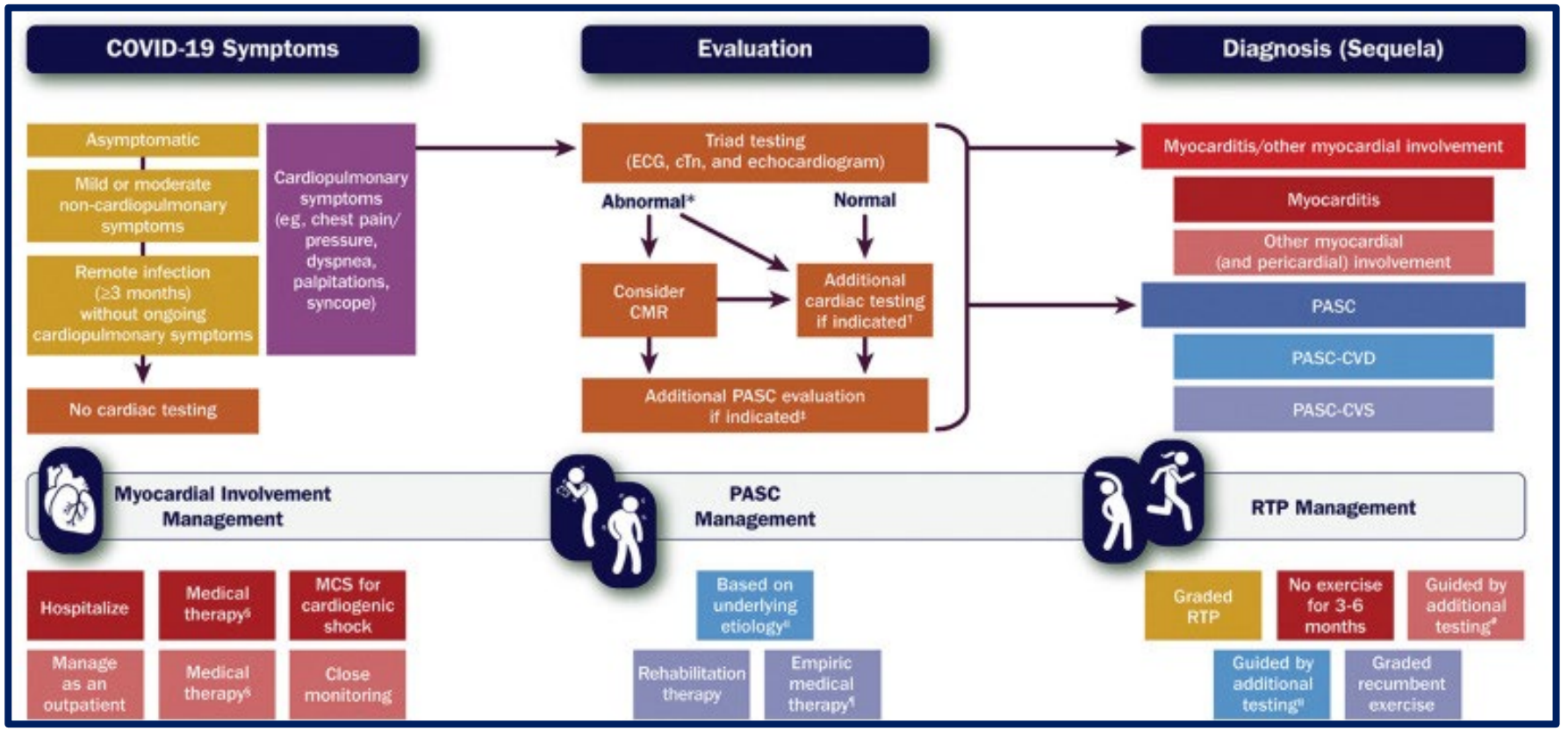


- **In ambient light, estimate the difference in size between pupils (anisocoria).**
- **Illuminate the eyes tangentially from below with a light source (e.g., flashlight) and switch off the room light.**
- **Observe the dilatation dynamics of both pupils carefully for 20 seconds. Photos may be taken at 5, 10, 15 and 20 seconds.**
- **In a patient with Horner syndrome, the normal pupil will dilate rapidly immediately after the room light is switched off; dilatation of the Horner pupil will be delayed because of sympathetic denervation.**
- **After the first few seconds of darkness, the Horner pupil will dilate slowly from the decreasing parasympathetic tone and will reach its maximal dilatation after 15–20 seconds.**
- **Anisocoria will be greater after 5 seconds in darkness than after 15–20 seconds.**
- **The presence of anisocoria with dilatation lag is highly suggestive, but not pathognomonic, of Horner syndrome.**

History of COVID 19

- During clinical examination of a member of the track team, you note that the cadet recently had COVID 19.
- The athlete is asymptomatic, and has no other clinical findings.
- How do you proceed?

COVID 19 Evaluation



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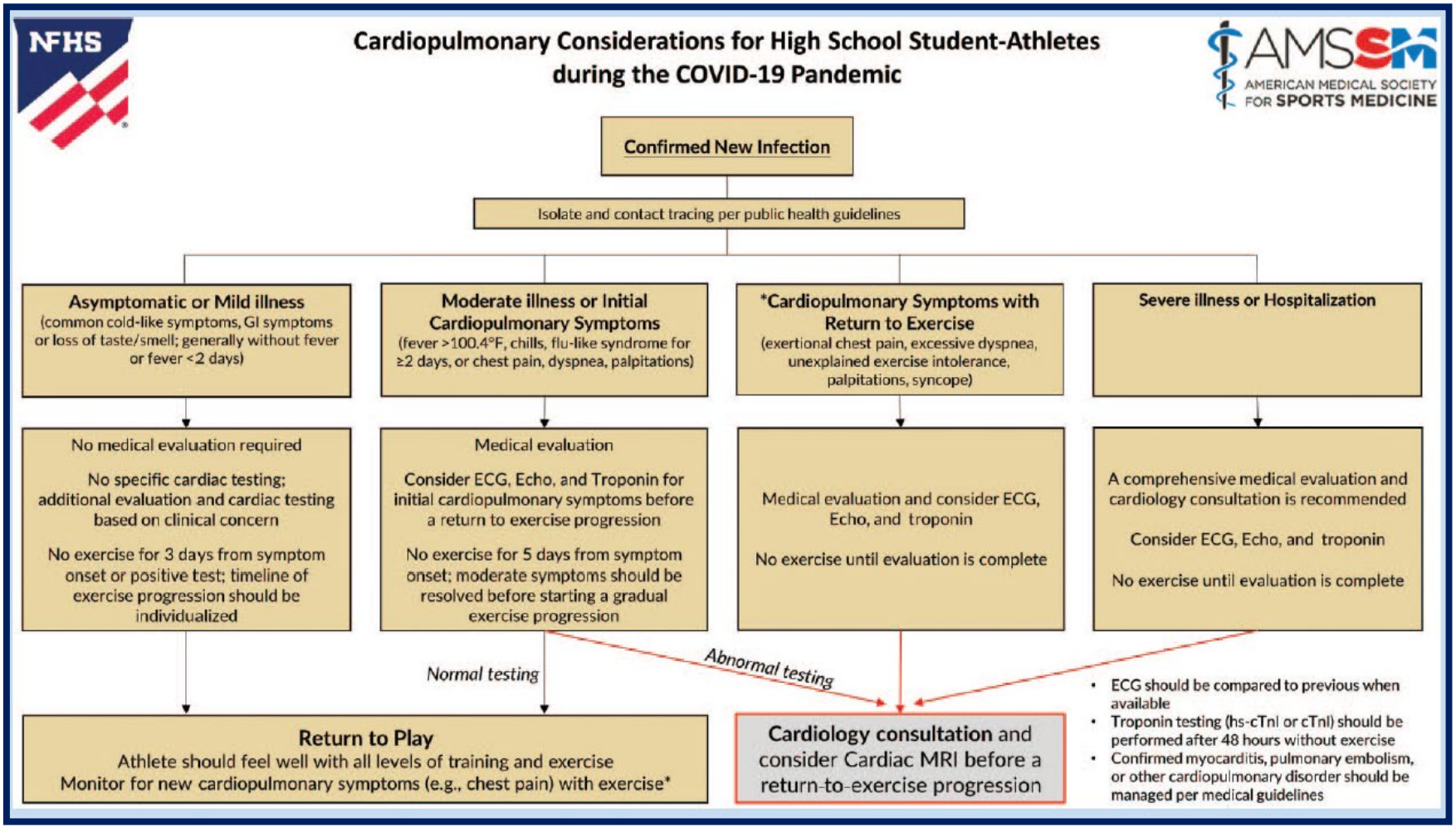
COVID 19 Management



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Final Senior Editor Thoughts!

- The PPE is **only as good as the practitioner** who takes the time to review the questionnaire, ask follow-up questions, and try to determine the risks and benefits of participation in sport or exercise for the athlete.
- Consider **every patient who comes to clinic an athlete and our goal as providers it to promote exercise**. Therefore PPE should be performed on every patient in hopes of preventing any catastrophic event and guiding the patient/athlete in making exercise/sport a positive experience.
- **Final Comment**: would **focus on mental health screening** as main new portion of the PPE.

Final Senior Editor Thoughts!

- The PPE is **not an evidence based** exam
- Incorporating the PPE **into health prevention visits within the health care home i**s best practice
- **History & PE should drive case finding** studies
- **Universal ECG screening is not recommended**
- Use **shared medical decision** making to determine medical eligibility for sports participation
- There are **many knowledge gaps** in the PPE
- **Coding the PPE may allow big data to inform PPE**

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

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