

FROM THE FAMILY PRACTICE INQUIRIES NETWORK

# Do preparticipation clinical exams reduce morbidity and mortality for athletes?

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## EVIDENCE-BASED ANSWER

Though clinical preparticipation exams (PPE) are recommended by experts and required in most states, we found no medium- or better-quality evidence that demonstrates they reduce mortality or morbidity. PPEs detect only a very small percentage of cardiac abnormalities among athletes who subsequently die suddenly (strength of recommendation [SOR]: **C**, case series study). PPEs are also unable to accurately identify athletes with exercise-induced bronchospasm (SOR: **C**, small cross-sectional study) and are poorly predictive of which athletes are at increased risk of orthopedic injuries (SOR: **C**, cross-sectional study).

## ■ EVIDENCE SUMMARY

A systematic review of the literature on PPE identified 310 studies of athletes age <36 years. The authors searched multiple electronic databases and reviewed the bibliographies of retrieved articles but did not perform hand searches of journals or contact authors directly. The review did not find any prospective cohort or randomized trials addressing the effectiveness of clinical PPE. The 5 studies that assessed the format of the PPE concluded that it is not adequately standardized, does not consistently address the American Heart Association (AHA) recommendations for cardiovascular screening and exam, and is administered by a variety of health care professionals, some without proper training.<sup>1</sup>

Sudden cardiac death is defined as a nontraumatic, nonviolent, unexpected event resulting from sudden cardiac arrest within 6 hours of a previously witnessed state of normal health.<sup>2</sup> Such events occur in about 1 in 200,000 high school athletes per academic year (about 16 deaths in the US annually). Detection of cardiovascular abnormalities that may cause morbidity or mortality is difficult. A case series reviewed 158 sudden deaths that occurred in trained athletes in the US from 1985 to 1995. The athletes were identified from

news accounts, the National Center for Catastrophic Sports Injury Registry, and informal communications and reports. The authors interviewed families, witnesses, and coaches, and they analyzed postmortem information. Of the 115 athletes who had a standard preparticipation medical evaluation, only 4 (3%) were suspected of having cardiovascular disease. The cardiovascular abnormality responsible for sudden death was prospectively identified in only 1 athlete.<sup>3</sup>

PPE does not accurately identify student athletes with exercise-induced bronchospasm (EIB). Of the studies on EIB, the best was a prospective cross-sectional study of 352 adolescents from 3 suburban Washington state schools. The students completed a 14-item EIB questionnaire, had a physical exam, and underwent a 7-minute exercise challenge spirometry. Complete data were available for 256 of the students. EIB was diagnosed by spirometry in 9.4% of the athletes. No student had EIB detected solely by physical exam. Using a cutoff of 2 positive questions, the questionnaire had a sensitivity of 71% and a specificity of 47%, with a negative and positive predictive value of 6% and 12%, respectively. This study concluded that EIB occurs frequently in adolescent athletes, but screening by physical exam and medical history does not accurately detect it.<sup>4</sup>

PPEs are not able to predict which student athletes will experience an orthopedic injury, and no controlled studies have been done to determine whether PPE prevents or reduces the severity of orthopedic injuries. A study surveyed 1204 student athletes (aged 13–20 years) from Richmond County, Georgia, who had a standardized PPE before participating in sports. The questionnaire was administered via mail or telephone and inquired about injuries sustained after the PPE. The response rate to the survey was 56%. The study found that a history of knee or ankle injury and abnormal findings on exam in male athletes slightly increased the likelihood of repeated injury of the same joint. However, the sensitivities of history or physical exam for ankle or knee injuries were all <25%.<sup>5</sup>

## Recommendations from others

The AHA recommends a national standard for PPE and that screening should be mandatory for all high school and college athletes before participation in organized sports, with screening repeated every 2 years, and an interim history obtained during the intervening years. Specific items are given in the **TABLE**.<sup>6</sup>

In 2004, the American Academy of Family Physicians, along with the American Academy of Pediatrics, American College of Sports Medicine, American Medical Society for Sports Medicine, American Orthopedic Society for Sports Medicine, and the American Osteopathic Academy of Sports Medicine, published recommendations for PPEs. They suggested a detailed history (consisting of a 16-point questionnaire incorporating AHA recommendations for cardiovascular screening), limited medical exam, and a detailed musculoskeletal exam evaluating strength, flexibility, and stability of major joints.<sup>7</sup>

## AHA recommendations for preparticipation exams

<b>CARDIOVASCULAR SCREENING QUESTIONS</b>
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1. Have you ever become dizzy or passed out during or after exercise?
2. Have you ever had chest pain during or after exercise?
3. Do you get tired more quickly than your friends do during exercise?
4. Have you ever had racing of your heart or skipped heartbeats?
5. Have you ever had high blood pressure or high cholesterol?
6. Have you ever been told that you have a heart murmur?
7. Has any family member or relative died of heart problems or sudden death before age 50?
8. Have you had a severe viral infection such as mononucleosis or myocarditis within the last month?
9. Has a physician ever denied or restricted your participation in sports for any heart problems?
10. Have any of your relatives ever had any of the following conditions:
  - a. Hypertrophic cardiomyopathy
  - b. Dilated cardiomyopathy
  - c. Marfan's syndrome
  - d. Long QT syndrome
  - e. Significant heart arrhythmia

#### **CARDIOVASCULAR SCREENING EXAM**

1. Recognition of the physical manifestations of Marfan's Syndrome
2. Blood pressure, seated position
3. Palpation of radial and femoral pulses
4. Cardiac exam to include rate, rhythm and characterization of murmurs and abnormal heart sounds.
  - a. Precordial auscultation supine
  - b. Precordial auscultation standing
  - c. Maneuvers to clarify murmurs such as squat-to-stand, deep inspiration, or ValsalvaM

#### **CARDIAC FINDINGS REQUIRING FURTHER EVALUATION**

1. Murmur grade 3/6 or greater
2. Diastolic murmur
3. Murmur that increases with Valsalva or other maneuver

#### CLINICAL COMMENTARY

## The PPE provides us an opportunity to address preventive health issues

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Most physicians involved in screening athletes recognize the limitations of PPEs in detecting those at risk for sports-related morbidity and mortality. The history is the most important part of the examination for identifying athletes who might be at risk and should be thorough. Prepared PPE forms such as those endorsed by the AAFP and ACSM can assist in obtaining this history. Because this may be the only occasion for the athlete to see a physician, the examination is best performed by a primary care provider who can use the opportunity to address preventive health issues such as tobacco, alcohol, and drug use, depression and suicidality, sexuality, nutrition, and accident prevention. This kind of counseling is difficult to do in a group format.

#### REFERENCES

1. Wingfield K, Matheson GO, Meeuwisse WH. Preparticipation evaluation: an evidence-based review. *Clin J Sport Med* 2004;14:109–122.
2. Lyznicki JM, Nielsen NH, Schneider JF. Cardiovascular screening of athletes. *Am Fam Physician* 2000;62:765–774. Erratum in: *Am Fam Physician*, 2001; 63:2332.
3. Maron BJ, Shirani J, Poliac LC, Mathenge R, Roberts WC, Mueller FO. Sudden death in young competitive athletes. Clinical, demographic, and pathological profiles. *JAMA* 1996;276:199–204.
4. Hallstrand TS, Curtis JR, Koepsell TD, et al. Effectiveness of screening examinations to detect unrecognized exercise-induced bronchoconstriction. *J Pediatr* 2002;141:343–348.
5. DuRant RH, Pendergrast RA, Seymore C, Gaillard G, Donner J. Findings from the preparticipation athletic examination and athletic injuries. *Am J Dis Child* 1992;146:85.
6. 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;94:850–856.

7. Smith DM. American Academy of Family Physicians, Preparticipation Physical Evaluation Task Force. *Preparticipation Physical Evaluation*. 3rd ed. Minneapolis: McGraw-Hill Healthcare; 2004.