The Pre-participation Sports Physical
Nicole Cain, MD
August 1, 2014

Objectives
• Discuss purpose and timing of PPEs
• Give Overview of PPE
• Review 3 key specific areas: CV, Ortho, Neuro
• Identify conditions which warrant further investigation prior to allowing participation
• Discuss populations of athletes with special considerations
• Discuss clearing athletes for participation

Objectives of the PPE
• Primary Objectives
  1. Screen for conditions that may be life-threatening or disabling
  2. Screen for conditions that may predispose to injury or illness
• Secondary Objectives
  1. Determine general health
  2. Serve as an entry point to the healthcare system for adolescents
  3. Provide opportunity to initiate discussion on health-related topics
What the PPE is NOT:

- PPEs should NOT replace routine health care or comprehensive physicals
- The PPE is a screening tool to determine fitness for athletic participation
- The PPE often takes place in a format which does not allow adequate time for anticipatory guidance
- The PPE often takes place in a format which does not provide adequate privacy to discuss confidential issues

Frequency and Timing of the PPE

- Ideally do PPEs 4-6 weeks before athlete’s season to allow for eval/treatment of problems
- National Federation of High School Associations: PPE necessary - but leaves to states to mandate & standardize
- NCAA recommends & most institutions require annual exams
- Youth / club sports - no formal requirements

SC High School League By-Laws

Each school shall keep on file for all student athletes, a certified copy of the student’s birth record, a duplicate copy of all submitted eligibility forms, transfer form (if applicable), a parent’s permission record properly filled out and a current physical form properly completed by a licensed doctor of medicine or a nurse practitioner in a written collaboration with a licensed medical doctor or a certified physician assistant in a written collaboration with a licensed medical doctor.

1. These forms must be on file for all participating students regardless of level of competition.
2. Forms can be found on the League website.
3. A physical examination is valid from April 1 of the current school year through the following school year.
## RATIONAL FEDERATION OF STATE HIGH SCHOOL ASSOCIATIONS
### 2012-13 ATHLETICS PARTICIPATION SUMMARY

### TEN MOST POPULAR BOYS PROGRAMS

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Effectiveness of PPE

- Unknown as to:
- Effectiveness of PPE as a screening tool
  - Lack of efficacy data for PPE
  - Little effect on morbidity & mortality
- Ability of PPE to affect outcomes
- Detect risk for catastrophic events

Is the PPE a good screening tool?

- Significant burden of disease in population
- Preclinical stage is detectable and prevalent
- Early detection improves outcome (mortality) with acceptable morbidity
- Screening tests are acceptable to population, inexpensive, and relatively accurate
- Effective treatment available for detected disease

Approaches to the PPE

Historically: the HHH exam
- Hi, how are ya?
- Heart
- Hernia
**Approaches to the PPE**

- **Office Based:** maximizes privacy, allows single examiner to complete entire exam, but inefficient for large groups of people.
  - Recommended method
- **Locker-Room Approach:** allows for one examiner to complete each part of the PPE but is also inefficient for large groups and does not allow for privacy
- **Station-Based:** requires multiple examiners, each doing a different part of the exam. Improves efficiency and privacy

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**What’s actually happening…**

- Everybody waits until the last minute
- Urgent care centers & drug store clinics advertise same day, fast appointments where they will complete your forms for $39 and they are open on the weekends and in the evenings
PPE: The History

- History forms are very helpful:
  - athletes and parents should jointly complete a history form prior to the PPE
  - Review form: 75% of issues detected through Hx alone
- Web based history forms may be more convenient for the athletes (ePPE)
- Preparticipation form recommended by the AAFP, AAP, AMSSM, and AOSSM is available in the Preparticipation Physical Evaluation, 4th ed. 2010.
The Cardiovascular History
- Screening for conditions that predispose to Sudden Cardiac Death
- Most common cause of SCD in US athletes <30 is HCM

Cardiac History
- Personal History of:
  - Syncope during or after exercise
  - Chest pain during exercise
  - Palpitations during exercise
  - Prior diagnosis
  - Lightheaded or SOB during exercise
- Family History of:
  - Sudden death <50y
  - Family history of heart problems
  - Family history of unexplained fainting or seizures

AHA Guidelines
- A positive finding on ≥1 element on history is sufficient to warrant further CV investigation
- Might include ECG, ECHO, Stress test or referral to cardiology
The Neurologic History

- At each PPE, athletes should be asked about previous neurologic problems:
  - Prior concussions
  - Previous neck injuries
  - Previous history of stingers/burners
  - Seizure history
  - Current neurologic symptoms (numbness, tingling, weakness, etc.)
  - Current learning/emotional problems

Neurologic History

- Consider baseline neurocognitive studies in athletes who have a history of:
  - Multiple concussions
  - School performance problems

The Musculoskeletal History

- Complete history of musculoskeletal injuries is important
  - Operations
  - Time lost from play
  - Prior rehab
- Ongoing musculoskeletal complaints
  - require a more complete history
  - Deserve detailed evaluation
Screening for the Female Athlete Triad

- All female athletes should be screened for the Female Athlete Triad
- Age of onset of menarche, frequency of menstrual periods, any missed periods, etc.
- History of bony injury, especially stress fractures
- Risk factors for osteopenia
- History questions aimed at identifying distorted body image, pathologic eating behaviors, etc.

Other Important Historical Issues

- Respiratory- h/o asthma or allergic problems
- Infectious- h/o HBV, HCV, HIV, EBV
- Derm- Herpes, current rashes, MRSA
- Hematologic- Sickle Cell, bleeding disorders
- Endo- diabetes
- Other- prior heat-related illness, sickle trait

The Physical

- Each PPE should include vitals, examination of HEENT, CV, RESP, ABD, GU (males only), MSK, DERM, and NEURO systems
- Forms, such as the one published in the Preparticipation Physical Evaluation, 4th ed., 2010, may be helpful.
The Physical

- General: Attention for excessive height, Marfanoid appearance
- Vitals: especially important to check BP. Also Ht, Wt, BMI
- HEENT: Visual acuity, pupils, conjunctivae, lenses, ear exam, oropharyngeal exam
- RESP: resp effort, wheezes, crackles, etc
- ABD: masses, splenomegaly
The Physical

- CV: Auscultation, Femoral/Radial pulses, BP, provocative maneuvers for HCM
  - Systolic Murmur that increases in volume/ intensity with Valsalva or with going from supine to seated
  - Murmur of HCM will diminish with squatting

Hypertrophic Cardiomyopathy
Further Eval: CV Findings

- Findings requiring further evaluation:
  - Systolic Murmur that is 3/6 or greater
  - ANY diastolic murmur
  - ANY murmur which increases in intensity with Valsalva
  - Any FH of SCD or predisposing condition (Long QT, Marfans, ARVD, HCM) or worrisome personal hx
- The Hypertrophic Cardiomyopathy Murmur:
  - Cres-Decres systolic murmur heard best at LLSB
  - Increases with maneuvers to decrease venous return (eg Valsalva, lying to standing)
  - Decreases with maneuvers to increase venous return (ie squatting)

The Physical Cont

- GU (males only): hernia, mass, undescended testicle. Instruction on TSE
- Derm: Rashes, lesions
- Neurologic: strength testing incorporated into MSK exam; more extensive evaluation required for pts with neurologic complaints
- Extremity: arachnodactyly
The Musculoskeletal Exam:

- Asymptomatic pts: General Screening Exam only
- Pts with specific complaints: Gen. Screening Exam PLUS a joint specific exam
- Sport Specific Exam: consider doing a more complete joint exam for commonly injured joints (Shoulders in swimmers and throwers, Knees in athletes who do cutting maneuvers, etc.)

Beyond the Physical

- Are more tests necessary?
Beyond the Physical: Screening Labs?

- Screening labs are NOT recommended at routine PPE’s.
- Some sport governing bodies require lab tests for performance enhancing substances.
- NCAA requires sickle trait screening.
- Captive adolescents: should we screen for STIs?
  - Recent paper in J Adol Health found the following:
    1. Males 2.8% + for chlamydia, 0.7% + for gonorrhea
    2. Females 6.5% + for chlamydia, 2.0% + for gonorrhea
    3. 93.1% of all positives reported NO SYMPTOMS.

Beyond the Physical: Screening CV Studies?

- The Italians:
  - Since 1982 Italy has screened ALL athletes with PPE, EKG, as well as Stress tests and ECHO’s for Elite/Olympic athletes.
  - 2.5% of all athletes screened were disqualified, 51% due to CV probs.
Beyond the Physical: Screening CV Studies?

- Baseline rate of SCD prior to initiation of screening protocol was 3.6/100000
- After initiation of screening, rate of SCD fell to 0.4/100000 (89% reduction)
- Sounds really compelling for routine use of ECGs, right?

But Italy is not the USA…

Risk of SCD Now Equivalent in Italy and US

- 2001-2006 Risk of SCD in US is 0.61/100000
- In Italy, the EXCESS risk from SCD (3.6/100000) was related to ARVD
- By doing EKG/ECHO, the risk to Italian athletes is reduced to a comparable risk that exists in the US
Beyond the Physical: Screening CV Studies?

- Lausanne Recommendations of the European Society of Cardiology, 2006
  - Similar screening questions to AHA
  - Similar physical screening exam to AHA
  - Adds 12-lead ECG after onset of puberty for all athletes
- Endorsed by IOC

Beyond the Physical: Screening CV Studies?

- AHA recommends against cardiovascular screening of asymptomatic athletes with ECG or Echo
  - Not practical for mass, universal screening
    - Size of athlete cohort (huge)
    - Prevalence of disease (low)
    - Limited resources ($, personnel)
    - Absence of physician workforce to interpret ECG
    - Potential to create anxiety with False positive results (morbidity)

Beyond the Physical: Screening CV Studies?

- Epstein and Maron estimated in 1986 that ECHO alone would prevent 1 death per 200,000 athletes, at a total cost of $100,000,000 per life saved
- In 2012 AHA estimated it would cost $2 billion a year for screening ECGs
- ~100 athletes die per year in the US = $20,000,000 per life saved
NCAA Study

- Results support that ECG screening in NCAA athletes is feasible, has a low false-positive rate, and provides superior accuracy compared to a standardized history and physical exam to detect athletes with potentially dangerous cardiovascular conditions. This study also applied new international consensus standards for ECG interpretation — an important component that minimized false-positive results.
- Likely adding ECGs to their physicals

SC Legislation

- House Bill 4404
- A Bill To Amend The Code Of Laws Of South Carolina, 1976, By Adding Section 59-63-77 so as to require a student who participates on a school-sponsored athletic team to be administered an electrocardiogram test during the student’s preparticipation physical and to require the doctor who administers the test to clear the student for participation on the team before he is eligible to participate; and to provide necessary definitions

H 4404

- Introduced in the House on January 14, 2014
- Currently residing in the House Committee on Education and Public Works

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How I read this

- Each athlete must have an ECG each year with their physical
- I have job security
Figure 2. Flow diagram summarizing causes of death in 1866 young competitive athletes. *Suicide (n=22); lightning (n=12); drowning (n=10 and 3 during the swimming segment of triathlon events); cerebral aneurysm (n=9); rhabdomyolysis (n=8); epilepsy (n=2); ... Maron B J et al. Circulation 2009;119:1085-1092

Figure 3. Cardiovascular deaths according to race, with respect to the number of white and nonwhite athletes with each disease.

Beyond the Physical: Screening Neurologic Studies?

- Currently, the NHL, NFL, many colleges, and increasing numbers of high schools require screening neuropsychological testing for athletes involved in contact/collision sports
- Preseason neuropsych testing allows each individual to provide his/her own control for comparison should a head injury occur during the season
Further Eval: Prior Head Trauma

• Prior concussion is an independent risk factor increasing risk for subsequent concussion
• Recurrent concussion increases risk for learning, emotional, and cognitive problems
• In pts with h/o concussion, consider baseline neuropsychological evaluation
• Consider neuropsych eval in kids with school performance problems (baseline study)

Further Eval: MSK Injuries

• Findings of new/recent injuries on PPE deserve appropriate evaluation and treatment
• Findings of inadequately rehabilitated injuries on exam should be followed up for several reasons:
  - Risk of re-injury or injury to others
  - Risk of long term complications (arthritis, etc)

Special Populations of Athletes

• Athletes with Down’s Syndrome
• Paralympics / Handicapped Athletes
• Athletes with one-organ or functionally one-organed
• Athletes s/p transplant
• Athletes with specific medical problems: bleeding disorders, infectious diseases, etc.
Athlete’s with Trisomy 21

- Cardiovascular Abnormalities
  - 50% of children with Down Syndrome have congenital heart disease
- Hypothyroidism
  - Occurs in 15% of
  - Should be screened annually
- Atlantoaxial Instability
  - Should be screened for with flex/ext C-spine films at age 3 years
  - Required for participation in Special Olympics or contact sports

The Functionally One-Organed Athlete

- Concern is for damage to the “good” organ:
  - Ophtho: athletes with one eye or whose best corrected vision is worse than 20/40
  - Recommend appropriate protective equipment
  - Renal: athlete’s s/p nephrectomy
  - Recommend appropriate protective equipment
  - GU: male’s s/p orchiectomy
  - Recommend appropriate protective equipment
- Bottom Line: we are ALL one-organized athletes competing with 1 brain, liver, pancreas, etc.

Clearing Athletes for Participation

- 3.1% to 13.9% of athletes are initially not cleared pending further evaluation.
- Ultimately, 0.3% to 1.3% are denied clearance
- Options for Clearance:
  - Cleared without restriction
  - Cleared, pending evaluation or treatment of a specific problem
  - Disqualified
- Letter of clearance/DQ should be reviewed with athlete, athlete should sign release of information form, form should be passed on to coach/trainer
Final Thoughts

• The PPE is an important skill for PCP’s to be comfortable with
• The PPE does not replace routine health care maintenance visits
• CV, neurologic, and orthopedic abnormalities may require further evaluation prior to clearance
• Vast majority of athletes screened will be permitted to participate without restriction

Questions?

Selected References

• Preparticipation Physical Evaluation, 4th ed., 2010


- Bille K et al. Sudden cardiac death in athletes: the Lausanne recommendations, European Journal of Cardiovascular prevention and rehabilitation. 2006;13:859-875

My thoughts

- What I don’t want to happen
My thoughts…..

Coronary Abnormalities

ARVC / ARVD

- ARVD is caused by genetic defects of the desmosomes, areas on the surface of heart muscle cells which link the cells together.
- The disease is a type of non-ischemic cardiomyopathy that involves primarily the right ventricle.
- It is characterized by hypokinetic areas involving the free wall of the right ventricle, with fibrofatty replacement of the right ventricular myocardium, with associated arrhythmias originating in the right ventricle.
- ARVC/D is an important cause of ventricular arrhythmias in children and young adults. It is seen predominantly in males, and 30-50% of cases have a familial distribution.
Channelopathies

Long QT syndrome

Brugada Syndrome

- Named by the Spanish/Belgian cardiologists Pedro Brugada and Josep Brugada
- The most common cause of sudden death in young men without known underlying cardiac disease in Thailand and Laos