The Pre-participation Exam
Is it Truly Necessary?

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Objectives

- Discuss purpose of PPE
- Understand evidence based screening of the athlete
- Apply knowledge of research regarding the PPE
Why do we do the PPE?
The PPE Monograph, 4th edition

Published 2010

Revision in Works, Planned 2019 Release

American Academy of Family Physicians
American Academy of Pediatrics
American College of Sports Medicine
American Medical Society for Sports Medicine
American Orthopedic Society for Sports Medicine
American Osteopathic Academy of Sports Medicine
Objectives of the PPE

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

• **Secondary Objectives**
  • Determine general health
  • Serve as an entry point to the health care system of adolescents
  • Provide opportunity to initiate discussion on health-related topics
PPE forms in the US

- 23 states use the recommended PPE-4 form
  - 53% of states use outdated or unidentifiable form
- 98% require PPE prior to starting sport
  - VT allows individual schools to decide
- 80% require annual exam
  - 14% biennially; South Dakota requires less frequent
- 45% require to start in 9th grade
  - 2% 8th grade, 26% 7th grade, 20% 6th grade
- Only 43% of states addressed all 12 of the PPE-4 personal and family history cardiovascular questions
  - 29% had <3 screening items

*Caswell SV, et al; Pediatrics 2015*
PPE forms in the US

Caswell SV, et al; Pediatrics 2015
Mayo Clinic Experience

• 2739 PPE’s over 3 years
  • Station exam
  • 11.9% needed further follow up
  • 53 (1.9%) disqualified
    • Reasons not all specifically described

Smith J, Mayo Clinic Proceedings, 1998
Cleared with Follow-Up
n = 327 (11.9%)

- Vision: 53.5%
- Musculoskeletal: 27.8%
- Cardiac/HTN: 13.5%
- Other: 5.2%
Mayo Clinic Experience

Not Cleared
n = 53 (1.9%)

Musculoskeletal 43.4%

Vision 13.2%

Testicle/hernia 7.5%

Cardiac/pre-syncope 18.9%

Seizures 7.5%

Other 9.5%
Germany Experience

• 733 adolescents
• Age 12-13 on eval for entry to elite sports school
  • Comprehensive evaluation
    • History
    • Physical Exam
    • ECG, Exercise ECG, Echo
    • Labs (CBC, LFTs, Chem Panel, Ferritin)
    • Skin Folds
    • Xrays and U/S as indicated (except L-Spine)
Germany Experience

• History
  • 16.4% had obvious issues
    • 3% Cardiac

• ECG, Exercise ECG, Echo
  • 9.7% abnormal ECG
  • 3.4% abnormal exercise ECG
  • 2.8% abnormal Echo
    • 2 findings requiring DQ
      • Aorta aneurysm and ARVC
Germany Experience

- Labs
  - Ferritin <10 in 5.9%
- Xrays indicated in 49%  
  - 80% were for spondy screening  
    - 5% had Grade I Spondy
- Temporary Restrictions 5.6%
  - 85% MSK conditions (Osgood, Severs, Scoliosis)
- 3 ultimately denied (0.4%)
  - 2 Cardiac, scoliosis >45 degrees

*Mayer F, et al; BJSM 2012*
Conducting the PPE

- Washington State Survey (AAP, AFP, AD’s)
  - 95% AAP/AFP wants statewide PPE
  - 66% of AD’s willing to adopt
- 54% of states don’t use statewide mandated form
- Of 23 states that do, only 8 had 4\textsuperscript{th} edition recommended form
  11% of high school students get recommended standard form

\textit{Madsen NL, et al, CJSN, 2013}
Conducting the PPE

- 37% of peds and FPs had knowledge of 4th edition monograph
- Obstacles to complete
  - Not enough time with patient
  - Unsure how to perform history
  - Unsure how to perform exam
  - Unsure of importance of each component
  - PPE forms too long
  - Time spent covering non-PPE topics
  - Lack of standard approach

*Madsen NL, et al, CJSM, 2013*
Conducting the PPE

• Knowledge of Monograph associated with
  • Increased satisfaction with PPE
  • Increased comfort when to refer to subspecialist
  • Increased number performed per month

Madsen NL, et al, CJSM, 2013
PPE : Parental Perceptions

• Survey of parents (n=381)
  • 95% felt PPE important to detect problems related to athletic participation
  • 30% planned to use PPE as only contact with health care provider
  • Parents felt also should address
    • Med problems unrelated to athletics (34%)
    • Health screening procedures (22%)
    • Assess social and behavioral issues (16%)
    • Provide immunizations (7%)

PPE: Athlete Perspective

- 503 male and female collegiate athletes
  - 66% felt they could safely participate in athletics and avoid injury or death without undergoing a PPE
  - Felt prevents major injuries (89%) and minor injuries (79%)

*Carek et al; Arch Fam Med, 1999*
Who should fill out the form?

- High School Station Based PPE
  - 111 students and parents
  - Students did alone and also with parent assistance
  - Only 19.8% had complete agreement
  - 4 of 14 sections accounted for 59% of discrepancies
    - Cardiovascular, Neurologic, MSK, Weight questions
  - Students answered more ‘yes’ answers than parents

Carek PJ, et al. CJSM, 1999
CV Screening

• Is the PPE questionnaire enough?
• Is it sensitive/specific enough?
• Should we be doing screening ECGs and/or Echocardiograms during adolescent PPE?
Can CV Screening be Feasible?

• 2007 Texas piloted cardiovascular screening
• Goals
  • Determine feasibility of state wide screening
  • Determine ability of identifying those at risk
  • Determine problems in screening state wide
• 2,506 students evaluated

Zeltser I, et al; Am J Cardiology, 2012
Can CV Screening be Feasible?

**Model 1**

- Collect Registration & History form
  - Vital Signs
  - 12-lead ECG
  - Limited 2D echo

**Model 2**

- Collect registration form (UIL)
  - 12-lead ECG
    - NORMAL: No further evaluation
    - CONCERN FOR HC: Limited 2D echo
    - CONCERN FOR OTHER POTENTIAL SD: Recommend comprehensive f/u with cardiologist
      - NORMAL: No further evaluation
      - CONCERN FOR HC: Recommend comprehensive f/u with cardiologist
Can CV screening program be feasible?

- 22% reported ≥ 1 CV symptom on history
  - 32% > 1
  - 14% report abn’l heart rhythm or enlarged heart
  - 6% reported heritable CV condition
- 23% of screen ECG’s had findings
  - 100% agreement with blinded reviewers
- 0.7% of screen ECHO’s had findings
  - 79% agreement with blind reviewers with final diagnosis
Can CV screening program be feasible?

- **HCM**
  - 73% had normal Echo in those that screen was concerning
  - 9 referred -- 37% followed up – none had HCM

- **Prolonged QT**
  - 0.5% of ECGs
  - 93% followed up – 25% had prolonged QT

- **WPW**
  - 0.3% of ECGs
  - 57% followed up – all had ablations
Can CV screening program be feasible?

- If PPE hx alone used, 36% would have been referred with disease found in 1.2%
- 0.9% reporting CV symptoms had positive screen results
- 0.6% reporting family hx had positive screen results
- 4 additional found with screening without hx
Can CV screening program be feasible?

- Ultimately 0.4% of total screened had diagnosis of concern for sports participation after comprehensive cardiology evaluation
- Only 2/3 followed up as recommended
- $61 per for model 1; $41 per for model 2
Can Pediatric Cardiologists Identify Abnormalities on PPE?

- 18 ECGs
  - 53 members of Western Society of Peds Cards
  - Sensitivity to any abnormality
    - 68%
  - Specificity to any abnormality
    - 70%
  - Sports clearance recommendations
    - 74% accurately permitted
    - 81% accurately restricted

% of correct responses

- Total Correct: 69%
- HCM: 59%
- Myocarditis: 75%
- LQTS: 98%
- WPW: 80%
- PAH: 34%
- Normal: 71%

*p < 0.05

Washington University Physicians • St. Louis Children’s Hospital
% giving correct sport participation recommendations

- Total Correct: 78%
- HCM: 80%
- Myocarditis: 89%
- LQTS: 98%
- WPW: 64%
- PAH: 38%
- Normal: 74%

*p < 0.05
212 HCM

128 Diagnosed Correctly
- 3 Allowed Sports Participation
- 125 Restricted Sports

84 Diagnosed Incorrectly
- 39 Allowed Sports Participation
- 45 Restricted Sports
Are Pediatric Electrophysiologists any better?

• Same 18 ECGs
• 68 pediatric electrophysiologists reviewed

% correct reads

% correct recommendations
Screening for Exercise Induced Bronchospasm

- EIB screening
  - 256 athletes
  - 14 item questionnaire, Physical Exam, 7 minute exercise challenge with spirometry
    - EIB present 9.4%
  - None detected by physical
  - Screening questions suggestive in 39.5%
    - Only 12.9% actually had EIB

Screening for Exercise Induced Bronchospasm

- 7.2% had EIB but had negative review of symptoms
- 45% of all adolescents with EIB negative on all questions of symptoms and history of EIB, asthma or allergic rhinitis
- Highest specificity: “Symptoms of asthma or symptoms of chest tightness or cough/wheeze with running”
- Highest sensitivity: “Family history of asthma or allergies”

*Hallstrand, et al. J Peds, 2002*
PPE Genital Exam

- 755 male athletes, ages 12-25
  - 5 question survey on genital health
- 50% knew why genital exam performed
- 49% didn’t wear any genital protection
  - 2/3 of football players did not
- 66% knew to be seen immediately for painful scrotal swelling
- Only 36% were aware that testicular cancer most frequent in young men

Congeni J, et al; CJSM, 2005
Future Directions/Conclusions

• NOT A LOT OF GREAT EBM for/against PPE
  • What is the most efficient process?
  • Who is best to conduct the PPE?
  • Where is best place to conduct?
  • How often should it be performed?
  • Benefits of electronic PPE?
  • Need for screening testing?