PREP The Course
Sports Medicine

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Outline

- Epidemiology
- Nutrition/ Fluids
- Performance Enhancing Substances
- Cardiac Disqualifications
- Heat Illness
- Return to play
  - Medical Illnesses
  - Head Injury
National Council of Youth Sports 2008 Survey

- 112 organizations
- 44 million children (32 million ’97)
- 66% Boys, 34% girls (no change)
- vs. ’97, girls are participating in organized sports at a younger age.
- Average time in program – 5 years (no change)
- 7 million adults (coaches, refs, other)
- 75% offered year round
EPIDEMIOLOGY

Increased Injury Rate With Increased Age

- Trend reflects increased body size and speed, plus intensity and magnitude of competition

- Improper / non-existent training techniques, poor coaching, equipment and playing fields may contribute to injuries

- Programs matching children based on age alone misunderstand demands placed on body masses of different sizes and shapes
Risk factors - Previous Injury

A high school athlete who has sustained a previous injury is at greater risk of subsequent injury.

- previous injury doubled the risk of injury in competitive cheerleading and in football.
- soccer players with previous injury had a 74% increased risk of injury compared with players who had not.
- football players were at an increased risk for ankle sprain if they had previously suffered an ankle sprain.
- football players who had previously sustained a concussion were 5x as likely to sustain another concussion.

Management of an Acute Injury

★ Protect – prevents re-injury - splint vs. boot vs. crutches
  – Based on ability to weight bear
★ Rest – OK to weight bear as soon as able
★ Ice – 20-30 minutes on and off
  – Ice can go directly on the skin, chemical packs can not
★ Compression – ACE bandage
  – Wrap distal to proximal but not too tight as to cause swelling distally
★ Elevation – above the level of the heart
Management of Overuse Injuries

- Heat before
- Ice x 30 minutes after
- NSAIDs as needed
- Brace for activity
- Modify activity – relative rest, avoid aggravating activates, X-train
- **Set limits** – 1 day off/ week, 1 month off/ 6 months, 1 sport/ season, 1 team/ sport, 1 sport/ day, no extra training in season
Nutrition

- Carbohydrates - *primary energy source for exercise*
- Fat
- Protein
- Vitamins
- Minerals
- Fluids
CARBOHYDRATES

Glycogen

- storage form of CHO
- important early in exercise
- important with burst type exercise
- readily available, but short lived
  - 2-3 hours of moderate exercise
  - 15-30 minutes of high intensity exercise
Target Sports Diet

Carbohydrates
- 60-70% (avg. 50%)
- 3-5 grams of CHO per pound
- 1 gram of CHO = 4 kcal of energy

Fats
- 15% of diet (avg. 35%)
- unsaturated fat rather than saturated
- 1 gram of fat = 9 kcas of energy

Protein
- 15-20% diet (avg. 15%)
- 1/2 -1 gram of protein per pound
- protein needs vary
Special Needs

- Vegetarians – **Protein**, Iron, Zinc, Vitamin B12, Calcium
- Females – Iron, Folic Acid, **Calcium/ Vitamin D**
- Runners, Gymnasts, Dancers, Adolescents - Multivitamin
- Diabetics - lower % CHD diet, more CHD during exercise
Pre-Event Meal

- CHO booster 1 hour prior to event
  - 1/2 gram CHO per pound equivalent to 50 gram snack
- Beware “sugar sensitive” individuals
  - hyper-insulin response
  - early exercise hypoglycemia
Weight Management

- Most acute changes in weight are fluid related.
- Pathologic weight loss is common in aesthetic sports (gymnastics, dance, cheer) and weight category sports (wrestling, MMA).
- Weight Loss – no more than 1-2 pounds per week (wrestlers, MMA)
  - Avoid saunas, rubbers suits
- Weight Gain – high calorie shakes (football players)
How much do I have to drink, coach?

- Typical day - 8x8 ounce glasses/day
- Exercise/Practice – (ACSM)
  - 500cc (17 oz.) 2 hours before exercise
  - 500cc 15-20 minutes before exercise
  - 10 ounces every 30 min. during

- Thirst is a good mechanism!
- After exercise - replace 16 oz of fluid for every pound of weight lost
- Fluids should never be restricted
Performance Enhancing Supplements (PES)

- **Supplements**: any additions to a normal diet (considered food not a drug)
- **Performance Enhancers**: Any substance or method used to enhance performance through increased energy utilization:
Supplement use in Adolescents

- MS & HS Athletes use supplements
- Purity/ Contamination of supplements are unregulated
- Few studies on side effects, especially long term and none in children
- Most adolescent athletes do not make the most of their diet for performance
- No drug testing in most public high schools
Testosterone Actions:

- Increase in strength
- Increase in weight
- Increase in aggressiveness, sense of well being
- Heightened sexual arousal and function
- Increased capability of sustaining repetitive, high intensity workouts
- Enhanced performance
Clues to abuse

- hypertension
- Blood work- inc. LDL, dec. HDL, elevated LFTs
- gynecomastia
- acne, striae, androgenic alopecia
- aggressiveness, extreme mood swings, other drug use, “Reverse Anorexia”
Stimulant Sources

- Ripped Fuel: combination of synephrine, gaurana, ma haung
- Diet Fuel
- Metabolife
- Hydroxycut
- Coffee
- Cokes/Chocolate
- Energy Drinks
Signs/ Symptoms of use:

- insomnia, instability, agitation and restlessness
- Dyskinesias - especially in facial muscles
- palpitations, hypertension
- Nausea/ Vomiting
- Rebound fatigue and depression
PES Summary

- MS and HS athletes use supplements
- They don’t know about the potential risks of use
- Education of athletes by coaches works!
- More research on stimulant/ HGH abuse in young athletes
- Random testing will always be too expensive/ difficult to be practical at the HS level
- Need to further clarify Food vs. Drug (use EDR vs. RDA) - Congress
Sudden Cardiac Death

- HCM (36%)
- Coronary anomalies (19%)
- Ruptured Ao (5%)
- Turned LAD (5%)
- Myocarditis (4%)
- Dilated C-M (3%)
- ARVD (3%)
- MVP (2%)
- CAD (6%)
- Other
HEART HEALTH QUESTIONS ABOUT YOU

- Have you ever passed out or nearly passed out DURING or AFTER exercise?
- Have you ever had discomfort, pain, tightness, or pressure in your chest during exercise?
- Does your heart ever race or skip beats (irregular beats) during exercise?
- Has a doctor ever told you that you have any heart problems? If so, check all that apply:
  - High blood pressure, heart murmur, high cholesterol, heart infection, Kawasaki disease
- Has a doctor ever ordered a test for your heart? (For example, EKG, echocardiogram)
- Do you get lightheaded or feel more short of breath than expected during exercise?
- Have you ever had an unexplained seizure?
- Do you get more tired or short of breath more quickly than your friends during exercise?
HEART HEALTH QUESTIONS ABOUT YOUR FAMILY

- Has any family member or relative died of heart problems or had any unexpected or unexplained sudden death before age 50? (including drowning, unexplained car accident, or sudden infant death syndrome?)
- Does anyone in your family have:
  - hypertrophic cardiomyopathy, Marfan syndrome, arrhythmogenic right ventricular cardiomyopathy, long or short QT syndrome, Brugada syndrome, or catecholaminergic polymorphic ventricular tachycardia?
- Does anyone in your family have a heart problem, pacemaker, or implanted defibrillator?
- Has anyone in your family had unexplained fainting, seizures, or near drowning?
Hypertrophic Cardiomyopathy

- #1 cause of sudden death among US athletes
- Prevalence - estimated 1/500
- Heterogenous genotype/ phenotype
- Nondilated, asymmetrically hypertrophied left ventricle
- Obstructive and Nonobstructive forms
  - Malignant arrhythmias through abnl muscle
- First clinical event often sudden death
- Suspect with DOE, chest pain or syncope with exercise, or family history of sudden death
Athletic Heart Syndrome

- Normal physiologic adaptations to training allows improved cardiac function
  - Cardiac Chamber Enlargement
  - Increased Ventricular Wall Thickness
    - laterally displaced PMI
    - Systolic ejection murmur
  - Increased Vagal Tone
    - Decreased HR
    - Sinus arrhythmia
    - First degree heart block
Abnormal ECG Findings in Athletes

“Seattle Criteria”

- T-wave inversion (>1 mm in >2 leads V2-V6, II & aVF or I & aVL)
- Long QT interval (QTc >470 ms in men, >480 ms in women)
- Short QT interval (QTc <320 ms)
- ST-segment depression (≥0.5 mm in 2 or more leads)
- Pathologic Q waves (>3 mm in depth or >40 ms in duration in two or more leads, excluding III and aVR)
- Left atrial enlargement (P-wave duration >120 ms leads I or II/ negative portion of the P wave >1 mm and >40 ms in lead V1)
- RVH (R-V₁ + S-V₅ >10.5 mm + right axis deviation >120°)
- Compete left bundle branch block (LBBB) or any QRS >140ms
- Mobitz type II 2° AV block or complete heart block
- Ventricular preexcitation (PR<120 ms, delta wave, QRS>120 ms)
- Profound sinus bradycardia (<30 beats/ min or sinus pauses ≥3 s)
- Atrial tachyarrhythmias (SVT or atrial fibrillation/ flutter)
- PVCs (>2/ 10 sec), ventricular tach (couplets, unsustained VT)
- Type 1 Brugada pattern
Hypertension

- Exercise is part of the treatment
- Limit high static activities (weights) until controlled
- Based on Age/Height charts
  - >99th% - excluded until treatment
  - 95-99th% - cleared with follow-up
  - <95% - cleared
Classifications

Sports by strenuousness:
- High to moderate dynamic and static demands:
  - Boxing, wrestling, crew, cycling, football, rugby, hockey, sprints.
- High to moderate dynamic and low static demands:
  - Basketball, baseball, racquetball, soccer, swimming, tennis, volleyball.
- High to moderate static and low dynamic demands:
  - Field (throwing), gymnastics, martial arts, weight lifting, rodeo.
- Low dynamic and low static demands:
  - Golf, bowling, cricket, riflery, pool.
Determining Clearance

- Usually done case by case, must individualize.
- The PPE monograph contains a table of medical conditions and clearance suggestions - few “no’s” – carditis, fever; qualified no’s – HCM, CA anomalies, ARVD, Acute RF with carditis, vomiting/ diarrhea
Other Contraindications

- **Neurologic**
  - Concussions – DQ same day, until asymptomatic
  - Seizures - No Swimming, Weight lifting, Archery/Riflery, Heights
  - Spine - Atlantoaxial Instability - Downs; Stenosis - DQ
- **EIA (Exercise Induced Asthma)** - none if well controlled
- **Myopia** - DQ if < 20/40 corrected or h/o Detached Retina, no Boxing/MMA (think Marfan’s!)
- **Single Organs** – protect
- **Mononucleosis** – 4 weeks
Heat Illness

- Exercise associated collapse characterized by extreme hyperthermia (T > 102 F) with thermoregulatory failure and CNS dysfunction - paralysis, hysteria, delirium, dysarthria, ataxia, seizures, coma
- Can progress to CV collapse
- Preventable and treatable if recognized early
Heat Exhaustion - presentation

- Fatigue
- Weakness
- Lightheaded
- Cramps
- Fever T>102<104
- Tachycardia
- +/- Hypotension
Heat Exhaustion Treatment

- Remove from environment
- Remove clothing
- Orally rehydrate if able
- IVF
- Cool them
- If symptoms persist or worsen → transport
Heat Stroke

- Thermoregulatory system failure
- Dry, hot, flushed → Not in Athletes
- Temp > 104
- **CNS Dysfunction**
  - paralysis, hysteria, delirium, ataxia, seizures, coma
- Electrolyte disturbances
- 25% Mortality
- 20% permanent CNS injury

**ALTERED MENTATION**
Heat Stroke

- Take a rectal temperature!
- Initiate Emergency Action Plan
- ABC’s
- Cool rapidly (1\text{st})
- Transfer care to EMT’s (2nd)
- Admit to hospital for observation
Cooling Method Rates

Prevention

Know who is at risk:
- #1 - prior heat illness
- Dehydration – no practice with vomiting/ diarrhea
- Medications - caffeine, diuretics, alcohol
- Medical conditions – DM, CF, AN, MR
- Poorly conditioned
- Obese
- Fever - No practice
- Age – pediatric?/ elderly
Prevention

- Practice in the morning
- Don’t be afraid to call-off practice
- Use the shade for rest breaks
- Loose fitting/ light-colored clothing
- Make fluids (water) available at all times
- Recommend conditioning before the start of two-a-day practices
- Recognize and treat heat illness early
Acclimatization

- Physiologic changes that improve capacity for exercise in the heat
- Typically takes 4-7 sessions of 2-4 hours each of exercising in the heat - Start slow at 15 minute intervals and increase slowly
- Results in increased heat loss and smaller rise in core temperature
Acclimatization

Physiologic changes
- Increased blood volume
- Decreased heart rate at given heat/exercise
- Skin vasodilatation/Sweating earlier in exercise
- Increase sweating-May double
- Decreased Na concentration of sweat
- Lower core temp at given work-load/heat stress
- Reduced perception of exercise intensity
Return to Play

- Safe Return
- Risk of Further Injury to self or others
- Can Protect Themselves
- Pain
- Meet Criteria
CRITERIA

- Little / No Pain
  - Patient Subjectivity
- Normal Motion
- Normal Strength
- Functional Ability
- Sports Specific Skills
- Other Factors
OTHER FACTORS

- Dominant Extremity
- Can it be Protected
- Sport Relevance
- Position Played
- Level of Competition
Return to Play:
ACUTE ILLNESS

Sports participation “as able”
- URI
  “Neck” rule - restrict exercise with symptoms below the neck
- Skin Infections
  Appropriately treated, covering insufficient
- Hepatitis/HIV
  Universal precautions
Return to Play: ACUTE ILLNESS

- Restrict sports participation
  - Systemic signs/symptoms
    - Fever
    - Body aches
    - Severe fatigue/malaise/myalgias
  - Mononucleosis x 4 weeks
  - Illness causing loss/inadequate intake body fluids
    - Nausea/vomiting/diarrhea
Infectious Mononucleosis
Complications: Splenic Rupture

- Greatest worry for sports participation
- 0.1-0.5% incidence
  - 90% cases are male
- “Spontaneous” > Traumatic
- Greatest risk 4-21 days after onset of illness
- Kehr’s sign
Infectious Mononucleosis
Return to Play

- No activity for minimum 3 weeks
- Gradual return to activity over 1 week
- Restrict longer if tender/ enlarged spleen
- Imaging controversial
- Normalizing lab studies
- Athlete must also be subjectively improved
Head Injury

- Severe/ Moderate/ Mild Traumatic Brain Injury
- Majority are mTBI or concussion
- 300,000 sports-related brain injuries per year
  - 250,000 in high school football
  - 8 fatalities yearly in college and high school football
- Most agree under-reported

What is a Concussion?

- Lots of terms – *bell rung, dinged, cobwebs*

- “A trauma induced alteration in mental status that may or may not involve loss of consciousness”
  — AAN 1997

- No uniformly agreed upon definitions
Graded Symptom Checklist

Headache - 85%
Dizziness - 70%
Confusion - 60%
Disorientation – 48%
Amnesia - 30%
LOC - 9%

(Guskiewicz; Concussion in HS Football players AJSM 2000)

“Headache plus”
Child SCAT3 (under age 12)

- Symptom Checklist – Parent and Child
- Cognitive Assessment – Orientation, Memory, Concentration
- Neck Exam
- Balance Exam – BESS

*(2013 Zurich Concussion in Sport Consensus Statement)*
HS RIO™ Injury Surveillance System

- Internet-based high school sports-related injury surveillance system
- Weekly data capture 2005 - 2010 academic years
- Representative sample of 100 US high schools
  - Geography (4 US census regions)
  - Size (≤1,000 vs >1,000 students)
- 20 sports
  - Boys’ - football, soccer, basketball, wrestling, baseball, lacrosse, ice hockey, swimming & diving, track & field, volleyball
  - Girls’ - volleyball, soccer, basketball, softball, lacrosse, field hockey, gymnastics, swimming & diving, track & field, cheerleading
# Concussion Rates, 2005-2010

<table>
<thead>
<tr>
<th>Sport</th>
<th># of Concussions</th>
<th>National Estimates</th>
<th>Practice</th>
<th>Competition</th>
<th>Overall</th>
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<tbody>
<tr>
<td>Football</td>
<td>1392</td>
<td>357,114</td>
<td>1.3</td>
<td>11.4</td>
<td>2.9</td>
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<tr>
<td>B Soccer</td>
<td>182</td>
<td>89,237</td>
<td>0.3</td>
<td>3.0</td>
<td>1.1</td>
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<tr>
<td>G Soccer</td>
<td>243</td>
<td>132,062</td>
<td>0.3</td>
<td>4.6</td>
<td>1.6</td>
</tr>
<tr>
<td>G Vball</td>
<td>54</td>
<td>17,326</td>
<td>0.2</td>
<td>0.6</td>
<td>0.3</td>
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<tr>
<td>B Bball</td>
<td>111</td>
<td>27,404</td>
<td>0.2</td>
<td>1.3</td>
<td>0.6</td>
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<tr>
<td>G Bball</td>
<td>184</td>
<td>47,439</td>
<td>0.4</td>
<td>2.7</td>
<td>1.1</td>
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<tr>
<td>Wrestling</td>
<td>152</td>
<td>33,979</td>
<td>0.6</td>
<td>1.9</td>
<td>1.0</td>
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<tr>
<td>Baseball</td>
<td>32</td>
<td>9,569</td>
<td>0.1</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Softball</td>
<td>66</td>
<td>23,692</td>
<td>0.4</td>
<td>0.8</td>
<td>0.5</td>
</tr>
</tbody>
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Includes concussions resulting in <1 day time loss (non time loss = 2% of all concussions)
Management

- Reassess frequently
- Don’t leave them alone
- Talk to parents/guardian before they go home
  - Reassess in 24 hours?
- Who goes to ER?
  - Prolonged LOC, vomiting, GCS of 14, persistent HA, neuro deficit, signs of basilar skull fx
  - Also consider social situation, location
Treatment

- Complete rest from all activities
  - No sports, PE

- Cognitive (Brain) Rest
  - Limit testing (untimed, open book, only one per day)
  - Limit homework/projects
  - No standardized tests
  - Avoid difficult subjects – math, language
  - Begin with ½ day @ school
  - No computer, texting, video games if symptoms
Recommendations

- No return to play on the same day if concussion suspected
- No return to play until asymptomatic
- Use of computerized neuropsych testing helpful but not required (tool in the tool box)
- Cognitive (Brain) Rest
- Follow graded return to activity plan after resolution of symptoms
  - Uses multiple sources of info: ATC’s, teammates, parents, friends, teachers
- Individualize concussion treatment
Gradual Return to Play

Day 1 – Light activity
Day 2 – Moderate/ intense activity
Day 3 – Sports Specific
Day 4 – Practice (no contact)
Day 5 – Full practice
Day 6 – Games

(2013 Zurich Concussion in Sport Consensus Statement)
Helmet Use

- There is sound evidence for the effectiveness of bicycle, skiing and snowboarding helmets, promotion of helmets at a community level, through physician counseling, and legislation - Parkin PC, Curr Opin Pediatr. 2008 Dec;20(6):719-23.

- Community-wide interventions - mandating helmet wearing, education campaigns, distribution of free helmets all report success in influencing helmet wearing across communities.
No Concussion Proof Helmets!
Prevention: Mouth Guards


- Prospective cohort—Level 2
- No difference in concussion rate
- Significantly lower rate of dental trauma
Prevention: Goggles

- All youths involved in organized sports should be encouraged to wear appropriate eye protection.
- All functionally 1-eyed athletes should wear appropriate eye protection for all sports.
- Contact lenses offer no protection.
- An athlete who requires prescription spectacles:
  - polycarbonate lenses in a sports frame that passes ASTM standard F803
  - contact lenses plus an appropriate protector
  - an over-the-glasses eyeguard that conforms to ASTM standard F803
Resources

- 2010 AAP Sport-Related Concussion Statement
  - Return to Learn Statement
- 2017 Zurich Concussion in Sport Consensus Statement
- CDC Toolkits for Concussion
  - High School Coaches
  - Physicians
  - Youth Coaches
  - School Administrators
  - Parents
Thanks