Sports Injury Prevention in Young Athletes
3:30 – 4:15 p.m.

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Disclosure

• I have no relevant financial relationships with the manufacturers of any commercial products and/or providers of commercial services discussed in this CME activity.

– Member of WIAA Sports Medicine Advisory Committee – topics discussed today are my own independent opinions.
Objectives

• Introduction to Youth Sports
• Injury Surveillance
• Acute Injuries
  – Football & Concussion
• Overuse Injuries
Who Oversees Youth Sports?

• National Governing Organizations (NGO)
  – USA Track, USA Hockey, etc.
• National Federation of State High School Associations (NFHS)
  – Writes rules for major sports
• Wisconsin Interscholastic Athletic Association (WIAA)
Youth Sports

• Estimated 45 million 6-18 y/o per year in some form of organized athletics
  – 70% boys, 53% girls participate on 1 or more teams
  – More opportunity AND more exposure
  – Athletes often age grouped
    • Skill
    • Size (football)
Concerns

- 10,000 hours +/- 10,000 hrs
- Push for earlier involvement with sport and training – bone and muscle strengthening
  - Don’t have a clear “best age” to begin structured conditioning activities
  - Growing bones cannot handle as much stress as mature bones of adults
Concerns

- Multiple studies find 50% of pediatric sports medicine visits due to overuse injuries
  - Rising?
- Costs
  - Direct & indirect medical costs
    - 10 mil PCP visits/year
    - 2.5 mil ED visits/year
  - Stop participation = increased sedentary
Long Term Consequences of Injury

• Decreased activity participation in later life
• Loss of function
• Chronic pain
  – Lohmander et al 2007, 50% of ACL & mensicus patients report OA w/ pain and impairment 10-20 years later
  – Not great studies on pediatric/adolescent population that follow through to adulthood
Young Athletes Not Just Little Collegiate or Professional Athletes

• Youth
  – Less coordination = less body control
  – Lower speed, size & strength = less blunt force trauma

• Adolescent
  – Increased injury risk (during growth spurts)
  – Greater speed, size & strength
    • Yet still developing complex motor skills
  – More immature = impulsive & emotional
    – “Invincibility”

• Parental expectations
Injury Surveillance Systems/Epidemiology

• Governing Body Systems
• National Electronic Injury Surveillance System (NEISS)
  • US Consumer Product Safety Commission (CPSC) – 100 hospitals
• CDC
• Individual studies (or lack thereof)
• National Center for Catastrophic Sport Injury Research (NCCSIR)
  – Director: Kristen Kucera, PhD
  – Medical Director: Robert Cantu, MD
  – The National Center for Catastrophic Sport Injury Research collects and disseminates death and permanent disability sports injury data that involve brain and/or spinal cord injuries. The research is funded by a grant from the National Collegiate Athletic Association, the American Football Coaches Association, and the National Federation of State High School Associations. This research has been conducted at the University of North Carolina at Chapel Hill since 1965.
High School RIO Background

• Created by R. Dawn Comstock, PhD
• 2015/16 is the 11th year of data collection for this prospective high school sports injury surveillance system
• Athletic Trainers from high schools across the country report data via an internet-based data collection system, RIO™
• Two concurrent study samples (Random and Convenience)
• Originally 9 sports studied, now 20 sports studied
  – Boys’ baseball, basketball, football, ice hockey, lacrosse, soccer, swimming & diving, track & field, volleyball, wrestling
  – Girls’ basketball, field hockey, gymnastics, lacrosse, soccer, softball, swimming & diving, track & field, volleyball
  – Co-Ed Spirit
• Middle School RIO (first year)
Definitions

- Injury
  - occurred as a result of an organized high school athletic practice or competition and
  - required medical attention (came to AT’s attention) and
  - resulted in restriction of the athlete’s participation for ≥1 days beyond the day of injury or
  - concussions, fractures, and dental injuries (since 2007/08)
- Athletic Exposure (AE)
  - one athlete participating in one competition or practice
Uses for Injury Surveillance Data?

• Source of “real time” data
  – Skin disease for wrestling
• Provide data to help drive evidence-based discussions which can lead to the development and implementation of injury prevention efforts
  – Identify potential concerns
• Evaluate the effectiveness of injury prevention efforts
  – Rule changes
• Advancing knowledge in the field
Injury rates per 1,000 Athletic Exposures by sport and type of Athletic Exposure, High School RIO, 2009-10
<table>
<thead>
<tr>
<th>Sport</th>
<th>Competition</th>
<th>Practice</th>
<th>Performance</th>
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<td>89.7</td>
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<td>Girls' Swimming &amp; Diving</td>
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<tr>
<td>Boys' Track &amp; Field</td>
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<td>Boys' Wrestling</td>
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<td>Girls' Softball</td>
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<tr>
<td>Girls' Basketball</td>
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<td>48.1</td>
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<td>Boys' Soccer</td>
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<td>Girls' Soccer</td>
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<tr>
<td>Boys' Ice Hockey</td>
<td>71.6</td>
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</table>

Percentage of injuries occurring in competition and practice by sport, High School RIO, 2009-10
Ice Hockey Data – Spin?

• Canadian Medical Journal Study
  – Bantam age 13-14y (allow checking)
  – 50% 11-12y = no check; 50% = check
  – Studied injury risk at 13-14y with checking
    • 11-12y allowed to check had 33% less injuries
  – Interpretation
    • Further consideration for body checking at youth level due to injuries
    • Earlier checking reduces injury risk
Fair Play Incentives

• 1990’s in Canada (bantam level)
  – Points awarded to teams at end of season
  – Reward proper behavior, minimize illegal conduct
  – Compared to non-Fair Play counterparts
    • 30% decrease in penalties
    • 25% decrease in 1 game suspensions
Rule Changes

• Softball pitching distance increased to 43 feet in 2010-11
  – Decrease in batters injured when hit by pitch
  – Decrease in fielders injured by fielding batted ball

• Breakaway bases in 2008-9
  – Stationary base – 35% injuries from sliding into base
    • 82% of those were ankle fracture/dislocation
  – >95% reduction in foot and ankle injuries
Field Hockey Eye Protection

• Began in 2011-12
• Kriz 2012, 2015: Mandatory protective equipment (MPE) versus no MPE
  – Eye/orbital injury: 0.080 no MPE v 0.025 with MPE per 1000AE
  – No concussion rate difference
  – 67% less severe head/face injuries (>21 d lost)
  – 70% less medical DQ head/face injuries
Football Injury Data - Kickoff

• All kickoffs: 2005-2010
  – 36.5% concussion (14.3% overall)
  – 10.5% required surgery (7.1% overall)
  – 70% time loss >7 days (54.9% overall)

• Onside kicks: 2010
  – 2,361 total injuries
    • 76.8% concussion (most while being tackled)
Football Kickoff Changes

• NFHS – 40 yard line
• NFL kickoff moved from 30 to 35
  – Actually at 35 in 1993
  – Noted a >40% decline in concussions
• Future considerations
  – Weight limitations/matching
  – No running prior to kickoff
  – When contact can be initiated (after ball fielded for onside kick)
Horse Collar Tackle

- Defender tackles by grabbing inside-back of opponent’s shoulder pads
  - Drag down backwards in twisting motion
  - Legs under body
  - High risk of internal derangement of knee & tib/fib fractures
- Illegal in 2005 (NFL), 2008 (NCAA & NFHS)
  - Decreasing in frequency in HS
    - 2009: 2,360 injuries
    - 2010: 1,240 injuries
    - BUT – only 4.1% called a penalty
• Equipment does not prevent concussion
  – Helmets
    • Virginia Tech STAR rankings
    • UW study found no difference in helmet type
  – Mouth guards
  – Soccer headgear

• 70% of all football concussions are result of head to head contact
  – Decrease illegal helmet contact
WIAA Contact Limits

- **DRILL CONTACT**
  - Air – run unopposed without bags or opposition
  - Bags – activity executed against bag, shield, pag to allow soft surface contact with teammate or coach standing behind bag
  - Wrap or Control – drills run at full speed until contact, which is above waist and all players remain on feet
WIAA Contact Limits

• COMPETITION / FULL CONTACT
• Thud – Same as wrap, but competitive tempo without a predetermined winner & players not tackled to ground
• Full contact – Drills or games situations where live action occurs – game speed with tackling to ground
WIAA Contact Limits

• Acclimatization Regulations apply
• Week 1
  – Unlimited drill contact
  – No competition contact
• Week 2
  – Unlimited drill contact
  – Competition contact <75 mins/week
    (excluding scrimmage)
• Week 3 and beyond
  – Unlimited drill contact
  – Competition contact <60 mins/week
    (excluding games)
NFHS Minimizing Head Exposure

• Two-way or Three-way players
• Multiple levels of practice/competition (varsity, JV, etc.)
• Twice-daily practice (only 1 should include contact)
• Avoid back to back days of contact
• Limit competitive contact to <30 mins/day and no more than 60-90 mins/week
• Consider limitations on quarters per week or games per week
Ankle Sprain Reduction

• Lace up ankle braces
  – Decrease incidence of M&F ankle sprains, but not severity or other LE injury
  – Especially in athletes with prior ankle injury
    • BASKETBALL
    • 0.47 vs. 1.41 per 1000 AE

  • FOOTBALL
    • 0.49 vs. 1.12 per 1000 AE

• Ongoing studies on brace v. exercises
  – Proprioceptive exercise shown to decrease recurrence rate

McGuine 2011, 2012 AJSM
Overuse Injuries
Etiology

- Repetitive microtrauma from chronic submaximal loading of tendons, muscles, and bones
  - Beyond the level required for fitness and conditioning gains
  - Without adequate rest for positive adaption

- Stress of exercise causes remodeling of tissue
  - Breakdown followed by rebuilding
  - Too much breakdown

- Pediatric & adolescent overuse is more likely to affect bone
  - Especially during times of growth
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  – Especially during times of growth

• REMEMBER
  – Puberty and skeletal maturity are a better marker of maturity than chronologic age
Decline of “Free Play” to Blame?

• Free play is self-regulated
  – Enjoyment, physical level of tolerance
  – Poor conditioning plays a primary role in sports injury

• Organized sport is “adult regulated”
  – Unreasonable training/competition schedules
  – Train in long practice sessions
  – Compete in tournament events (often across multiple days)
    • Inadequate rest, nutrition, hydration between bouts
Extrinsic Factors

- Training errors
  - Excessive intensity, duration
  - Seasons are too long
  - Inflated competition demands
  - Inadequate rest
- Over scheduling
- Improper training of technique
- Equipment & surface
- Early specialization
Intrinsic Factors

- Inadequate skill level
  - Poor technique
- Muscular imbalances
  - Strength & flexibility
- Extremity malalignment
- May not recognize signs of injury
- May not correlate fatigue and poor performance with injury
- Incomplete rehab of prior injury
Patients often present after weeks of symptomatic activity

- Increase with exercise, decrease with rest
- When performance is affected
- When discomfort happens in daily life
Recovery Time

• Multifactorial – time needed for adequate recovery
  – Duration
  – Intensity
  – Environmental conditions
  – Nutrition status (hydration, carbohydrate, etc)
  – Psychosocial factors

• Why adequate recovery time doesn’t happen
  – Increasing competition/training
  – Other sports/teams
  – Use of sports facilities
  – Poor sleep
Recovery Time

  - Recommend 2 hours between moderate to vigorous intensity sport-related training sessions lasting over 1 hour
  - If heat illness is a risk, extend that time
  - Avoid excessive cumulative nutritional & fluid deficits
  - Need more research to define timing
Overtraining Syndrome

- Well described in adult literature
- Series of psychological, physiologic and hormonal changes that result in decreased sport performance
  - Non-specific muscle/joint complaints
  - Fatigue
  - Mental health: depression, irritability
  - Difficulty completing routines
  - Poor academic performance
  - Lack of enthusiasm about participation
  - Elevated resting HR
  - Increased rate of illness/infection & injury
Treatment of Overtraining

• Clinical diagnosis
• Rest (4-12 weeks)
  – Low intensity activity
• Consider psychotherapy
• Prevention
  – Make training fun
  – Allow 1-2 days off per week
AAP: Overuse Injuries, Overtraining, and Burnout in Child & Adolescent Athletes

• 1-2 days off per week to allow physical and psychologic recovery
• 10% rule: weekly training time, number of reps, total distance should not increase by over 10% per week
• Encourage 2-3 months away from specific sport (or motion) per year
• Emphasis on fun, sportsmanship, skills, safety
• Participate in 1 team per season
• Educate on appropriate nutrition & hydration
• Caution with multigame tournaments
• Injury screening  
  – Also check for concussion & heat illness
• Musculoskeletal screening exam  
  – Identify discomfort and unequal motion/strength
• No good research showing the effectiveness of this tool  
  – Different implementation & forms  
  – PREPARTICIPATION EVALUATION 4th EDITION
Prevention – Performance Enhancement Program

• 14-18y soccer
  – Equivalent intervention & control teams
  – Player education, structured warm-up/cool-down, and injury rehab
  – 20% decrease in injury incidence for players on teams performing the interventions
  – Statistical significance for mild, overuse, noncontact, and groin injuries

• 15-17y Norwegian team handball
  – Equivalent intervention & control teams
  – Running exercises, jump-shot landings, balance training, and upper-leg exercises
  – Risk of sustaining any injury was significantly lower (RR = 0.5) for players in the intervention group
  – Reduced risk of injury for leg injuries and acute knee injuries (RR = 0.5)
Prevention - Orthotics

• 5 trials, 6 comparisons (2500 military recruits) effectiveness of different insoles to reduce leg injuries
  – All showed preventive effects of insoles compared with controls
  – All showed injury risk reduction of >30%, and in 4 the risk reduction was >50%
  – Effectiveness of custom-made and prefabricated insoles similar

• 1 study compared 19 different types of orthotics and no difference was found
Prevention - Other

- Proper equipment and playing surface/conditions
  - Cheer & dance often tumble on thin mats or stages, as opposed to a spring floor like gymnastics
- Proper expectations & education
  - Parent & athlete
- Proper coaching
- Proper officiating
Thank you!
Questions?
Contact Information

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