Sport Specialization:

*Prevalence, Attitudes, Behaviors and Injury Risks*
Tim McGuine PhD, ATC

University of Wisconsin
School of Medicine and Public Health
COI – Disclosures

Neither I, nor any family member(s), have any relevant financial relationships to be discussed, directly or indirectly, referred to or illustrated within the presentation.
Background and Perspectives
“Direct” Experience With High School Athletics
Research Focus

Identifying and understanding:

• Risk factors
• Prevention techniques
• Health related outcomes

For injuries sustained by adolescent and high school athlete populations.
The Wisconsin Sports Injury Research Network

Collect and report “real time” research data in high schools

16,000+ adolescent athletes,

96 High schools

Cross sectional, prospective cohort and RCT’s
Sport Specialization......Background
Anecdotes

“Our team’s post season has been impacted the last 2 years by club sport injuries…”

“I played in 84 soccer games my senior year....”

“We can’t get enough girls to play basketball at our school because of club volleyball....”

“If my son doesn’t play baseball in the fall, they won’t let him play in the spring....”

‘My 12 yr. old was asked to sign a contract to train with her club soccer team all winter and not play other sports....”

My daughter just wants to make her varsity team....”
Sports Specialization
Risks vs Benefits

Multi Sports
- Injuries
- Burnout
+ Crosstrain
+ Late Adoption

Specialization
- Performance
- Adaptive Changes
- Culture
- More Training
Sport Specialization Defined

“year-round intensive training in a single sport at the exclusion of other sports”.

Sport Specialization

≠

Single Sport Participation
AOSSM Early Sport Specialization Consensus Statement

Robert F. LaPrade,* MD, PhD, Julie Agel,†‡ MA, ATC, Joseph Baker,§ PhD, Joel S. Brenner,‖ MD, MPH, Frank A. Cordasco,¶** MD, MS, Jean Côté,†† PhD, Lars Engberg,‡‡‡ III MD, PhD, Brian T. Feeley,¶¶ MD, Daniel Gould,‖‖ PhD, Brian Hainline,‡‡§§ MD, Timothy Hewett,‖‖‖ PhD, Neil Jayanthi,‖‖‖ MD, Gregory D. Myer,‡‡¶¶ PhD, FACSM, CSCS*D, Alex Philipp,‡¶§§ MD, and
Brittany Patrick, MPH,§

Sports Specialization and Intensive Training in Young Athletes

Joel S. Brenner, MD, MPH, FAAP, COUNCIL ON SPORTS MEDICINE AND FITNESS

CLINICAL REPORT  Guidance for the Clinician in Rendering Pediatric Care

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™
ATTITUDES AND BEHAVIORS
Specialization Scale  (Jayanthi)

<table>
<thead>
<tr>
<th>Question</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you train more than 75 percent of the time in your primary sport?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you train to improve skill and miss time with friends as a result?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you quit another sport to focus on one sport?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you consider your primary sport more important than your other sports?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you regularly travel out of state for your primary sport?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you train more than eight months a year in your primary sport?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Score: 0 – 3 = Not Specialized (NoSPEC),  4 - 6 = Specialized (YesSPEC)

<table>
<thead>
<tr>
<th>Question</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you quit another sport to focus on one sport?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you consider your primary sport more important than your other sports?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you train more than eight months a year in your primary sport?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Score: 0,1 = Low Specialization (LOW)  
2 = Moderate Specialization (MOD)  
3 = High Specialization (HIGH)  

Jayanthi, AJSM 2015
Prevalence of Specialization

- **High** 37.5% (n=754)
- **Moderate** 37.3% (n=749)
- **Low** 25.2% (n=507)

Similar youth and high school data
Exploring Attitudes and Behaviors

2016/17 Parent & Child Survey
Anonymous, Self-administered
3 Sections:
• Background of parent and child
• Sport participation patterns
• Perceptions and knowledge

N = 1000 parents
61% female (n=614) 44.5 ± 6.7 yrs
N = 1000 youth athletes
48% female (n=234) 13.1 ± 2.8 yrs

mcguine@ortho.wisc.edu
Parents Awareness of Safe Sport Recommendations

- **Hours/Week**
  - Yes: 15
  - No: 83
- **Months/Year**
  - Yes: 18
  - No: 82
- **Simultaneous Leagues**
  - Yes: 10
  - No: 89
Parent: How much of a problem is early sport specialization in youth sports? 84%
How likely do you believe your child will receive a college athletic scholarship?

- Very Unlikely: 30%
- Somewhat Unlikely: 10%
- A Little Unlikely: 5%
- Neither Likely or Unlikely: 5%
- A Little Likely: 20%
- Somewhat Likely: 15%
- Very Likely: 0%
How likely you will receive a college scholarship that is related to athletic performance?

- 0% Extremely Unlikely
- 10% Very Unlikely
- 20% Somewhat Unlikely
- 30% Neither Likely Nor Unlikely
- 49% Somewhat Likely
- 49% Very Likely
- 0% Extremely Likely

49%
Athlete: Does playing one sport year-round increase your chances of making a high school team?

- Not At All
- A Little
- Somewhat
- Quite A Bit
- A Great Deal

93%
Exploring Attitudes and Behaviors

200+ Head or Asst. Coaches

78% unaware of recommendations regarding maximum:
Number of months per year
Hours per week in one sport
Number of simultaneous leagues

11% knew the number of months recommended

43.2% were “very” or “extremely” concerned about injuries.

60.1% of believed that sport specialization was a problem
Survey Discussions

• Recommendations associated with youth sport participation are not well known.

• Parents and youth athletes are concerned about...
  – risk of injury (parents more than kids)
  – consider sport specialization a problem
  – playing year round increases chance of overuse injury

• Athletes see specialization as beneficial for making high school team.
INJURY RISKS
Theoretical Model For Specialization and Injury

- Biomechanical Factors
- Sport Specialization
- Volume
- Sports Injury

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Previous Evidence


Hall. Sports Specialization and Anterior Knee Pain in Females - *J Sport Rehab* 2015
The Association of Sport Specialization and Training Volume With Injury History in Youth Athletes

- 2011 youth athletes
- 12-18 years of age
- 49% (n=989) female and 51% (n=1022) male
- Mean age 13.7 ± 1.6 years
- Anonymous survey at local youth sport tournaments
  - Sport specialization scale
  - Sport participation volume
  - Injury history in the previous year
Specialization and Injury

<table>
<thead>
<tr>
<th>Low (0-1 pt)</th>
<th>Moderate (2 pts)</th>
<th>High (3 pts)</th>
</tr>
</thead>
</table>

- Any Previous Injury
  OR: 1.62 (1.28, 2.06)
  P<0.001

- Any Overuse Injury
  OR: 1.48 (1.09, 2.03)
  P=0.02

- Upper Extremity Overuse Injury
  OR: 1.96 (1.17, 3.43)
  P=0.02
Months Per Year and Injury

Any Overuse Injury
OR: 1.60 (1.21, 2.14)
P<0.01

Upper Extremity Overuse Injury
OR: 1.68 (1.06, 2.80)
P=0.049

Lower Extremity Overuse Injury
OR: 1.66 (1.22, 2.30)
P<0.01

Concussion
OR: 1.61 (1.08, 2.47)
P=0.03

*All analyses adjusted for age and gender
Hours per Week and Injury

- **Hours Per Week ≤ Age**
  - Any Previous Injury
    - OR: 1.34 (1.12, 1.61)
    - P < .01

- **Hours Per Week > Age**
  - Any Previous Injury
    - OR: 1.34 (1.12, 1.61)
    - P < .01
  - Any Overuse injury
    - OR: 1.26 (1.01, 1.59)
    - P = 0.04
Previous Injury Research

Limitations: Small studies
Convenience samples
Retrospective designs
Descriptive findings
Limited injury focus
Simple analyses

Alternatives: Prospective design
Population samples
Direct data collection
Broad injury focus
Rigorous data analyses
Solution..... a New study

Propective

Diverse school sample

Enroll actual athletes from multiple sports

Collect baseline data and record all exposures

Licensed medical providers (AT’s) collect data on specific injuries (lower extremity).

Analyses include: Multivariate analyses with Cox Proportional Hazard Modeling
Research Support
Data collection: 2015/16 academic year
Sites: 29 WI high schools ATs in with WISIRN
Subjects: (male and female, interscholastic athletes in grades 9-12).
Baseline Data: Previous time loss LEI
Club and interscholastic sports
Primary Sport
Competition volume
Specialization Scale (Jayanthi)

Daily Athletic Exposures (AE): All practices and games.
Injury Data: AT’s record onset, injury type, days lost etc.
Analyses: %, days lost due to injury (Med [IQR 25th,75th], Odds Ratios (OR, [95%CI])) Chi Square, Fishers exact tests, Cox hazards models.
Results

1,544 Subjects
(Female = 50%, Age = 16.0 ± 1.1)

2,843 Athletic Seasons

167,349 Athletic Exposures
## Subject Demographics

<table>
<thead>
<tr>
<th>Variables</th>
<th>(%)</th>
<th>Variables</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td><strong>Previous LEI</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>50.5</td>
<td>No</td>
<td>68.3</td>
</tr>
<tr>
<td>Male</td>
<td>49.5</td>
<td>Yes</td>
<td>31.7</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td><strong>Primary sport league</strong></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>27.1</td>
<td>No</td>
<td>50.3</td>
</tr>
<tr>
<td>10</td>
<td>27.1</td>
<td>Yes</td>
<td>49.2</td>
</tr>
<tr>
<td>11</td>
<td>24.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>20.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Primary Sport</strong></td>
<td></td>
<td><strong>Primary sport competitions</strong></td>
<td></td>
</tr>
<tr>
<td>Basketball</td>
<td>21.4</td>
<td>Low (&lt; 30)</td>
<td>52.8</td>
</tr>
<tr>
<td>Soccer</td>
<td>20.2</td>
<td>Moderate (30 - 60)</td>
<td>30.0</td>
</tr>
<tr>
<td>Football</td>
<td>17.0</td>
<td>High (&gt; 60)</td>
<td>17.2</td>
</tr>
<tr>
<td>Volleyball</td>
<td>15.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseball / Softball</td>
<td>8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tennis</td>
<td>4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track / XC</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrestling</td>
<td>2.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other¹</td>
<td>11.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Quick Hits!

20% of high school athletes participated in a single sport

Females were more likely to specialize

Soccer: highest level of specialization

50% played in a league outside of school

15% competed in a club sport and high school sport simultaneously

17% took part in 60 or more primary sport competitions (school and club) per year
Distribution of Specialization

<table>
<thead>
<tr>
<th>Level</th>
<th>Females</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>54.4%</td>
<td>64.6%</td>
</tr>
<tr>
<td>Moderate</td>
<td>29.1%</td>
<td>25.0%</td>
</tr>
<tr>
<td>High</td>
<td>16.4%</td>
<td>10.3%</td>
</tr>
</tbody>
</table>
Distribution of Specialization

<table>
<thead>
<tr>
<th>Sport</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOCCER</td>
<td>53%</td>
<td></td>
</tr>
<tr>
<td>VOLLEYBALL</td>
<td>47%</td>
<td></td>
</tr>
<tr>
<td>BASKETBALL</td>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>FOOTBALL</td>
<td></td>
<td>18%</td>
</tr>
</tbody>
</table>
Distribution of Specialization

- BASE/SOFTBALL: 37%
- WRESTLING: 36%
- TENNIS: 31%
- TRACK: 16%
- OTHER: 41%

Categories:
- MODERATE
- HIGH
A Prospective Study on the Impact of Sport Specialization on Lower Extremity Injury Rates in High School Athletes

## Injury Characteristics

<table>
<thead>
<tr>
<th>Body Area^1</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle</td>
<td>34.4</td>
</tr>
<tr>
<td>Knee</td>
<td>25.0</td>
</tr>
<tr>
<td>Upper Leg</td>
<td>12.7</td>
</tr>
<tr>
<td>Lower Leg</td>
<td>12.0</td>
</tr>
<tr>
<td>Hip / Pelvis</td>
<td>8.0</td>
</tr>
<tr>
<td>Foot</td>
<td>8.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Injury Type</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ligament Sprain</td>
<td>40.9</td>
</tr>
<tr>
<td>Muscle / Tendon Strain</td>
<td>25.4</td>
</tr>
<tr>
<td>Tendonitis / Tenosynovitis</td>
<td>19.6</td>
</tr>
<tr>
<td>Fracture - Stress</td>
<td>3.6</td>
</tr>
<tr>
<td>Fracture - Acute</td>
<td>2.9</td>
</tr>
<tr>
<td>Meniscus Tear</td>
<td>1.8</td>
</tr>
<tr>
<td>Other</td>
<td>5.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Injury Onset</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td>66.3</td>
</tr>
<tr>
<td>Gradual</td>
<td>23.1</td>
</tr>
<tr>
<td>Recurrent</td>
<td>7.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surgery</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>8.3</td>
</tr>
<tr>
<td>No</td>
<td>91.7</td>
</tr>
</tbody>
</table>

*N = 235 Subjects  
N = 276 Injuries*
# Actions Taken for New LEI

<table>
<thead>
<tr>
<th>Medical provider</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>School AT</td>
<td>67.6</td>
</tr>
<tr>
<td>Primary Care Provider</td>
<td>24.1</td>
</tr>
<tr>
<td>ER / ED</td>
<td>8.2</td>
</tr>
<tr>
<td>Other</td>
<td>1.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagnostics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>X-RAY</td>
<td>30.9</td>
</tr>
<tr>
<td>MRI</td>
<td>15.4</td>
</tr>
<tr>
<td>CT</td>
<td>1.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surgery</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>8.3</td>
</tr>
</tbody>
</table>
New LEI Incidence  (3 pt. scale)

<table>
<thead>
<tr>
<th>Level</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>12.2%</td>
</tr>
<tr>
<td>MOD</td>
<td>18.9%</td>
</tr>
<tr>
<td>HIGH</td>
<td>21.3%</td>
</tr>
</tbody>
</table>

Multivariate Cox Hazards Ratios

- MOD: 1.51 (1.04 - 2.20), $p = 0.029$
- HIGH: 1.85 (1.12 - 3.06), $p = 0.017$
Injury Onset and Sport Specialization

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td>9.8%</td>
<td>13.3%</td>
<td>12.3%</td>
</tr>
<tr>
<td>Chronic/Repetitive</td>
<td>2.9%</td>
<td>7.4%</td>
<td>10.9%</td>
</tr>
</tbody>
</table>

Chronic / Repetitive

MOD > LOW
HR: 2.61 (1.34 – 5.07)
p = 0.005

HIGH > LOW
HR 4.74 (2.04– 11.05)
p < 0.001
Question:
Does sport specialization increase the incidence of LEI equally in both males and female athletes?

New Analyses:
A total of N = 902 subjects in paired sports (Baseball / Softball, Basketball, X–Country, Soccer, Tennis and Track)

95,444 athletic exposures

HIGH subjects was 2X higher than LOW!
**Comparison in Paired Sports**

- **LOW**
  - Female: 13.7%
  - Male: 11.5%

- **MOD**
  - Female: 18.6%
  - Male: 18.1%

- **HIGH**
  - Female: 24.0%
  - Male: 23.0%

**Males:** 14.6%, **Female:** 16.7%

**HR:** 0.89 (0.66 – 1.20)

**p = 0.452**
Ankle Sprain (3 pt. scale)

Multivariate Cox Hazards Ratios

Mod vs Low: 1.66 (1.01 - 2.73)  High vs Low: 2.12 (1.06 - 4.26)
Discussion

The first Study to prospectively document the association between sport specialization and risk of LEI

MOD specialized $> 50\%$ incidence of LEI than LOW

HIGH specialized $> 85\%$ incidence of LEI than LOW
Discussion

This study supports the findings of previous retrospective and case control (clinic) research.

Highly specialized athletes more likely to sustain recurrent injury or acute ankle sprain than athletes in the low specialized category.

Injury risks increased when controlling for all variables
Economic Costs – Ankle Sprains

US CPSC NEISS 2014 Estimate (ages 14 -18)

n = 186,200 ankle sprains / strains

$283 million (direct)

$2.4 billion (indirect)
Limitations

Recall bias

All data collected in a single state

Some sports not represented

Did not measure injuries in club sports
Future Epidemiology Research

Upper Extremity Injuries
Target: Baseball, Softball, Swim, Tennis & Volleyball
Sample: US high schools (50 states)
Subjects: N = 5000+
Data Collection: Web based

Longitudinal Studies
Target: 10,000 youth athletes
Sample: Multi-state
Subjects: 8 yr. – 10yr. male and female
Data Collection: 10 Years

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Need to Consider…..

50% athletes competed in their primary sport outside of school

These athletes have 1/2 to 2/3 of their primary competitions outside of school

What level of health care is provided to club athletes (not interscholastic)?

Should club sport teams and associations be required to provide the same level of sports medicine care as US high schools?
Specialization $ Costs

What about kids who “can’t afford” to play on a club team?

Are these kids given the message they shouldn’t participate in high school sports?
SOULTIONS FOR HIGH SCHOOLS
High School Administrators

Educate your coaches!
   Get them on board
   Share your concerns and expectations

Booster clubs, parents and athletes
Volume recommendations (months/year, hours/week)
Caution against playing multiple sports/leagues simultaneously
Participate in an injury prevention program!
AOSSM Early Sport Specialization
Consensus Statement

Robert F. LaPrade,* MD, PhD, Julie Agel,†‡ MA, ATC, Joseph Baker,§ PhD,

“Early sport specialization has not been shown to be beneficial for high-caliber athletic performance at the national team / Olympic / professional levels, and in fact may be detrimental.”

“Specialized athletes are subject to overuse injury and burnout from concentrated activity.”
Find your “Multi-Sport” advocates

Wisconsin coaches encourage young athletes to play multiple sports

Tony Cartagena
ESPN Wisconsin

May 4, 2017

Tony Cartagena covers the Wisconsin Badgers for ESPN Wisconsin

MADISON, Wisc. – A public service announcement to prep athletes, coaches and parents.

Don’t specialize. Play multiple sports.

On the surface, that should be a pretty easy concept to grasp. As the seasons change, so should the sports that you’re playing. But times are evolving too. Competition at the high school level is at an all-time high and doesn’t appear to be nearing a plateau.
Specialization “is not about getting a college scholarship anymore,” he said, adding: “It’s about just getting playing time at their high school with their peers now. That’s the way we’ve made it, and it’s a real shame.”

-Tim McGuine

New York Times: 4/30/16
THANK YOU!
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