Sport Specialization in Overhead Athletes: Athlete Risks and Parent Perspectives

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Eric Post, PhD, ATC
Assistant Professor
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Objectives

• At the conclusion of this talk participants should be able to:
  – Interpret recent research examining the prevalence, benefits, and risks of sport specialization in overhead athletes.
  – Identify factors and stakeholders that influence sport specialization decision making.
  – Describe recommendations for parents, coaches, and athletes regarding the volume of sport participation.
ACTIVE KIDS DO BETTER IN LIFE
WHAT THE RESEARCH SHOWS ON THE COMPOUNDING BENEFITS

ACTIVE PARENTS ASSOCIATED WITH ACTIVE KIDS

KIDS OF ACTIVE MOMS ARE 2X MORE LIKELY TO BE ACTIVE

INTERGENERATIONAL CYCLE

COMPRESSION OF MORBIDITY 1/3 THE RATE OF DISABILITY

REDUCED RISK OF HEART DISEASE, STROKE, CANCER, DIABETES

MORE PRODUCTIVE AT WORK

LOWER HEALTH COSTS

7-8% HIGHER ANNUAL EARNINGS

15% MORE LIKELY TO GO TO COLLEGE

LESS SMOKING, DRUG USE, PREGNANCY AND RISKY SEX

UP TO 40% HIGHER TEST SCORES

1/10 AS LIKELY TO BE OBSE

EARLY CHILDHOOD  ADOLESCENCE  ADULTHOOD

The Aspen Institute: Project Play
Sports & Fitness Industry Association (SFIA) data. The Aspen Institute: Project Play

**60 million:** Organized Athletics

**44 million:** > 1 Sport

**27 million:** Team Sports

- **Basketball**
  - 2008: 5.7 M
  - 2013: 5.0 M
  - Change: -10.7%

- **Soccer**
  - 2008: 5.6 M
  - 2013: 5.0 M
  - Change: -10.7%

- **Track & Field**
  - 2008: 847 K
  - 2013: 731 K
  - Change: -13.7%

- **Baseball**
  - 2008: 5.3 M
  - 2013: 4.5 M
  - Change: -14.4%

- **Football**
  - 2008: 1.8 M
  - 2013: 1.3 M
  - Change: -28.6%

- **Softball**
  - 2008: 1.3 M
  - 2013: 862 K
  - Change: -31.3%

**2.6M fewer kids playing these sports alone in past 5 years.**
When did things change?
AOSSM Early Sport Specialization Consensus Statement

Sports Specialization and Intensive Training in Young Athletes

All that was missing was....

• Actual evidence!

• Since the time of those position statements, there has been a huge increase in research articles focused on sport specialization.
Sport Specialization Definition

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

**Method 1:** Track by number of sports

**Method 2:** Jayanthi Scale
Sport Specialization Scale

1. Do you train or participate in your primary sport more than 8 months out of the year?
2. Do you consider your primary sport more important than your other sports?
3. Have you quit other sports to focus on your primary sport?

- Low (0-1 pt)
- Moderate (2 pts)
- High (3 pts)
Prevalence of Specialization

- Bell, AJSM 2016, N=302:
  - High: 36.4%
  - Moderate: 28.8%
  - Low: 34.8%

- Post, AJSM 2017, N=2011:
  - High: 37.5%
  - Moderate: 37.3%
  - Low: 25.2%
Specialization and Overuse Injury

1. Jayanthi et al., JMST, 2011 (OR: 1.55)
2. Jayanthi et al, AJSM, 2015 (OR: 1.36)
3. Hall et al, J Sport Rehab, 2015 (RR: 1.50)
4. Bell et al, AJSM, 2016 (OR: 2.93)
5. Post et al, AJSM, 2017 (OR: 1.45)
6. Post et al, Sports Health, 2017 (OR: 2.08)
8. Bell et al, Pediatrics 2018 (Pooled RR: 1.8 [1.3-2.6])
    – Meta-analysis of 5 studies with total N=5617 subjects
High School Prospective Data

- Many existing studies limited by study design.
- Unable to determine whether specialization leads to injury or injury causes specialization.
Prospective Study - Methods

- 1544 high school athletes (16.0 ± 1.1 yrs) tracked over the course of 2015-2016 academic year

- Exposures and injury data recorded by school athletic trainer
  - 2843 athletic seasons
  - 167,349 athletic exposures
Overuse LEI Incidence

Multivariate Cox HR* = 4.74 (2.04 – 11.05) \( p < 0.001 \)

*Controlling for sport, sex, grade, previous LEI, and competition volume

McGuine et al. AJSM 2017, N=1544
Injury Onset and Sport Specialization

McGuine et al. AJSM 2017, N=1544
Overuse Injury – Sport Specific

• Previous research has examined large cohorts of many different sports.

• Risk may be sport-specific!

• Different movement profiles – some sports more repetitive, while some are more broad.
Sport Effects on Specialization

Prevalence of Specialization

χ² = 32.3, p<0.001

Post AJSM 2017, N=2011
Specialization in High School Baseball

• Survey of 551 high school baseball players in San Diego, Alabama, and Michigan.

• Goals: Examine prevalence of specialization based on geography and association of specialization with overuse injury.
Geography and Specialization (Baseball)

- Alabama, N=225: 56% High, 30% Moderate, 14% Low
- California, N=206: 58% High, 30% Moderate, 12% Low
- Michigan, N=192: 41% High, 35% Moderate, 25% Low

$\chi^2 = 19.1$, $p<0.001$
Overuse Upper Extremity Injury

Odds Ratio* = 3.77 (1.39 – 10.20)  
*p = 0.009

*Controlling for state, age, hours per week of baseball participation, pitching, private baseball coaching, showcase participation.

Post et al. (In press, Journal of Shoulder and Elbow Surgery, 2020)
UE Overuse Injury - PITCHERS ONLY

Odds Ratio* = 4.29 (1.22 – 15.10)
\[ p = 0.024 \]

*Controlling for state, age, hours per week of baseball participation, private baseball coaching, showcase participation, innings in previous year and average pitches per game.

Post et al. (In press, Journal of Shoulder and Elbow Surgery, 2020)
Youth Throwing Score

• Also assessed throwing arm health using Youth Throwing Score (YTS).

• Validated and reliable 14-item PROM.
  – Generate score between 14-70, higher scores indicate better arm health.

• Among all players:
  – Highly specialized: 53.3 ± 0.7
  – Low specialization: 56.5 ± 1.1
  – \( P=0.034 \)

• Among pitchers only:
  – Highly specialized: 50.4 ± 0.8
  – Low specialization: 56.5 ± 1.7
  – \( P=0.003 \)

Post et al. (In press, Journal of Shoulder and Elbow Surgery, 2020)
Specialization in Little League Baseball

- Survey of 246 Little League athletes.
  - (Male N=241, age: 9.5 ± 1.6)
  - Parents assisted in completing survey.

- Goals: Determine prevalence of specialization, association of specialization with throwing arm health (YTS).

Post et al., unpublished, N=246 Little League baseball players
**Prevalence and Consequences**

**Differences in YTS Score:**

- **Unadjusted:**
  - Highly specialized: 57.0 ± 9.2
  - Low specialization: 63.1 ± 7.4
  - Effect Size (95%CI): 0.59 (0.2-1.0)
  - \( P < .001 \)

- **Adjusted:**
  - Highly specialized: 56.9 ± 1.6
  - Low specialization: 61.1 ± 1.2
  - \( P = 0.01 \)

Post et al., unpublished, \( N = 246 \) Little League baseball players
Little League MRI Studies

• Prospective study of 26 asymptomatic Little League players over the course of a season.

• Pre- and post-season MRI imaging of shoulder and elbow.

• Factors related to MRI abnormalities at the shoulder or elbow:
  – Year-round play (>8 months)
  – Single-sport athlete and focused on just baseball
    • 100% of year-round single sport athletes had an abnormal shoulder MRI!

Pennock et al. OJSM 2018, Pytiak et al. OJSM 2017
Specialization in Pro Baseball Players

- Survey of 746 former first and second round MLB draft picks.

- Single or multi-sport in high school?
  - 32% multi in HS
  - 68% single sport in HS

- Multisport athletes:
  - Played in more total games ($p<.01$)
  - Played in more MLB games ($p=.04$)

- Single sport athletes:
  - Higher prevalence of UE injury (63% vs. 50%, $p=.009$)
  - More likely to have recurrent elbow injuries (33% vs. 17%, $p=.002$)

Confino et al. OJSM 2019
Specialization in HS Volleyball

- High school volleyball has a huge club team component – up to 59% of athletes participating on club teams in addition to HS team.

- Prospective survey of 1588 female HS volleyball athletes across 83 high schools in Wisconsin.
  - Age: $15.6 \pm 1.1$ years old
Previous Injury History

Odds Ratio = 2.30 (1.64 – 3.24)  
$p < 0.001$

Biese et al. PT in Sport (In Review 2020)
Why specialize?

• 10,000 hours rule – obtain sport skill expertise? (Ericcson 1993)

• Increase the chances of a youth athlete obtaining a scholarship or professional contract.
Baseball Parent Surveys

• Descriptive survey of parents and youth athletes to determine:
  – Perceptions towards sport specialization.
  – Knowledge regarding college scholarships.

• 155 HS baseball parents
  – 54% female, age 49.4 ± 5.5 y.o.
  – (Post et al., Sports 2019)

• 247 parents of Little League athletes
  – 61% female, age 41.1 ± 6.3 y.o.
  – (Post et al., unpublished)
LL Parent: How much does specializing increase the chances of your child getting injured?

Post et al., unpublished, N=247 Little League baseball parents
HS Parent: How much does specializing increase the chances of your child getting injured?

Number of Responses

- Not at all: 7
- A little: 20
- Somewhat: 50
- Quite a bit: 47
- A great deal: 13

47.1%

Post et al., Sports 2019, N=155 HS baseball parents
LL Parent: How much does specializing increase the chances of your child getting better at their sport?

71.9%

Post et al., unpublished, N=247 Little League baseball parents
HS Parent: How much does specializing increase the chances of your child getting better at their sport?

Post et al., Sports 2019, N=155 HS baseball parents

Number of Responses

Not at all | A little | Somewhat | Quite a bit | A great deal

- Not at all: 1
- A little: 10
- Somewhat: 20
- Quite a bit: 50
- A great deal: 79

79.6%
LL Parent: How much does specializing increase your child’s chances of making a college team?

- Not at all
- A little
- Somewhat
- Quite a bit
- A great deal

Number of Responses

- Not at all: 23
- A little: 50
- Somewhat: 62
- Quite a bit: 64
- A great deal: 52

49.5%

Post et al., unpublished, N=247 Little League baseball parents
HS Parent: How much does specializing increase the your child’s chances of making a college team?

Not at all: 6
A little: 10
Somewhat: 20
Quite a bit: 40
A great deal: 60

Number of Responses

69.9%

Post et al., Sports 2019, N=155 HS baseball parents
LL Parent: How much does specializing increase your child’s chances of making their high school team?

Not at all | A little | Somewhat | Quite a bit | A great deal
---|---|---|---|---
0 | 20 | 40 | 60 | 80

54.9%

Post et al., unpublished, N=247 Little League baseball parents
HS Parent: How much does specializing increase your child’s chances of making their high school team?

Not at all  |  A little  |  Somewhat  |  Quite a bit  |  A great deal

Number of Responses

Post et al., Sports 2019, N=155 HS baseball parents

65.8%
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

## What about College Scholarships?

<table>
<thead>
<tr>
<th>Sport</th>
<th>Age Level</th>
<th>Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseball</td>
<td>Youth (6-17 yr)</td>
<td>6,836,000</td>
</tr>
<tr>
<td></td>
<td>High School Varsity</td>
<td>453,055</td>
</tr>
<tr>
<td></td>
<td>College Teams</td>
<td>25,938</td>
</tr>
<tr>
<td></td>
<td>Minor Leagues</td>
<td>4,000</td>
</tr>
<tr>
<td></td>
<td>MLB (40-man roster)</td>
<td>1,200</td>
</tr>
</tbody>
</table>

Only 4.6% of college baseball players and 0.26% of high school players reach the Major Leagues.

How many scholarships available on 35-player Division I Baseball Roster?

Reality – 11.7 scholarships

Post et al., Sports 2019, N=155 HS baseball parents
How likely do you believe it is that your child will receive a college scholarship that is related to athletic performance?

- Very unlikely: 10 responses
- Somewhat unlikely: 15 responses
- A little unlikely: 10 responses
- Neither likely nor unlikely: 15 responses
- A little likely: 30 responses
- Somewhat likely: 25 responses
- Very likely: 15 responses

58.1% of the responses indicated a likelihood of Very likely.

Post et al., Sports 2019, N=155 HS baseball parents
How likely do you believe it is that your child will receive a college scholarship that is related to athletic performance?

Number of Responses

- Very Unlikely: 85 responses (17.4%)
- Somewhat Unlikely: 40 responses
- A Little Unlikely: 15 responses
- Neither Likely nor Unlikely: 20 responses
- A Little Likely: 10 responses
- Somewhat Likely: 5 responses
- Very Likely: 1 response

Post et al., unpublished, N=247 Little League baseball parents
Specialization and Sport Performance

• 58% of 102 professional baseball players surveyed specialized in baseball prior to HS.
  – Athletes who specialized early reported more serious injuries during their career.

• 63.4% of players thought specialization was not required to play pro baseball.

Wilhelm et al. OJSM 2017
Specialization and Sport Performance

- Survey of 708 minor-league baseball players.
- Only 25% reported specializing before age 12.
- Mean age of specialization was 15.5 ± 4.0 years old.

Ginsburg et al. Journal of Clinical Sport Psych 2014
Specialization and Sport Performance

• Specialization may be beneficial for sport performance in certain sports/contexts.

• In elite swimmers, years of high-level competition and previous participation in junior World Championships predicted future success.

Yustres et al. PLoS One 2019
What about the 10,000 hours rule?

Deliberate Practice and Performance in Music, Games, Sports, Education, and Professions: A Meta-Analysis

Brooke N. Macnamara¹, David Z. Hambrick², and Frederick L. Oswald³

¹Princeton University; ²Michigan State University; and ³Rice University
Meta-analysis - 10,000 hours rule

• Meta-analysis of 88 studies (111 independent samples, total N=11,135).

• Conclusions:
  – Practice does make you better at something, but has less of an effect than you might think.
  – Effects depend heavily on the domain.

Macnamara et al. Psychological Science 2014
Meta-analysis - 10,000 hours rule

Deliberate Practice and Performance

Fig. 3. Percentage of variance in performance explained (light gray) and not explained (dark gray) by deliberate practice within each domain studied. Percentage of variance explained is equal to $r^2 \times 100$. 
Social Science – Replication Issues

Macnamara et al. Royal Society Open Science 2019

What about the 10,000 hours rule?
Does Early Sport Specialization Really Make a Difference?

DiFiori et al. JAT 2019

• Comparison between:
  – 273 NCAA DI athletes
  – 155 undergraduates who played sports until college

• No differences between groups in sport start age or age of specialization.

• Only major difference: NCAA athletes were more likely to have siblings or parents who played collegiately or professionally.
2020 Toronto Blue Jays

Dante Bichette (4x All-Star)

Craig Biggio (Hall of Fame 2015)

Vlad Guerrero (HoF 2018)
Prince and Cecil Fielder
Specialization and SES

Purpose:
• To describe the socioeconomic status of parents with children participating on youth club sport teams.

Methods:
• Data from survey of club sport parents (949 parents, 61% female).
• SES measured by household income and educational attainment.

Post et al, PT in Sport 2018, N=949
Results

• Parents spent an average of $1500 USD on non-school sports per child per year.

• Parents in the higher income categories were significantly more likely to have a child that is highly specialized (p=.007).

Post et al, PT in Sport 2018, N=949
Total Household Income of Club Sport Parents

- $0-50,000: 62 responses
- $50,001-100,000: 250 responses
- $100,001-200,000: 450 responses
- >$200,000: 350 responses

Post et al, PT in Sport 2018, N=949
HS Baseball Parents in San Diego

- Median amount spent on child’s baseball participation in last 12 months:
  - $3000 [$1500-$6000]

- Children of high income parents were more likely to be highly specialized (p=0.02).

Post et al., Sports 2019, N=155 HS baseball parents
Socioeconomic Factors for Sports Specialization and Injury in Youth Athletes

Neeru A. Jayanthi, MD,†‡ Daniel B. Holt Jr, MD,§ Cynthia R. LaBella, MD,¶ and Lara R. Dugas, PhD, MPH#
Jayanthi – SES and Specialization

• Survey of 1139 youth athletes (7-18 years old)

• SES estimated by subject zip code and divided into tertiles (low, med, high SES)

• Subjects completed surveys on training patterns (specialization, months per year, hours per week).

Jayanthi et al, Sports Health 2018
Results

• Compared to low SES athletes, high SES athletes:
  – Trained more months per year in their main sport (9.7 ± 3.1 months vs 7.6 ± 3.7 months, p<.01).
  – Were more likely to be highly specialized (38.9% vs. 16.6%, p<.01)
  – Spent more hours per week playing organized sports (11.2 ± 6.0 hours vs 10.0 ± 6.5 hours, p=.02)
Results

Figure 2. Months athletes spent training for their main sports by insurance type and socioeconomic status (SES).
## Key Indicators of Early Access

Average age at entry into organized or team sports

<table>
<thead>
<tr>
<th>Age (years/months)</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
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</tr>
<tr>
<td>Boys</td>
<td>6.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>7.4</td>
<td></td>
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<tr>
<td><strong>Race/Ethnicity</strong></td>
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<tr>
<td>Caucasian</td>
<td>6.6</td>
<td></td>
<td></td>
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<tr>
<td>Hispanic</td>
<td>8.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>7.7</td>
<td></td>
<td></td>
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<tr>
<td><strong>Parent Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>6.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single/never married</td>
<td>8.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Child Exercise Frequency</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td>6.8</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Once a week</td>
<td>8.9</td>
<td></td>
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<tr>
<td><strong>Household Income</strong></td>
<td>$100K</td>
<td></td>
<td>$35K</td>
<td></td>
</tr>
<tr>
<td>$100K</td>
<td>6.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$35K</td>
<td>8.1</td>
<td></td>
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</tbody>
</table>

*Money is the biggest driver of early participation.*
What’s the bigger problem?

- Are sports becoming exclusively for rich kids?
So....

- What can we do as athletic trainers?
Recommendations

• Inform parents and athletes:
  – Volume recommendations (Pitch Smart, months/year, hours/week)
  – Classify on the 3-point scale
  – Caution against playing multiple sports/leagues simultaneously
  – Use a screening question: How many hours per week does your son/daughter play sports?
Dispel Myths

• Specialization at an early age is NOT necessary to play at an elite level.

• The “10,000” hours rule is not a valid framework for most youth sports.

• Many elite athletes follow a path of early sport sampling, followed by eventual specialization in late adolescence.
American Academy of Pediatrics

• **Delay single sport specialization** until age 15-16 to minimize risks of overuse injury.

• Encourage your child to participate in multiple sports.

• **Speak with a pediatrician** to discuss the child’s goals to determine whether they are appropriate and realistic.

Brenner et al, Pediatrics 2016
American Academy of Pediatrics

• Encourage a young athlete to **take off at least three months** during the year, in increments of one month, from their particular sport. They can still remain active in other activities during this time.

• Young athletes should take **one to two days off per week** to decrease chances of injury.

Brenner et al, Pediatrics 2016
• Play a variety of sports.
• Not year-round in any single sport.
• Mostly unorganized.
To wrap things up...

My college athletics experience has had a positive or very positive effect on the following skills/qualities in myself (% Responding Positive or Very Positive)

<table>
<thead>
<tr>
<th>Skill</th>
<th>All Student-Athletes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal responsibility</td>
<td>93%</td>
</tr>
<tr>
<td>Teamwork skills</td>
<td>92%</td>
</tr>
<tr>
<td>Work ethic</td>
<td>91%</td>
</tr>
<tr>
<td>Leadership skills</td>
<td>88%</td>
</tr>
<tr>
<td>Personal values and ethics</td>
<td>87%</td>
</tr>
<tr>
<td>Self-confidence</td>
<td>81%</td>
</tr>
<tr>
<td>Time management skills</td>
<td>80%</td>
</tr>
<tr>
<td>Understanding of other races</td>
<td>79%</td>
</tr>
<tr>
<td>Study skills</td>
<td>68%</td>
</tr>
<tr>
<td>Commitment to volunteerism</td>
<td>65%</td>
</tr>
</tbody>
</table>

Youth sports participation keeps dropping

The percent of children who play team or individual sports on a regular, or "core," basis continues to fall. Almost 45 percent of kids played a team sport regularly in 2008, according to Aspen Institute data. Now only about 37 percent of kids do.

Source: Sports & Fitness Industry Association, Aspen Institute
JACOB BOGAGE/WASHINGTON POST
To wrap things up...

**WHAT**...

...is the goal of youth sports?

**WHO**...

...should benefit from youth sports?
Special Thanks

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• UW Sports Medicine Classic Fund
• National Federation of State High School Associations
• Michigan State High School Athletic Association
Thank You! Questions?

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