

# Early Sport Specialization and Injury Prevention in Gymnastics

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# Objectives

- Define early sports specialization
- Discuss risks and benefits of early sport specialization in gymnastics
- Review strategies to prevent injuries in relation to sport specialization



# What is Sport Specialization?

- Intensive, year-round training in a single sport at exclusion of other sports
  - Intensive?
  - Year round: typically >8 months
- Gymnasts found to specialize as early as age 5
- Recent study of former NCAA gymnasts: mean age of specialization was 8 (some specialized as early as 2!!!)



# What is EARLY Sport Specialization? (ESS)

- Intensive training/competition in organized sport
- Participating > 8 months per year
- Focusing on a single sport to the exclusion of other sports and free play
- Before age ~12; before puberty



# Sport Specialization

- 1. Have you quit sports to focus on 1 main sport?
- 2. Do you train >8 months per year in your main sport?
- 3. Do you consider your sport to be more important than other sports?



# Is ESS Bad or Good

- We don't really know
- There is little evidence either for or against early specialization, especially in gymnastics



# Other Sports

- Women's Tennis Association
  - Developed limits on number of games played and for hours of training for youth athletes
  - Over 10 years, the risk of early dropout fell from 7% to 1% for young professional women's players
  - There were also less injuries.
- Swimming: Early specialization → less time on national team
- Year-round involvement: overuse injuries 42% higher in HS athletes who participate year round vs those who take >3 months off
- NCAA athletes: 70% did not specialize until age 12 or older
- 97% of pro-athletes feel multiple sports increased their success

# Benefits of Sport Specialization

- Early talent identification
- Less fear
- Easier to spot younger gymnasts through new, difficult skills
- May peak earlier
- Deliberate practice” and the 10,000 hour rule
  - Small study in chess players and elite musicians
  - “Outliers” by Malcolm Gladwell





# Downsides to Early Sport Specialization

- Increases overuse injury risk
  - >16 hrs per week of intense training → increased injuries
- Social isolation: less exposure to peers
  - Interferes with normal psychological and skill development
- Burnout: more likely to withdraw from sport early
  - What does this do to long-term health?
- No evidence that ESS leads to long term success
- Early to mid-adolescence: sport diversification more important
  - Improved skill development
  - Less burnout



# Sport Specialization in Gymnastics

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## Sport Specialization and Fitness and Functional Task Performance Among Youth Competitive Gymnasts

[Hayley Root](#), PhD, MPH, ATC,\* [Ashley N. Marshall](#), PhD, ATC,\* [Anna Thatcher](#), PT, DPT, ATC,†

[Alison R. Snyder Valier](#), PhD, ATC, FNATA,\*§ [Tamara C Valovich McLeod](#), PhD, ATC, FNATA,✉† and

[R. Curtis Bay](#), PhD<sup>¶</sup>

- Are gymnasts who are more specialized better at functional movement skills?

Table 3

Responses to the Specialization Questionnaire Items by Level of Specialization, % (Frequency)

Item	Level of Specialization		
	Low (n = 19)	Moderate (n = 66)	High (n = 46)
Trains more than 75% of time in primary sport	31.6 (6)	95.5 (63)	93.5 (43)
Trains to improve skill and misses time with friends	26.3 (5)	50 (33)	50 (23)
Quit another sport to focus on 1 sport <sup>a</sup>	0 (0)	1 (1.5)	100 (46)
Considers primary sport more important than other sports <sup>a</sup>	0 (0)	98.5 (65)	100 (46)
Regularly travels out of state for primary sport	5.3 (1)	51.5 (34)	45.7 (21)
Trains >8 mo/y in primary sport <sup>a</sup>	63.2 (12)	100 (66)	100 (46)

[Open in a separate window](#)<sup>a</sup>Denotes questions used to calculate specialization level.

Table 1

## Preseason Assessment Fitness Components

Task	Targeted Area of Assessment	Procedure	Task Origin
Vertical jump	Power	Gymnast stands with the dominant side facing a wall and jumps for maximum height. Gymnast stands flat footed and reaches upward. The distance between the maximum reach and the height reached during the jump is measured.	GFMT MGFMT
Hanging pike	Strength, flexibility	Gymnast starts in a dead hang position on a horizontal bar. Gymnast then flexes at the hip with the knees extended and attempts to touch the toes to the bar. The number of pikes completed is recorded.	GFMT MGFMT
Shoulder flexion	Flexibility	Gymnast lies prone while holding a dowel in both hands with the shoulders flexed to 90°. Gymnast then flexes the shoulders while maintaining the wrists in neutral position.	GFMT MGFMT
Agility	Agility	Gymnast sprints diagonally on a 12- x 12-m gymnastics floor from 1 corner to the other and back 5 times.	GFMT MGFMT
Pull-up	Strength, endurance	Gymnast starts in a hanging position from a horizontal bar and completes as many pull-ups as possible (from full shoulder extension to the chin clearing the bar).	GFMT MGFMT
Push-up	Strength, endurance	Gymnast starts with the hands shoulder-width apart on a low beam and completes as many push-ups as possible (chest touches a 1-in [2.54-cm]-high block to full elbow extension).	GFMT
Handstand	Strength, endurance, balance	Gymnast starts with the hands on a low beam. Timing starts when the gymnast's feet leave the ground and stops when the hands change positions or any other body part touches the floor. Two trials are completed, and the best time is used.	GFMT MGFMT
Plank (right and left)	Core strength, endurance	Gymnast lies on 1 side with the feet stacked and the elbow directly under the shoulder. The hips are lifted to form a straight line from feet to neck.	NA
Hollow hold	Core strength, endurance	Gymnast lies supine with the arms overhead. The hips and knees are extended in the air. Time in the correct position is recorded up to 1 min.	NA
Double-legged lower down	Core strength, endurance	Gymnast lies supine with the arms across the chest and the legs straight up toward the ceiling. The examiner places 1 hand under the athlete's back. The athlete lies with the back flat and slowly lowers the legs until the spine extends beyond a neutral position. The position of the legs above horizontal (°) is recorded.	NA
Bridge (right and left)	Core strength, endurance	Gymnast lies supine on the ground with the knees bent and feet flat on the ground. Athlete bridges the hips upward to form a straight line from the knees to the neck. Athlete extends 1 knee out straight while maintaining a neutral pelvis. Time in the correct position is recorded up to 1 min.	NA

Abbreviations: GFMT, Gymnastics Functional Measurement Tool; MGFMT, Men's Gymnastics Functional Measurement Tool; NA, not applicable.

# No differences by specialization level were noted for most of the gymnastics fitness tasks ( $P > .05$ )

**Table 5**

Scores on the Gymnastics Fitness Tasks Adjusted for Age, Hours of Training, and Years of Gymnastics Participation, Mean (95% Confidence Interval)

Task	Level of Specialization			P Value
	Low	Moderate	High	
Vertical jump, cm	35.0 (32.0, 38.0)	33.10 (31.56, 34.60)	33.33 (31.56, 35.11)	.551
Hanging pike, repetitions	6.95 (4.57, 9.32)	5.34 (4.12, 6.56)	6.24 (4.84, 7.64)	.440
Normalized shoulder flexibility, cm/arm length	0.51 (0.41, 0.61)	0.65 (0.60, 0.70)	0.66 (0.60, 0.71)	.035 <sup>a</sup>
Agility, s	22.32 (21.42, 23.22)	21.92 (21.46, 22.37)	21.88 (21.34, 22.42)	.700
Pull-ups, repetitions	4.28 (2.87, 5.70)	2.75 (2.03, 3.48)	3.53 (2.70, 4.37)	.138
Push-ups, repetitions	16.69 (10.75, 22.62)	14.87 (12.79, 16.94)	13.82 (10.95, 16.69)	.654
Handstand, s	10.85 (4.32, 17.37)	10.01 (6.70, 13.33)	10.07 (6.17, 13.98)	.976
Plank right, s	83.82 (69.49, 98.14)	71.14 (63.77, 78.51)	76.10 (67.51, 84.69)	.306
Plank left, s	72.11 (57.03, 87.19)	72.57 (64.79, 80.35)	79.53 (70.31, 88.76)	.479
Hollow hold, s	41.80 (33.47, 50.13)	31.45 (27.39, 35.50)	35.39 (30.65, 40.14)	.091
Double-legged lower-down test, °	28.21 (19.84, 36.58)	27.73 (23.59, 31.86)	24.42 (19.56, 29.27)	.542
Bridge right, s	34.78 (26.67, 42.88)	40.60 (36.59, 44.60)	42.26 (37.55, 46.96)	.296
Bridge left, s	34.20 (26.55, 41.86)	40.33 (36.55, 44.12)	42.90 (38.45, 47.34)	.155

<sup>a</sup> $P < .05$ .

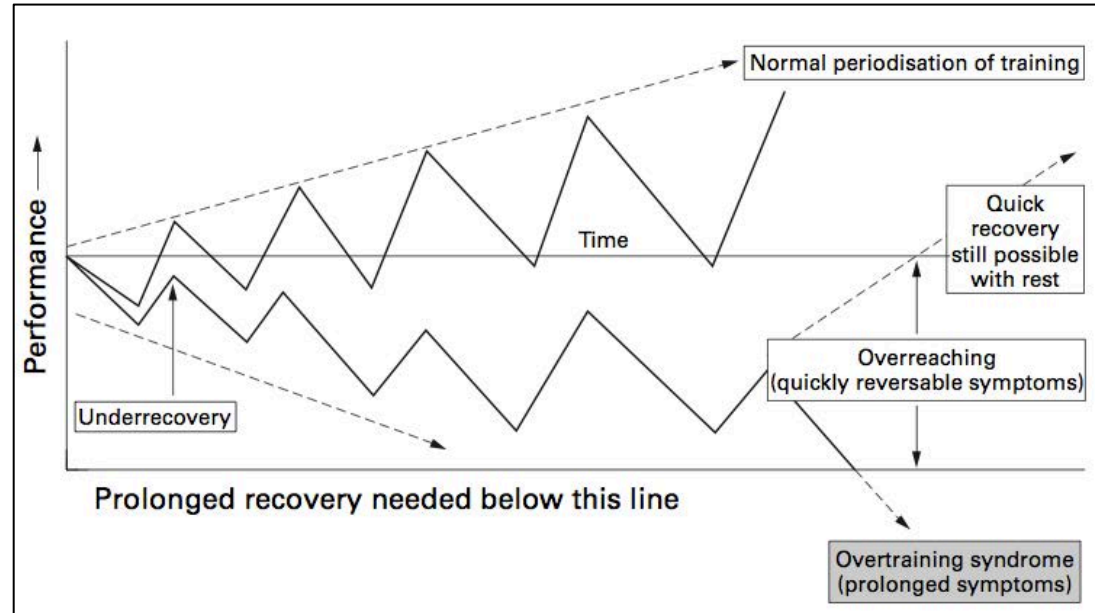
# Key Points

- More than 85% of gymnasts were either moderately or highly specialized
- Some gymnasts reported specializing as early as 5 years of age
- >50% of the gymnasts 11 years of age or older trained more hours/week than recommended by the American Academy of Pediatrics
- Most fitness tasks did not differ by specialization level when adjusted for age
- Specialization did not improve performance outcomes



# Burnout

- A spectrum of conditions due to overtraining
- Athletes often burnout due to lack of fun vs too many external pressures on performance



# Overuse Injuries

- About half of all athletic injuries (including in gymnastics)
  - Apophysitis: Sever's, Osgood-Schlatter's, Pelvis apophysitis
  - Tendonitis
  - Osteochondritis dissecans (OCDs)
  - Gymnast's Wrist
  - Spondylolysis
  - Stress fractures





# Overuse Injuries

- Prior injury = strongest predictor of future overuse Injury
  - Do you screen your athletes? Do you require an annual physical?
- Overuse injuries more common during adolescent growth spurt
  - Body mass and height increase
    - Imbalances in growth and strength
    - Joint hypermobility
  - Physis (growth plate) is less resistant to physical stress
    - Gymnast's wrist most common at growth spurt
- Address underlying causes of overuse injury

# Reducing Risk of Overuse Injuries

- Make individualized modifications in training based on:
  - Sport (artistic, rhythmic, T&T, acro)
  - Age
  - Growth rate (sex)
  - Physical readiness
  - Mental readiness
  - Injury History



# Reducing Risk of Overuse Injuries

- Limit hours per week (hours/wk < age in years)
- Limit days per week (max 5-6)
- Limit months per year (can we take 1-2 months off?)
- Monitoring during adolescent growth spurt
  - Height, menstrual dysfunction, dietary habits
- Preseason conditioning program
- Neuromuscular training



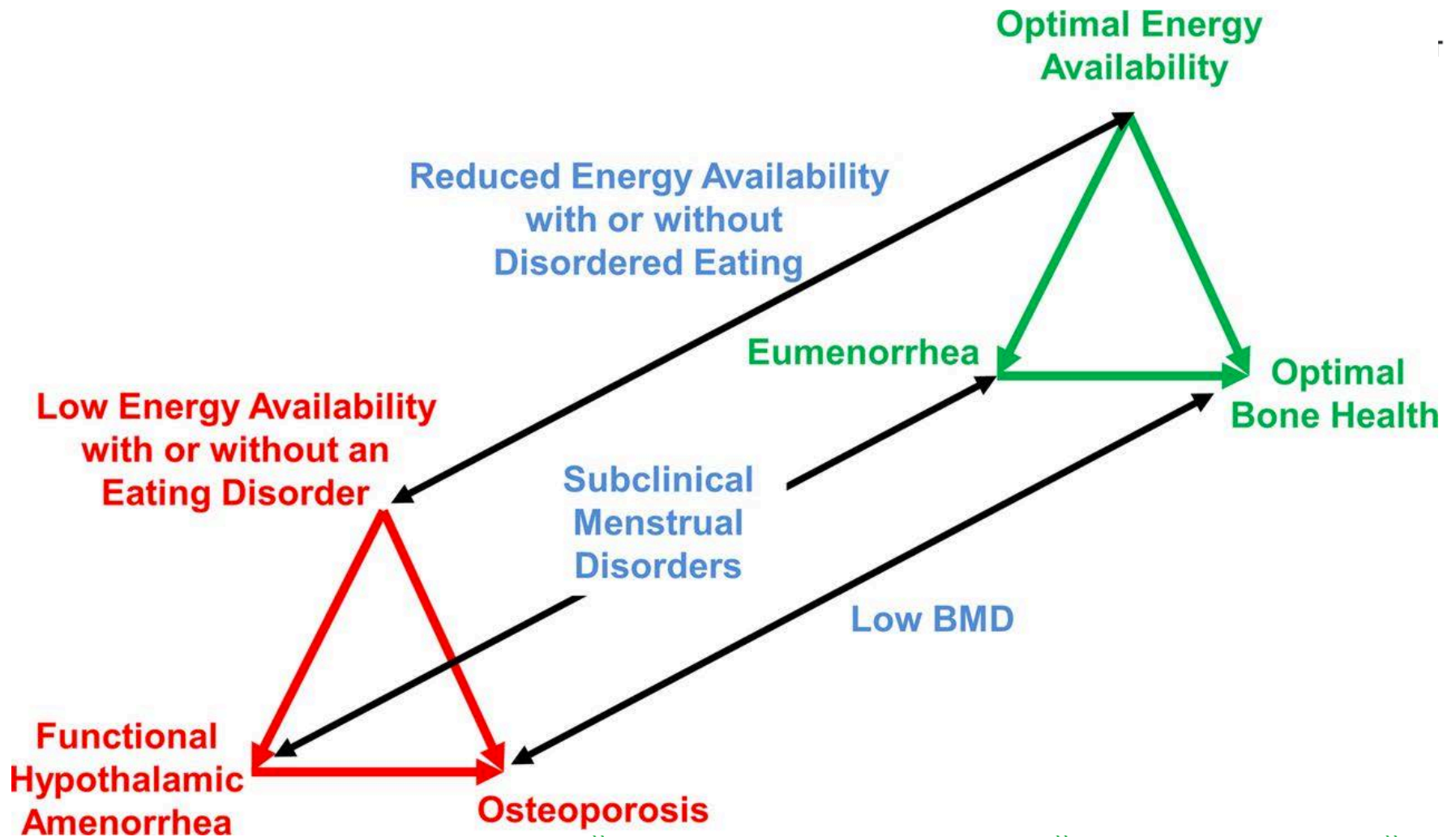
# Modifiable Risk factors for Injury Prevention

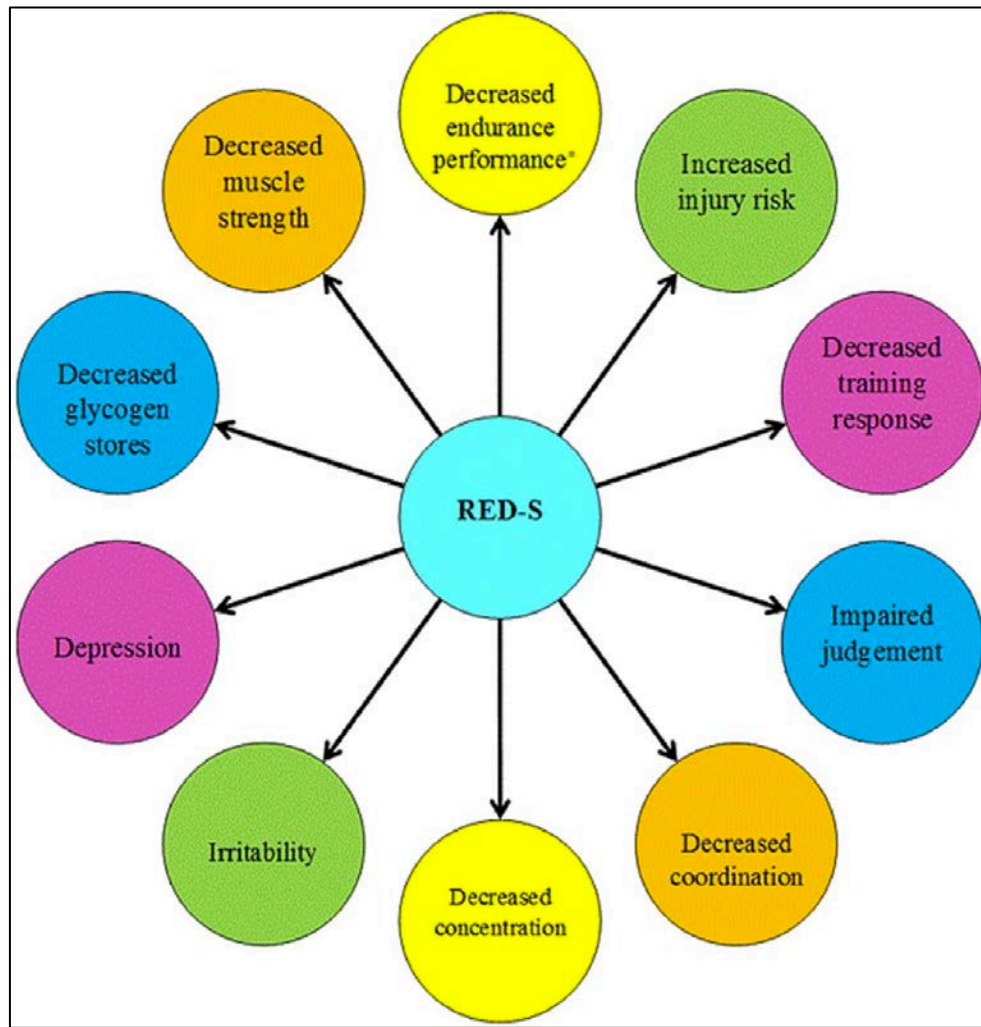
- Strength/Conditioning:
  - Improve endurance
  - Preseason preparation
  - Improve motor skills
- Training Load
  - Increased level and hours training/wk linked to wrist pain



# Puberty

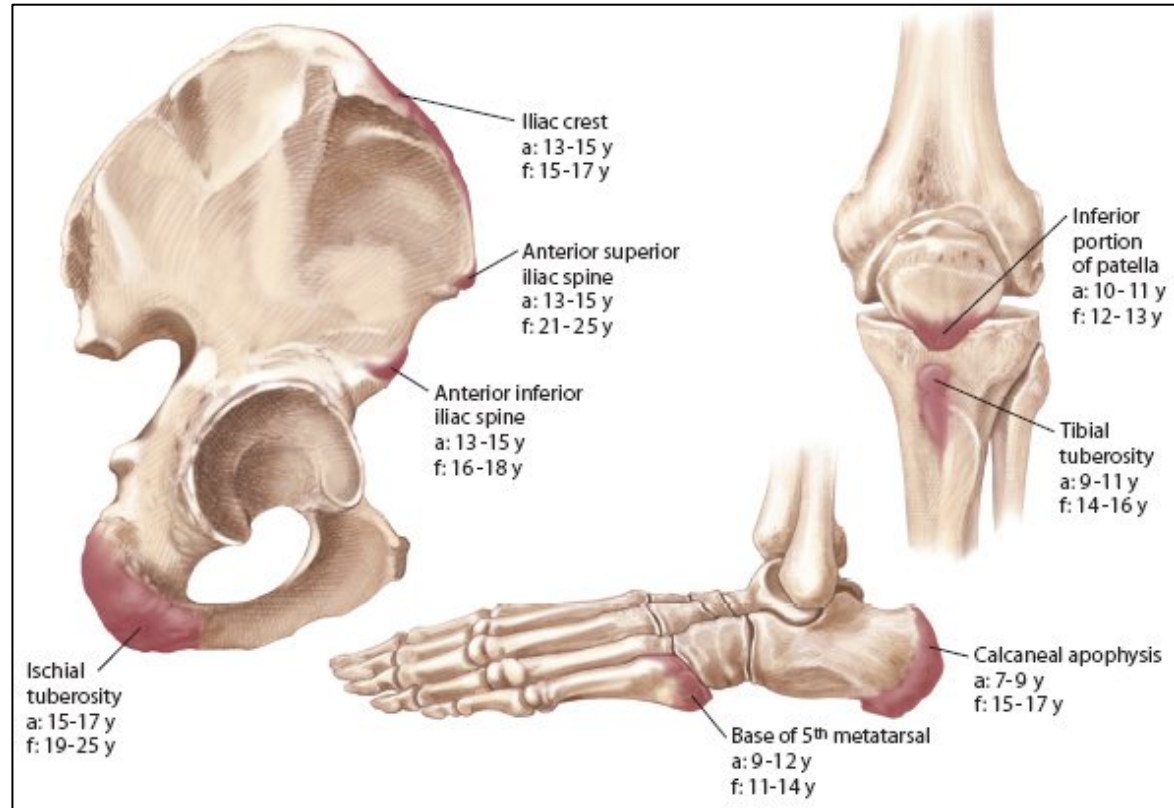
- Dr. Ellen Casey and Nick Ruddock discuss puberty in gymnasts:
- <https://shiftmovementscience.com/drellencasey/>
  
- Sexual and physical maturation
- Physical changes
  - Makes some skills temporarily more difficult
- Psychological/Social Development: Outside interests
- Female athlete triad and RED-S





# Apophysitis

- Prevention
  - Stretching
  - Monitor growth
  - Brace/padding
- Pay attention to # of reps and hard landings, esp during growth spurts





# Gymnast's Wrist

- Distal Radial Epiphysitis
- 11-14y/o
- Higher level gymnasts
- Tender over dorsal and radial wrist (thumb side)
- Pain with axial loading and forced extension of wrist (e.g. handstands, tumbling)
- Possibly swelling and decreased grip strength
- Prevention:
  - Tiger Paws or other wrist supports?
  - Limit high impacts esp when learning new skills



# Stress Fractures

- 20% of all injuries treated by sports med docs
- Foot, lower leg, hip, back
- Prevention
  - Very slow progression, especially after time off or injury
  - Ensure adequate nutrition
  - Monitor Female Athlete Triad and RED-S symptoms
  - Limit hard impacts during growth spurts
  - Ensure good form/technique

# Future Directions

- We need to prospectively track young athletes to see what happens to them over time
  - When do they specialize and how much are they training?
  - How many impacts, spine extensions, etc?
  - When are they growing?
  - Do they get injured?
  - Do they burn out and quit?
  - Do they become very successful (e.g. college scholarship, become elite, etc)?



# Recommendations

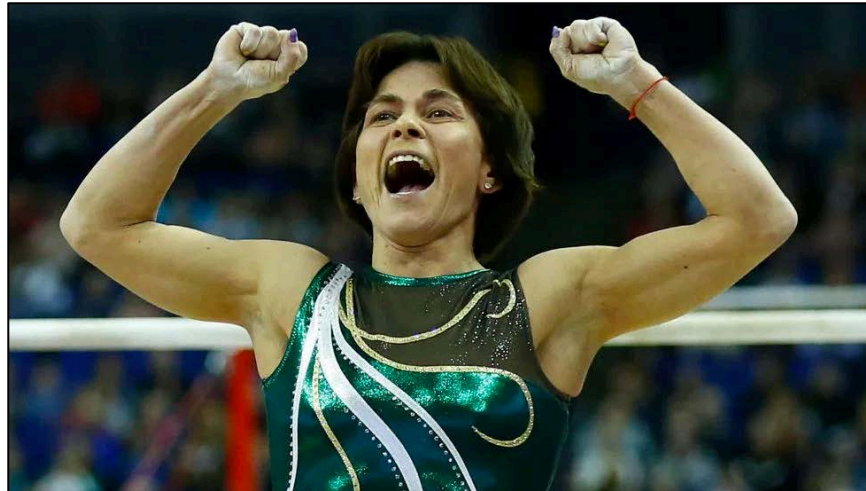
- Do not specialize until late adolescence
  - Diversity of sports/activities before age 12 (or later)
- No more hours per week than years in age?
  - < 16 hours per week?
  - Different limits for different levels?
- At least 1 day completely off of organized sports
- Don't ignore pain

# Take Home Points

- Early sport specialization leads to increased overuse injuries without increasing long term success: specialize ~13
- Use your resources - physicians, PTs, ATs, dietitians, psychologists, etc.
- Keep track:
  - # of progressions
  - Growth (height, seated height, wing span)
  - Weaknesses/inflexible areas
  - Injuries
- Treat Injury Prevention as an important part of practice (individualize mobility/strength)
- Allow time for free play/unstructured practice
- Don't ignore pain
- Encourage multiple sports
- Take time off each week and each year



- Practice makes perfect
- Perfect practice makes perfect
- Perfect practice at the right time, in an intrinsically driven athlete, makes perfect (Popkin 2019)



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THANK YOU!

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