I Have No Financial Disclosures
Benefits of Youth Sports

• Youth sport participants have higher levels of physical activity that positively influence physical and psychological health in adolescents and later in life.

• Physical health
• Social well-being
• Health behaviors
• Psychosocial health
• Academic performance

• Datalyscenter, Sport Injury Research and Prevention
But...

- While youth sports participation offers many benefits – An emphasis on competitive success has become widespread.
- This has resulted in increased pressure to begin high intensity training at young ages.
- Such an excessive focus on early intensive training and competition at young ages rather than skill development can lead to overuse injury and burn out.

*Position Statement from the American Medical Society for Sports Medicine, January 2014*
Physiologic Factors in Children and Adolescents

• Children are susceptible to athletic injuries because of a number of inherent developmental factors.
  
  – They often lack fully developed complex motor skills and during puberty may demonstrate a temporary decline in coordination and balance.
  
  – Limb length, mass, and moments of inertia naturally change with age.
  
  – Whereas limb length increases 1.4 times from age 6 to 14 years, limb mass increases by more than 3 times; this mismatch may lead to musculoskeletal imbalance.
  
  – The large increase in mass requires the muscles to generate greater force to move the limb, which in turn creates increased strain on the tendons, musculotendinous junctions, and apophyses.
  
  – Children have open physes, which are more vulnerable to stress
Developmental Skills and Children’s Sports

**Early Childhood (2 to 5 years)**

- **Motor Skills**
  - Limited fundamental skills
  - Limited balance skills

- **Learning**
  - Extremely short attention span
  - Poor selective attention
  - Egocentric learning—trial and error
  - Visual and auditory cues are important

- **Vision**
  - Not fully mature before ages 6 to 7 (farsighted)
  - Difficulty tracking and judging velocity of moving objects

- **Sports Recommendations**
  - Emphasize fundamental skills with minimal variation and limited instruction
  - Emphasize fun, playfulness, exploration, and experimentation rather than competition
  - **Activities**: Running, swimming, tumbling, throwing, catching
Middle Childhood (6 to 9 years)

**Motor Skills**
- Continued improvement in fundamental skills
- Posture and balance become more automatic
- Improved reaction times
- Beginning transitional skills

**Learning**
- Short attention span
- Limited development of memory and rapid decision making

**Vision**
- Improved tracking
- Limited directionality

**Sports Recommendations**
- Emphasize fundamental skills and beginning transitional skills
- Flexible rules of sports
- Allow free time in practices
- Short instruction time
- Minimal competition
- **Activities:** entry-level soccer and baseball
Developmental Skills and Children’s Sports

Late Childhood (10 to 12 years)

Motor Skills
- Improved transitional skills
- Ability to master complex motor skills
- Temporary decline in balance control at puberty

Learning
- Selective attention
- Able to use memory strategies for sports such as football and basketball

Vision
- Adult patterns

Sports Recommendations
- Emphasis on skill development
- Increasing emphasis on tactics and strategy
- Emphasize factors promoting continued participation
- Activities: entry level for complex skill sports (football, basketball)
Youth Sports Injury Statistics

• High school athletes account for an estimated 2 million injuries and 500,000 doctor visits and 30,000 hospitalizations each year.¹

• More than 3.5 million kids under age 14 receive medical treatment for sports injuries each year.¹

• Children ages 5 to 14 account for nearly 40 percent of all sports-related injuries treated in hospitals. On average the rate and severity of injury increases with a child’s age.⁴

• Overuse injuries are responsible for nearly half of all sports injuries to middle and high school students²

• Although 62 percent of organized sports-related injuries occur during practice, one-third of parents do not have their children take the same safety precautions at practice that they would during a game.²

• Twenty percent of children ages 8 to 12 and 45 percent of those ages 13 to 14 will have arm pain during a single youth baseball season.³

• Injuries associated with participation in sports and recreational activities account for 21 percent of all traumatic brain injuries among children in the United States.⁴
Youth Sports Injury Statistics

- According to the CDC, more than half of all sports injuries in children are preventable.

- By age 13, 70 percent of kids drop out of youth sports. The top three reasons: adults, coaches and parents.\(^2\)

- Among athletes ages 5 to 14, 28 percent of football players, 25 percent of baseball players, 22 percent of soccer players, 15 percent of basketball players, and 12 percent of softball players were injured while playing their respective sports\(^4\)

- Since 2000 there has been a fivefold increase in the number of serious shoulder and elbow injuries among youth baseball and softball players.\(^4\)

References:
- Safe Kids USA Campaign Web site. 2009.
Survey of injuries in Seattle area levels 4 to 10 female club gymnasts.

O'Kane JW, Levy MR, Pietila KE, Caine DJ, Schiff MA.

Author information
1 Department of Orthopaedics and Sports Medicine, University of Washington Sports Medicine Clinic, Seattle, Washington 98195, USA. jokane@u.washington.edu

Abstract

OBJECTIVE:
To evaluate incidence, distribution, and contributing factors of injury in club gymnastics.

DESIGN:
Cross-sectional survey.

SETTING:
Five randomly selected gymnastics clubs near Seattle, WA.

PARTICIPANTS:
Ninety-six club gymnasts from competitive levels 4 to 10.

INTERVENTIONS:
The participants completed a questionnaire regarding demographics, injuries and contributing factors, and exposure time in the last competitive season.

MAIN OUTCOME MEASURES:
Acute and overuse injury incidence rates stratified by practice and competition, age categories, and level using relative risks and 95% confidence intervals (CIs). Chi-square testing was used to compare demographic-specific and gymnastic-specific variables between injured and uninjured. Multivariate regression modeling was used to assess independent risk factors for risk of acute and overuse injuries.

RESULTS:
Acute injury rate was 1.3 per 1000 hours and in univariate, but not multivariate analysis, it was 3.6-fold greater (95% CI, 1.6-9.1) among 10 to 12 year olds and 3.1-fold greater (95% CI, 1.3-8.0) among 13 to 17 year olds compared with 7 to 9 year olds. The most common acutely injured body parts were foot (21.0%), ankle (19.3%), knee (14.0%), and wrist (8.8%). The majority of injuries occurred in practice, but the meet injury rate was higher. Most injuries occurred on floor exercise (32.1%), beam (20.7%), and bars (17.0). Injury was most common during landing. The overuse injury rate was 1.8 per 1000 hours. During their gymnastics careers, concussions occurred in 30.2% and stress fractures affecting mostly low back and foot occurred in 16.7% of the gymnasts.

CONCLUSIONS:
Gymnasts are at similar risk of acute and overuse injuries, and acute injury rates were greater among older gymnasts. However, this predictor did not remain significant in multivariate analysis. Concussions and stress fractures are common. Gymnastics injury prevention studies should focus on older gymnasts, concussion education, and landing after a skill.
Injuries

- Age Specific
- Sport Specific
- Acute vs. Overuse
- Overuse - High risk vs. Low risk
- Site Specific
Injuries

Children
(Boys <13, Girls <11)
prior to the development of secondary sex characteristics

• Acute - Bone, Growth Plate
• Chronic - Growth Plate

Adolescence
(Boys >14, Girls >12)

• Acute - Bone, Ligament, Muscle
• Chronic - Apophysis, Tendon
Bone Injury

• Bone injury occurs through the weakest point of the traumatized region.
• In children, this is often the growth plate or metaphyseal bone.
• Avulsion fractures usually occur after the appearance of the secondary ossification center.

[Graph showing bone mass over age with peaks and declines at different ages for males and females, with a mention of menopause and age-related bone loss.]
Muscle Injury

- Muscle strains and contusions are common in the young athlete.
- Muscle strains are associated with improper warm-up, fatigue, previous injury, and environmental factors (e.g., weather conditions, uneven playing surfaces).
- Stretching alters the mechanical properties of the muscle, which may correlate with injury prevention.
- Increasing muscle temperature, either actively through warm-up exercises or passively, also helps to prevent injury.
- Nonsurgical treatment strategies vary, but all involve the same basic principles.
  - An early compression wrap helps to control edema and bleeding.
  - Nonsteroidal anti-inflammatory drugs (NSAIDs) are routinely used for the first 5 days.
  - Immobilization in a slightly stretched position provides comfort and protection in the early period.
  - Early gentle, passive range of motion (ROM) should be followed by controlled active motion and stretching.
  - A strengthening program should begin when muscle contraction is pain free.
  - Functional activities may begin when the patient’s strength returns.
  - Surgical intervention is rare for these types of injuries.
Overuse Injury

- Overuse syndromes are extremely common injuries that result from a variety of factors.

- Although each type of injury varies, the underlying physiology is similar.

- Muscle overload or repetitive microtrauma strains the musculotendinous unit until it is unable to withstand additional loading. With further stress, collagen cross-links break, and shear forces cause the collagen fibril to slide.

- A stress fracture represents the inability of the skeleton to withstand repetitive bouts of mechanical loading, which results in structural fatigue and resultant signs and symptoms of localized pain and tenderness.
Training Level-Appropriate, Overreaching or Overtraining

More is not better!
Risk Factors

• Sports specialization-intensive year-round training in a single sport at the exclusion of other sports—especially prior to maturity
  – Recommend 2-3 months of consecutive rest

• Greater then 5-6 days a week participation

• Spending more hours a week in sports participation than their age in years

• Being encouraged to “play through pain”

• Being on more than one team per season
Risk Factors

• Prior injury is a strong predictor or future overuse injury.
• Overuse injuries may be more likely to occur during the adolescent growth spurt.
• A history of amenorrhea is a significant risk factor for stress fractures.
• Other factors
  – Poor fitting equipment
  – Overscheduling

  • Position Statement from the American Medical Society for Sports Medicine, January 2014
Our Role
(Why we showed up this morning)

• Identifying acute and “high risk” overuse injuries

• Treating acute and chronic injuries appropriately

• “Mediating between the parent and athlete”

• Educating physicians, therapists, trainers, coaches, parents, athletes, etc. on prevention techniques.
Overuse Injuries

• High-risk versus low-risk
  – High risk is defined as an injury that can result in significant loss of time from sport and or threatened future sport participation if unrecognized or treated inappropriately.

• Body site specific
<table>
<thead>
<tr>
<th>Location</th>
<th>High Risk</th>
<th>Low Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip/Pelvis</td>
<td>Femoral neck stress fracture</td>
<td>Pelvic apophysitis</td>
</tr>
<tr>
<td>Lumbar spine</td>
<td>Pars stress fracture-spondylolysis</td>
<td>Mechanical low back pain</td>
</tr>
<tr>
<td>Lower Leg</td>
<td>Tibia stress fracture</td>
<td>Shin splints, Exertional compartment syndrome</td>
</tr>
<tr>
<td>Ankle</td>
<td>OCD-talar dome</td>
<td>Distal fibula stress fracture, Achilles tendinitis</td>
</tr>
<tr>
<td>Foot</td>
<td>Navicular stress fracture, Fifth metatarsal proximal diaphyseal stress fracture</td>
<td>Lesser metatarsal stress fracture</td>
</tr>
<tr>
<td>Knee</td>
<td>OCD- femoral condyle or patella</td>
<td>Tibial tubercle apophysitis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inferior patellar pole apophysitis</td>
</tr>
<tr>
<td>Shoulder-arm</td>
<td></td>
<td>Proximal humeral epiphysitis</td>
</tr>
<tr>
<td>Elbow</td>
<td>OCD-capitellum</td>
<td>Medial epicondyle apophysitis</td>
</tr>
<tr>
<td>Wrist</td>
<td>Distal radial physeal of stress injury</td>
<td></td>
</tr>
</tbody>
</table>
Spine

• Acute and Chronic- Spondylolysis

- Stress fracture- L5> L4, L3
- Mechanism- hyperextension
- Gymnastics, weight lifting, football
- Pain usually spreads across the lower back and may feel like a muscle strain.
- Tightening of the hamstring muscles can result in changes to posture and gait.
- Initial treatment for spondylolysis is always nonsurgical- rest, brace, physical therapy.
- Surgery may be needed if back pain does not respond to nonsurgical treatment and begins to interfere with activities of daily living.
Shoulder

• Acute- Fractures, Dislocations
Shoulder

- Little leaguer shoulder-proximal humeral epiphysitis
- Swimmer’s shoulder-internal impingement
Elbow

- Acute Fractures, Dislocations
Elbow

- Medial Epicondyle Apophysitis - Little Leaguer’s Elbow
- Osteochondritis Dissecans (OCD) of the Capitellum
Hand/Wrist

• Acute- Distal Radius Fracture
Hand/Wrist

• Acute- The Jammed finger

Axial compressive forces cause PIP hyperextension and subluxation of joint

Volar plate injury/ avulsion can occur

Treatment involve brief immobilization (alumifoam splint) followed by edema control and motion (buddy taping) to avoid stiffness.

Return to play usually 1-2 weeks but pain and swelling might persist for months
Hand and Wrist

• Stress reaction of distal radial physis- gymnast wrist
Hip and Pelvis

• Acute- Apophyseal avulsion

ASIS, AIIS, ischial tuberosity

Rest followed by protected weight bearing

Light isometric stretching and full weight bearing

RTP with full strength and pain free ROM
Hip and Pelvis

- Chronic Pelvic apophysitis
- Femoral neck stress fracture
- Snapping hip
Remember !!!

- Chronic- Groin pull- SCFE

Pediatric and young adolescents do not get groin pulls

Get an X-ray
Knee

• Acute injury with associated effusion warrants X-ray +/- MRI evaluation
Knee

Acute- Distal Femur, Tibial Spine, Tibial Tubercle Fracture
Knee

- Acute- Patella Femoral Dislocation

  Reduction, immobilization
  Bracing/ PT vs. scope/ reconstruction
Knee

• **Acute- ACL tear**

The ACL can be injured in by changing direction rapidly, stopping suddenly, deceleration, landing from a jump incorrectly or direct contact or collision.

Some report hearing a "pop" with resultant giving away

Other typical symptoms include:
- Pain with swelling.
- Loss of full range of motion.
- Tenderness along the joint line.
- Discomfort while walking.

Most are reconstructed with attention to pt maturity and growth remaining.
Knee

• Chronic- Apophysitis (O-S, SLJ)

2 Factors

Growth
- Stretching

Activity
- Rest
- Damage vs. Discomfort

Before- Ibuprofen
During- knee strap
After- icing
Knee

- Chronic- Osteochondritis Dissecans

Lesion size, location, and grade determine management

Early stable lesions managed with rest

Surgery should be considered for unstable lesions
Knee

- Chronic- Adolescent Anterior Knee Pain (AAKP)

Factors include:
- Imbalance of thigh muscles (quadriceps and hamstrings)
- Poor flexibility
- Problems with alignment of the legs
- Using improper sports training techniques or equipment
- Overdoing sports activities

Symptoms reported include:
- Popping or crackling sounds in the knee when you climb stairs or stand up and walk after prolonged sitting.
- Pain during activities that repeatedly bend the knee (i.e., jumping, squatting, running).
- AAKP is not usually associated with symptoms like clicking, locking, snapping, or giving way of the knee.

Treatment:
- RICE, bracing, stretching/strengthening (PT/HEP)
Lower Leg

- Chronic- Tibial stress fracture
- Exertional compartment syndrome
- Shin Splints
Foot and Ankle

• Acute- Fractures
Foot and Ankle

• Acute- Sprains

P - protection, physical therapy, prevention
R - rest, regain motion/strength, return to play
I - ice, ibuprofen
C - compression, crutches
E - elevation
Foot and Ankle

• Chronic- Heel Pain

Calcaneal Apophysitis- Sever’s

Growth
Stretching

Activity
Rest
Damage vs. Discomfort

Before- Ibuprofen
During- Tuli cup
After- icing
Foot and Ankle

- Chronic stress fractures, tarsal coalition
Overuse Injury Prevention

- Encourage athletes to strive to have at least 1 to 2 days off per week from competitive athletics, sport-specific training, and competitive practice (scrimmage) to allow them to recover both physically and psychologically.

- Advise athletes that the weekly training time, number of repetitions, or total distance should not increase by more than 10% each week (eg, increase total running mileage by 2 miles if currently running a total of 20 miles per week).

- Encourage athlete to limit total participation to less than 12-16 hours per week.

- Encourage the athlete to take at least 2 to 3 months away from a specific sport during the year.

- Emphasize that the focus of sports participation should be on fun, skill acquisition, safety, and sportsmanship.

- Encourage the athlete to participate on only 1 team during a season. If the athlete is also a member of a traveling or select team, then that participation time should be incorporated into the aforementioned guidelines.
Overuse Injury Prevention

- General fitness essential for sports participation
- Multiple sports activity rather than early focus on a single sport*
- Self-regulation to avoid the danger zone of injury
- Avoidance of strict, intense schedules, which may lead to overuse injuries
- Modification of standard rules for specific age groups to ensure safety
- Shorter periods of activity
- Adjustment of court or field size to accommodate players of different aptitudes and ages
- Monitoring of opponent matching to provide safe, level fields of engagement
- Shift focus away from winner-takes-all attitude
- Warm-up and cool-down sessions, with stretching exercises
- Pre-participation physical examination
- Avoidance of maximum weight with exercise training
- Proper hydration
- Adequate adult supervision and officiating
Return To Play

• Ability to return to play at the pre-injury level
• “feeling good does not equal healed good”
  – Swelling and pain usually resolve in days –weeks and is the first step to returning
  – Probably only 70-75% recovered inviting reinjury
• Progression should be:
  – Pain free full range of motion and strength
  – Functional drills, endurance and agility
  – Sports specific skills
Additional information

- AAOS.org
- POSNA.org
- STOPSportsInjuries.org
Thank you for your attention

aknuth@ossdoctor.com