

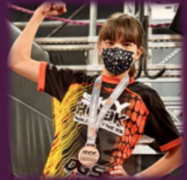
Keep Her in the Game: Supporting Girls in Sports

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June 18-19, 2026

Disclosures

I have no financial disclosures or conflicts of interest to report.

I do however care a whole lot about this kid.



Learning Objectives

- Describe trends in girls' sports participation and understand why puberty is a high-risk period for dropout
- Appreciate the physiological, psychological, social, and emotional changes unique to female athletes during puberty, and the impact of these changes on sports participation and performance
- Develop evidence-based counseling strategies to support continued sports participation

What We're Not Covering Today

- This talk covers issues relevant to cis-female (XX, assigned female at birth) children and may also apply to trans male athletes who are not on puberty blockers. It will not cover issues relevant to puberty in trans girls.
- Eating disorder screening, diagnosis, and treatment are extremely important but are out of the scope of this talk
- I'm speaking today for Family Medicine physicians doing routine pediatric care and sports physicals; I'm not a certified athletic professional nor dietitian. Involve these care team members when necessary!



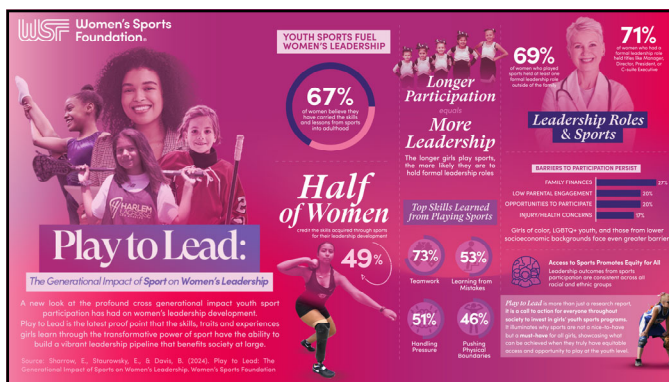
Benefits of Sports & Participation Trends

Why Sports Participation Matters

- Physical health
 - Better cardiovascular fitness, lower body fat, improved cardiometabolic profile
 - Disparity between participants & non-participants greater in girls than boys
 - Higher bone mineral density
 - 90% of peak bone mass achieved by end of adolescence
 - Decreased odds of substance use, irregular meals, high screen time, short sleep
- Mental health and psychological wellbeing
 - Higher self-esteem, greater life satisfaction, reduced depression and anxiety symptoms
 - Team sports show stronger effects than individual sports

Why Sports Participation Matters

- Social development
 - Athletes experience less loneliness and social dissatisfaction during the transition to high school
 - Athletes develop communication, conflict resolution, empathy, leadership, and teamwork skills through the structured social environment of sport
- Academic benefits
 - Small positive effect on academic performance; higher rates of graduation and college attendance



Trends in Girls' Sport Participation

- 70%** of youth athletes discontinue organized sports by age 13
 - Primary drivers in both sexes: injury and burnout
- Girls ages 9-15 experience an approximately **30%** decline in total physical activity, compared to 20% in boys
 - Both sexes reduce organized sport and moderate-to-vigorous physical activity (MVPA) over adolescence, but the decline is **steeper** and **earlier** in girls
 - Girls who started puberty earlier are 68% more likely to discontinue organized activities compared to those with average timing

Key Mediating Factors for Girls' Disengagement

- Social physique anxiety (SPA) — early-maturing girls develop increased body self-consciousness, reducing motivation
 - Depression, lower global self-worth, and maturation fears at age 11 predict lower physical activity enjoyment and MVPA at age 13
- Body composition changes — increased fat mass mediates reduced physical activity and decreased self-efficacy
- Sedentary gradient — early pubertal progression linked to fewer daily steps and more sedentary time

Menstruation needs its own slide ...



By the Numbers: Menstrual Concerns

88%

Girls 10-16 report fatigue, mood changes, and/or pain related to menses

63%

Girls who report menstruation disrupts training attendance

90%

Fear leaking through uniforms; up to 75% report inability to change protection

18%

Considered dropping out of sport due to period-related concerns

Physiology of Puberty

Hormonal Changes & Their Athletic Implications

Female puberty produces **coordinated hormonal, body composition, cardiovascular, neuromuscular, and skeletal changes** that collectively reshape athletic capacity

- Typically begins around age 10 (range 8–13); peak height velocity ~age 11.5
- Rising estradiol, progesterone (after menarche)
- Modest increase in adrenal androgens limits androgen-mediated muscle hypertrophy compared to boys (up to 30× testosterone increase)

The onset of puberty aligns with a large sex divergence in athletic performance that is minimal or absent before puberty (American College of Sports Medicine Consensus Statement, 2023)

- Top adult males almost always outperform the top females in events that rely on muscle power, strength, speed, and/or endurance; sex differences among the world's best are minimal in events relying more on skill (e.g. archery)

Hormonal Changes & Their Athletic Implications

- Estrogen effects:
 - Promotes fat deposition over lean mass → girls gain proportionally more fat mass than boys
 - Promotes glycogen sparing and increased fat oxidation during exercise
 - Enhances vasodilation, pulmonary diffusion, and cutaneous heat dissipation
- Progesterone effects:
 - Partially antagonizes estrogen metabolic benefits; increases protein catabolism in luteal phase
 - Raises thermoregulatory set point in luteal phase — may impair heat tolerance

Body Composition & Cardiorespiratory Fitness Changes

Girls During Puberty	Boys During Puberty (Comparison)
• Absolute VO_2 peak increases, but at a slower rate than boys • ~44% from ages 10–16 • Early-maturing girls with higher estradiol levels accumulate more visceral fat, impairing endurance performance • By late puberty: 6–11% higher body fat than males • Weight-relative cardiorespiratory fitness declines progressively through puberty even when controlling for physical activity	• Absolute VO_2 peak increases at a greater rate • ~82% from ages 10–16 • Attributable to lean tissue accumulation, not intrinsic cardiopulmonary difference • Sexual dimorphism in aerobic capacity • ~9% at age 10 • ~39% by age 16 • Androgen-mediated muscle hypertrophy augments neural adaptations from puberty onward

Neuromuscular Development

- Girls do not have a **defined strength spurt** analogous to boys
 - Before puberty: strength gains in both sexes driven by neural mechanisms (motor unit recruitment, synchronization)
 - After: Boys' gain in androgen-mediated contractile protein augments these mechanisms
- Both sexes experience comparable mechanical tendon strain - higher rate of increase in muscle strength in boys aligns with a greater increase in tendon stiffness
 - High-load exercises with long contraction durations (e.g., 3 s loading and 3 s relaxation) led to a reduction of pain prevalence and frequencies of high-level tendon strain, as well as an increase in tendon stiffness in male athletes
 - How to counteract musculotendinous imbalances in female athletes needs ~~more~~ study

ACL Injury Risk

- Quadriceps-hamstring imbalance emerges during puberty:
 - Girls: relative knee flexor strength decreases (right ~1%, left ~3%) despite modest gains in quadriceps strength
 - Boys: increased mass-normalized knee flexor strength through puberty
- Additional ACL risk factors in pubertal girls:
 - Anterior knee laxity increases significantly from peak height velocity
 - Increasing knee valgus during landing tasks — a pattern not seen in boys
 - Hamstring development lags behind quadriceps development
- Neuromuscular training programs show 56–88% reduction in ACL injury rates
 - Target proper landing mechanics, hamstring and gluteal strengthening, and proprioception

Skeletal Vulnerability During the Growth Spurt

- Rapid growth in stature → increased risk of bone and growth plate injuries
 - IRR 1.5 (bone) and 2.1 (growth plate) per SD increase in growth rate
- Apophyseal injuries most common as limb length increases faster than limb mass
 - Temporary decline in coordination and musculoskeletal balance
- Periphyseal stress injuries are common in select sports (wrist injuries in 10–83% of gymnasts)
 - 12.7% produce growth disturbance if not promptly diagnosed
- Intense training + inadequate energy intake can disrupt HPG axis:
 - Delayed menarche, oligomenorrhea, and amenorrhea in 10–15% of young female athletes
 - Compromises the critical window for peak bone mineral accrual (90% of peak bone mass is achieved by end of adolescence)

Menstrual Cycle Effects on Training & Performance

- Follicular phase (rising estrogen):
 - Dynamic maximal strength peaks in late follicular phase and at ovulation
 - Estrogen promotes satellite cell function and protein synthesis
 - ?Superior for resistance training, maximize strength and muscle mass gains
- Luteal phase (elevated progesterone):
 - Progesterone counteracts anabolic estrogen effects; increases protein catabolism
 - Thermoregulatory set point rises — may impair heat tolerance
 - Perceived performance is consistently reported as worse (even when objective measures vary)
- ACSM Consensus: Pattern-oriented, individually adaptive training approach with menstrual monitoring — NOT rigid phase-based periodization

Counseling Strategies in Primary Care

Important Caveats

Benefits of sport are substantial but NOT unconditional

- The Female Athlete Triad
 - Highest risk: aesthetic sports (gymnastics, dance), endurance sports, and weight-class sports
 - Low energy availability suppresses estradiol → adverse cardiovascular risk profile similar to menopause
 - Screen at PPE: energy intake, menstrual history, bone stress injury history
- Additional risk to monitor:
 - Team sport participation in girls is associated with increased odds of binge drinking (OR 1.13) — sport environments must actively address substance use prevention

The Pre-Participation Evaluation (PPE): A Key Opportunity

Key history items for female athletes:

- Menstrual history — age of menarche, cycle regularity, any amenorrhea/oligomenorrhea
- Nutritional assessment — screen for LEA and disordered eating
- Prior musculoskeletal injuries, especially lower extremity (knee, ankle, groin)
- Concussion history with full symptom review
- Cardiac symptoms and family history (hypertrophic cardiomyopathy)

The Pre-Participation Evaluation (PPE): A Key Opportunity

Physical exam focus areas:

- Cardiovascular system
 - Cardiac etiologies account for 56% of nontraumatic sudden death in collegiate athletes
- Musculoskeletal
 - Special attention to weight-bearing joints of lower extremities
- Baseline ocular examination

The Pre-Participation Evaluation (PPE): A Key Opportunity

Parental Counseling:

- Educate parents about how to show support, encouraging participation
 - Assess for barriers (transportation, finance, menstrual literacy)
 - Special attention to parental attitudes about physical activity in disabled children, who are especially at risk of low fitness
- Promote physical activity in and out of organized sports
- Interest in organized sports should come from the child, not the parent
- Empower parents with knowledge about positive coaching
 - Matters both for short-term skill development and long-term enjoyment
 - Help parents understand characteristics of well-designed programs, promoting athlete safety and preventing abuse

The Coach-Created Motivational Climate

- The coaching climate is the most actionable lever for retention — and is modifiable
 - Empowering (task-involving, autonomy-supportive) climate predicts season continuation (OR ~1.6–1.7)
 - Disempowering (ego-involving, controlling) climate predicts dropout
- Being female is independently associated with higher dropout risk when autonomy support is low
- Evidence-based empowering coaching behaviors:
 - Encourage effort, cooperation, and skill development — not winning as the sole criterion
 - Give athletes choices and explain the purpose of exercises
 - Show genuine interest in participants regardless of performance level

Menstrual Health Literacy & Support

- 81% of female athletes perceive menstrual health as a taboo topic in sport
- Only 11% discuss it with their coach — a massive communication gap
- Evidence-based recommendations:
 - Start menstrual health education BEFORE puberty — what to expect, symptom management, fueling
 - Establish a known female point of contact in the training environment for menstrual concerns
 - Coach education on menstrual topics — age-appropriate, sensitive communication
 - Practical accommodations: access to products, private changing areas, flexible uniform options
 - Physicians: normalize menstrual conversations at every sports-related visit

Structural & Peer-Based Strategies

Structural/Environmental Strategies

- Provide multi-level competition options — not just elite tiers; girls who don't engage before age 8 are unlikely to join later
- Avoid early sport specialization — associated with overuse injury, burnout, and dropout (AAP, ACSM)
- Offer choice and noncompetitive options — strongly preferred by lower-active girls
- Parental involvement predicts sport values → continued participation
- FIFA 11+ warm-up program: significant reduction in injury incidence in youth players

Peer-Led & Co-Designed Programs

Key design principle: Gender-responsive, address body image, social physique anxiety, and menstrual management specifically

- PLAN-A: Trained influential girls to support peers — leverages natural peer networks
- Girls Active Project (GAP): Co-designed using Behaviour Change Wheel; 21 validated behavior change techniques
- CHARMING: Female role models, fun taster sessions, single-sex, low-cost, community-linked
- HERizon Project: Increased perceived competence and intrinsic motivation in girls aged 13–16

Key Clinical Takeaways

- Sports participation has profound physical, mental, social, and academic benefits for girls — advocate for it at every visit
- Puberty is the highest-risk window for dropout — driven by social anxiety, body composition changes, and menstrual barriers
- The PPE is your primary prevention opportunity — screen for triad, injury history, menstrual health, and cardiac risk; counsel the athlete and the parents
- Neuromuscular training (e.g. FIFA 11+) reduces ACL injuries by 56–88% — recommend to coaches and athletic trainers
- Normalize menstrual health conversations; coach education and practical accommodations are evidence-based interventions
- Advocate for empowering coaching climates, multi-level competition options, and peer-led programming in your community

References

To be added