Care of the Female Athlete

Priscilla Tu, DO, FAOASM

May 1, 2019
Disclosures

NO DISCLOSURES FOR YOU
Objectives

- Briefly discuss medical issues specific to female athletes
- Utilize the Sports PPE to help identify concerns for female athletes
- Discuss more female predominant MSK diagnoses
- Highlight exercise in pregnancy and in elderly female
Since 1972, female participation in HS sports increased from 295K to 3 million.

College participation increased 450%.

No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance. —June 23, 1972
**Sports PPE History**

**PART II - MEDICAL HISTORY**

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<td>Yes</td>
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<td>5. Have you ever passed out or nearly passed out during or after exercise?</td>
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<td>6. Have you ever had discomfort, pain, or pressure in your chest</td>
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**FEMALES ONLY**

50. Have you ever had a menstrual period? ☐ ☐

51. Age when you had your first menstrual period? ________

52. How many periods have you had in the last 12 months?

| 16. Has anyone in your family had unexplained fainting, unexplained seizures, or near drowning? | ☐ | ☐ |
| BONE AND JOINT QUESTIONS | Yes | No | | | |
| 17. Have you ever had an injury, like a sprain, muscle or ligament tear, or tendonitis that caused you to miss a practice or game? | ☐ | ☐ | | | |
| 18. Have you had any broken or fractured bones or dislocated joints? | ☐ | ☐ | | | |
| 19. Have you had a bone or joint injury that required x-rays, MRI, CT, surgery, injections, rehabilitation, physical therapy, a brace, a cast, or crutches? | ☐ | ☐ | | | |
| 20. Have you ever had an x-ray of your neck for atlanto-axial instability? OR Have you ever been told that you have that disorder or any neck/whole spine problem? | ☐ | ☐ | | | |
| 21. Have you ever had a stress fracture of a bone? | ☐ | ☐ | | | |
| 22. Do you regularly use a brace or assistive device? | ☐ | ☐ | | | |
| 23. Do you currently have a bone, muscle, or joint injury that bothers you? | ☐ | ☐ | | | |
| 24. Do any of your joints become painful, swollen, feel warm, or look red? | ☐ | ☐ | | | |
| 25. Do you have a history of juvenile arthritis or connective tissue disease? | ☐ | ☐ | | | |

**MEDICAL QUESTIONS**

| Yes | No |
| ☐ | ☐ |
| 26. Do you cough, wheeze, or have difficulty breathing during or after exercise? | ☐ | ☐ |
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**EXPLAIN YES’ ANSWERS BELOW:**

*List medications and nutritional supplements you are currently taking here.*
Menstrual Dysfunction

- 2-3 times more common in athletes than in non-athletes
- HS students – up to 54% have had some menstrual irregularity
- 10-15% athletes have amenorrhea or oligomenorrhea
  - 1st year after menarche, 65% females oligomenorrhea
  - Can lead to later infertility
Menstrual Dysfunction

- Different forms of dysfunction
  - Primary amenorrhea = delayed menarche (by 15yo)
  - Secondary amenorrhea = absence of menses for 3-4 months after menarche
  - Functional hypothalamic amenorrhea (FHA) = absence of menses d/t suppression of hypothalamic-pituitary-ovarian axis without identifiable anatomic or organic cause (ie exercise-associated)
  - Oligomenorrhea
    - 6-9 cycles per year
    - Cycle length > 35 days but < 3 months
  - Anovulation = absence of ovulation (may still have regular menstrual bleeding)
  - Luteal phase deficiency = cycle length may be normal but decreased progesterone level
Menstrual Dysfunction

**Risk Factors**
- Body weight / composition
- Low energy availability
- Nutrition
- Training
- Previous menstrual dysfunction
- Psychosocial factor

**Consequences**
- Infertility
- Altered CV risk factors
- Decreased bone health
- May not be completely reversible
Menstrual Dysfunction

- Evaluation
  - Exclude other causes
    - Pregnancy, thyroid, prolactinoma, PCOS
  - If prolonged, check bone health

- Treatment
  - ↑ EA
  - ↓ energy expenditure
### Sports PPE History

**PART II - MEDICAL HISTORY - Explain “Yes” answers below**

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<td>5. Do you currently have any injuries or back problems?</td>
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<td>6. Have you ever had an injury related to a sports event?</td>
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<td>7. Have you ever had a head injury?</td>
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<td>8. Do you have any other conditions that could affect your performance?</td>
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**BONE AND JOINT QUESTIONS**

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**PAINFUL OR INFLAMED JOINTS**

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**MEDICAL QUESTIONS**

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**EXPLAIN “YES” ANSWERS BELOW:**

- [ ] 9. Do you have pain in your hands, wrists, fingers, or elbows? 
- [ ] 10. Do you have pain in your shoulders, neck, or back? 
- [ ] 11. Do you have pain in your hips, knees, or ankles? 
- [ ] 12. Do you have pain in your chest, abdomen, or pelvis? 
- [ ] 13. Do you have pain in your ears, nose, or mouth? 
- [ ] 14. Do you have pain in your teeth or gums? 
- [ ] 15. Do you have pain in your mouth or tongue? 
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*List medications and nutritional supplements you are currently taking here:
Bone Health

- Menstrual dysfunction → lower estrogen/progesterone → lower bone mineral density
- Up to 19% female athletes have low BMD
- 10% decrease in weight can → 1-2% loss in BMD
- Osteopenia
  - Low bone mass in children/adolescents
- Osteoporosis
  - Fx later in life → significant morbidity/mortality
Bone Health

- Peak bone mass attained between 20-30yo, 90% by end of adolescence
  - 60-80% dependent on genetic factors
  - Other factors: weight bearing exercise, lean body mass, reproductive hormone status, nutrition (energy and nutrients)
- Site-specific BMD higher in athletes engaging in impact activities and/or strength training (esp in puberty)
  - Effect dependent on intensity and volume of training
Bone Health

Factors ↓ing Bone Mass

- Tob use
- Excessive ETOH
- Medical Conditions
  - Renal disease
  - Hyperparathyroidism
  - Eating disorders
- Medications
  - Medroxyprogesterone acetate
  - SSRIs
  - Corticosteroids

Evaluation

- Dual Energy X-ray Absorptiometry (DEXA scan)
  - Z-score – use for children, premenopausal females
    - Athletes have 5-15% higher BMD than nonathletes
- If 2ndary risk factors:
  - -1.0 to -2.0 standard deviation = low bone mineral density
  - < -2.0 = “below expected range for age” → likely osteoporosis
Bone Health

- Treatment
  - Early Detection
    - Bone loss is most active in first year menstrual dysfunction
  - Change nutrition and exercise habits
  - Z-score
    - <-1.0 → refer to dietician
    - <-2.0 → referral and comprehensive medical evaluation
  - Pharmacologic only if non-pharmacologic not successful after 1 year
    - TD estrogen, OCP, Calcium/Vit D
    - Bisphosphonates, HRT should be avoided
Stress Injuries

- Repetitive Loads > Bone’s capacity to heal → Stress Injury

- Risk Factors
  - Exercise volume, intensity, type
  - Surface / footwear
  - Biomechanics
  - Muscle strength / balance
  - Alignment
  - Menstrual dysfunction
  - Previous stress injury
  - Low energy availability / poor nutrition
  - Low BMI

- Prevention
  - ID Risk Factors and address
  - Manage overload activities
### Sports PPE History

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<td>30. Have you had mononucleosis (mono) within the last month?</td>
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<td>31. Do you have any rashes, pressure sores, or other skin problems?</td>
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<td>32. Have you ever had a herpes or MRSA skin infection?</td>
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### HEART HEALTH QUESTIONS ABOUT YOU

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### EXPLAIN "YES" ANSWERS BELOW:

#_ _ #_ _

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*List medications and nutritional supplements you are currently taking here:
Disordered Eating

- HS female athletes: ~18% disordered eating
- Up to 60% college female athletes have had a h/o some form of disordered eating
- Often involve psychiatric disorder with distortion of body image
- Greater risk in sports involving aesthetics, endurance, and weight classifications
- Multiple health consequences
Disordered Eating: Risk Factors

- Pressure to optimize performance and/or modify appearance
- Psychological (low self esteem, perfectionism, obsessive compulsive traits, h/o abuse, family dysfunction…)
- Chronic diseases related to caloric utilization (DM, thyroid)
Disordered Eating: Consequences

- **BRAIN**: preoccupation with food/calories, fear of gaining weight, headaches, fainting, dizziness, mood swings, anxiety, depression
- **HAIR/SKIN**: dry skin and lips, brittle nails, thin hair, bruises easily, yellow complexion, growth of thin white hair over body (lanugo), intolerance to cold
- **HEART**: poor circulation, irregular or slow heart beat, very low blood pressure, cardiac arrest, heart failure
- **BLOOD**: low iron levels (anaemia)
- **INTESTINES**: constipation, diarrhoea, bloating, abdominal pain
- **HORMONES**: irregular or absent periods, loss of libido, infertility
- **KIDNEYS**: dehydration, kidney failure
- **BONES**: loss of bone calcium (osteopenia), osteoporosis
- **MUSCLES**: muscle loss, weakness, fatigue
Female Athlete Triad

Optimal Energy Availability

Reduced Energy Availability with or without Disordered Eating

Eumenorrhea

Optimal Bone Health

Low Energy Availability with or without an Eating Disorder

Subclinical Menstrual Disorders

Low BMD

Functional Hypothalamic Amenorrhea

Osteoporosis

Carilion Clinic

Virginia Tech Carilion School of Medicine
Female Athlete Triad

- Immediate Health Consequences
  - Increased MSK injuries
  - Infertility – potentially reversible
  - Poor athletic performance
  - Stress injuries

- Long Term Health Consequences
  - Infertility – if low energy availability and menses do not normalize
  - Lifelong disordered eating
  - Low BMD → Osteoporosis
  - Psychiatric Disorders

- Treatment
  - Non-pharmacologic – multidisciplinary
  - Pharmacologic only if no better in 1 year
Relative Energy Deficiency in Sport

- 2014 – IOC Consensus Statement: “Beyond the Female Athlete Triad: Relative Energy Deficiency in Sports (RED-S)”
- Energy Availability = amount of energy available for physiologic processes and activities of daily living after subtracting out the energy for exercise training
  - $EA = \frac{EI - EEE}{FFM}$
- Difficult to calculate as no reference protocol and would need access to body composition analysis
- Lab trials in women → optimal EA of 45 kcal/kg FFM/day
Relative Energy Deficiency in Sport – Health Consequences
RED-S – Potential Performance Consequences

- Decreased muscle strength
- Increased injury risk
- Decreased endurance performance
- Decreased training response
- Decreased coordination
- Decreased concentration
- Impaired judgement
- Depression
- Decreased glycogen stores
- Irritability
# RED-S Clinical Assessment Tool (RED-S CAT)

<table>
<thead>
<tr>
<th>HIGH RISK: NO START RED LIGHT</th>
<th>MODERATE RISK: CAUTION YELLOW LIGHT</th>
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<td><em>Anorexia nervosa and other serious eating disorders</em>&lt;br&gt;Other serious medical (psychological and physiological) conditions related to low energy availability&lt;br&gt;Extreme weight loss techniques leading to dehydration-induced haemodynamic instability and other life-threatening conditions.</td>
<td>Prolonged abnormally low percentage body fat measured by DXA or anthropometry using ISAK or non-ISAK approaches&lt;br&gt;Substantial weight loss (5-10% body mass in 1 month)&lt;br&gt;Attenuation of expected growth and development in adolescent athlete</td>
<td>Healthy eating habits with appropriate energy availability</td>
</tr>
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<td>Abnormal menstrual cycle: FHA &gt;6 months&lt;br&gt;Menarche &gt;16 yrs&lt;br&gt;Abnormal hormonal profile in males</td>
<td>Reduced BMD (either from last measurement or Z-score &lt;-1 SD)&lt;br&gt;History of one or more stress fractures associated with hormonal/medical dysfunction and/or LEA</td>
<td>Healthy BMD as expected for sport, age and ethnicity&lt;br&gt;Healthy musculoskeletal system</td>
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<td>Athletes with physical/psychological complications related to LEA/disordered eating;&lt;br&gt; - BCG abnormalities&lt;br&gt; - Laboratory abnormalities&lt;br&gt; Prolonged relative energy deficiency&lt;br&gt; Disordered eating behaviour negatively affecting other team members&lt;br&gt; Lack of progress in treatment and/or non-compliance</td>
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<tr>
<td>No competition</td>
<td>May train as long as he/she is following the treatment plan</td>
<td>Full sport participation</td>
</tr>
<tr>
<td>No training</td>
<td>May compete once medically cleared under supervision</td>
<td></td>
</tr>
<tr>
<td>Use of written contract</td>
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</tr>
</tbody>
</table>
Prevention Strategies

- Promoting healthy body image
- Provide accurate information on nutrition
- Dispelling misconceptions about body weight and body composition as it relates to athletic performance
- Provide information on healthy weight control
Social Factors

Exercise
to be fit, not ‘skinny’

Eat
to nourish your body

and always...

Ignore
the haters, doubters & unhealthy examples that were once feeding you.

You
are worth more than you realise.
### BONE AND JOINT QUESTIONS

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. Have you ever had an injury, like a sprain, muscle or ligament tear, or tendonitis that caused you to miss a practice or game?</td>
<td></td>
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</tr>
<tr>
<td>18. Have you had any broken or fractured bones or dislocated joints?</td>
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<tr>
<td>19. Have you had a bone or joint injury that required x-rays, MRI, CT, surgery, injections, rehabilitation, physical therapy, a brace, a cast, or crutches?</td>
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<tr>
<td>20. Have you ever had an x-ray of your neck for atlanto-axial instability? OR Have you ever been told that you have that disorder or any neck/spine problem?</td>
<td></td>
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</tr>
<tr>
<td>21. Have you ever had a stress fracture of a bone?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Do you regularly use a brace or assistive device?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Do you currently have a bone, muscle, or joint injury that bothers you?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Do any of your joints become painful, swollen, feel warm, or look red?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. Do you have a history of juvenile arthritis or connective tissue disease?</td>
<td></td>
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</tr>
</tbody>
</table>
Other MSK Differences

- Anterior Cruciate Ligament
- Patellofemoral Pain
- Shoulder Injuries
Anterior Cruciate Ligament

- Noncontact ACL injury rate ~ 2-6 x higher in female athletes
- High Risk Sports: Basketball, soccer, gymnastics, lacrosse, skiing
- MC in late teens, early 20s
- Why?
  - Anatomy
    - Increased Q Angle
    - Narrow Intracondylar Notch
    - Increase posterior tibial slope
  - Neuromuscular
    - Poor core muscle control
    - Greater Quadriceps-to-hamstring strength ratio
    - Gluteal muscle weakness
- Prevention Programs
  - Preseason >10 min, 3x/week for at least 8 weeks
  - In Season – continue during warm-up with modifications as needed
  - Components: dynamic stretching, strengthening, functional balance, agility, plyometrics
Patellofemoral Pain

- Risk Factors
  - Malalignment of pelvis and/or LE – static or dynamic
  - Poor neuromuscular control
  - Inflexibility or hypermobility
  - Altered patellar position and/or morphology
  - Trauma, overuse, and/or training errors

- Prevention / Treatment
  - ID MSK deficits to be addressed in conditioning
Shoulder Injuries

- Overhead sports at all skill levels
  - Softball and swimming = most commonly injured joint
  - Tennis and volleyball = 3rd MC joint
  - Gymnastics, diving

- Risk Factors
  - Overload/overuse
  - Muscle fatigue, imbalance and/or weakness
  - Poor technique

- Prevention
  - Manage overhead activity exposure
  - Training for activity-specific biomechanical techniques
  - Dedicated off-season conditioning program
Sports PPE History

PART II - MEDICAL HISTORY - Explain "Yes" answers below

This form must be completed and signed, prior to the physical examination, for review by examining practitioner. Explain "Yes" answers below with number of the question. Circle questions you don’t know the answers to.

GENERAL MEDICAL HISTORY

1. Has a doctor ever denied or restricted your participation in sports for any reason?
2. Do you currently have an ongoing medical condition? If so, please identify: [ ] Asthma [ ] Anemia [ ] Diabetes [ ] Infections [ ] Other:
3. Have you ever spent the night in the hospital?
4. Have you ever had surgery?

HEART HEALTH QUESTIONS ABOUT YOU

Yes No
5. Have you ever passed out or nearly passed out during exercise?
6. Have you ever had discomfort, pain, or pressure in your chest during exercise?
7. Does your heart race or skip beats during exercise?
8. Has a doctor ever told you that you have (check all that apply):
   - High Blood Pressure
   - Heart murmur
   - High cholesterol
   - Heart infections
   - Kawasaki disease
   - Other:
9. Has a doctor ever ordered a test for your heart? (For ex: ECG/ECG, echocardiogram)

MEDICAL QUESTIONS

Yes No
22. Do you regularly use a brace or assistive device?
23. Do you currently have a bone, muscle, or joint injury that bothers you?
24. Do any of your joints become painful, swollen, feel warm, or look red?
25. Do you have a history of juvenile arthritis or connective tissue disease?
26. Do you cough, wheeze, or have difficulty breathing during or after exercise?
27. Do you have asthma or use asthma medicine (inhaler, nebulizer, etc.)
28. Were you born without or are you missing a kidney, an eye, a testicle, spleen or any other organ?

EXPLAIN "YES" ANSWERS BELOW:

# ___ =
# ___ =
# ___ =
# ___ =
# ___ =

*List medications and nutritional supplements you are currently taking here:
Concussion

- Female more concussion-prone
  - Neck musculature; head/neck stability; neck strength to head size ratio
  - Lower biomechanical thresholds
  - Hormonal factors
- More sx at baseline after concussion
  - Vulnerability?
Pregnancy

- Physiological Changes
  - Ligamentous laxity
  - Displaced center of gravity
  - Changes in spine/pelvis
  - Weight gain
  - Increased HR, SV, CO, blood volume, resp rate
  - Increased nutritional needs

- Goal of exercise = maintain or improve pre-existing levels of maternal fitness without undue risk to mom or developing fetus
Pregnancy

Benefits of exercise through pregnancy
- Avoid excessive weight gain
- Improve balance
- Decrease back pain
- Improve well-being, energy, and sleep
- Improved labor symptoms and facilitate postpartum recovery
- Lower risk of C-Section
- Reduce risk of LGA or SGA infant

Risks
- High impact or strain activities can → higher risk miscarriage
- High risk trauma sports in late pregnancy → placental abruption
- Scuba diving CI
- Avoid exercise in supine position if symptomatic (can make some women hypotensive)
Elderly and Exercise

- **Disease Prevention:** Regular physical activity → decrease all-cause mortality
  - Increases/maintains BMD
  - Protects CV system → helps prevent HTN, DM
- **Disease Management**
  - HTN, DM, CAD, HLD, Dep, Osteopenia/Osteoporosis
- **Fall Prevention**
  - Multifaceted approach – strength, flexibility, balance, overall conditioning
  - Improve postural stability
  - Delay functional disability
Questions?
References

- Michaelidis M & Koumantakis GA. Effects of knee injury primary prevention programs on anterior cruciate ligament injury rates in female athletes in different sports: A systematic review
- VHSL Sports Physical Forms