




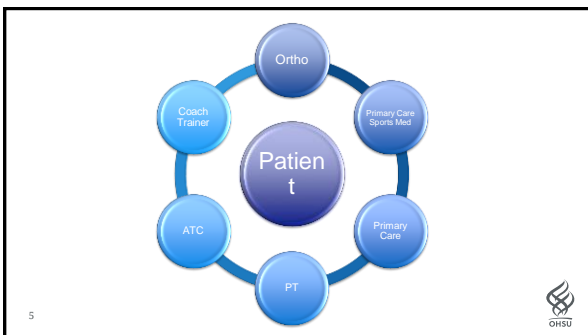
When Does Your Runner Need a Medical Work-up?

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- Philadelphia College of Osteopathic Medicine
- Family Medicine Residency at Lancaster General Hospital (PA)
- Sports Medicine Fellowship at Penn State Hershey Medical Center (PA)
- Family Medicine
- Sports Medicine
- Human Performance Laboratory
- Beaverton (Nike), Hillsboro (Orenco Station), and Marquam Hill (Hospital)
- Mountanside H.S.

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”Who is your primary care provider?”

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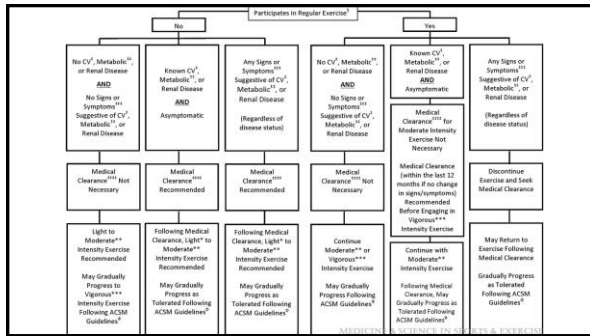
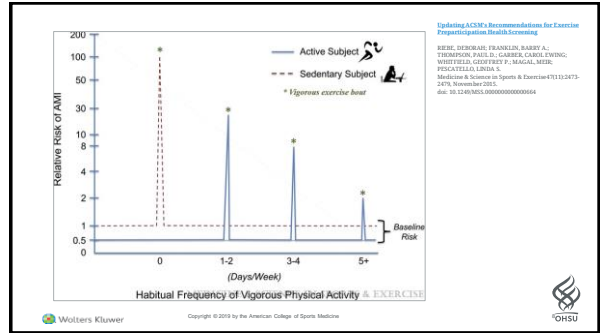


When does your athlete need a medical work-up??



1. Cardiovascular Risk

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Research

JAMA Cardiology | Original Investigation

Association of All-Cause and Cardiovascular Mortality With High Levels of Physical Activity and Concurrent Coronary Artery Calcification

Lavaie F, DeFina MD, Heo B, Radford MD, Carlson E, Barlow PhD, Benjamin EJ, Wilks MD, MPH, David Leonard PhD, Williams J, Haidich PhD, Stephen W, Farnell PhD, Anbarika Pavlovici PhD, Kathleen Abel, Janet D, Barry MD, Keith Klonek, MD, MSc, Benjamin D, Levine MD

0.29-0.91). In the group with CAC of at least 100 AU, men with at least 3000 MET-min/wk did not have a significant increase in all-cause mortality (HR, 0.77; 95% CI, 0.52-1.15) when compared with men with physical activity of less than 1500 MET-min/wk. In the least active men, those with CAC of at least 100 AU were twice as likely to die of CVD compared with those with CAC of less than 100 AU (HR, 1.93; 95% CI, 1.34-2.78).

When does your athlete need a medical work-up??



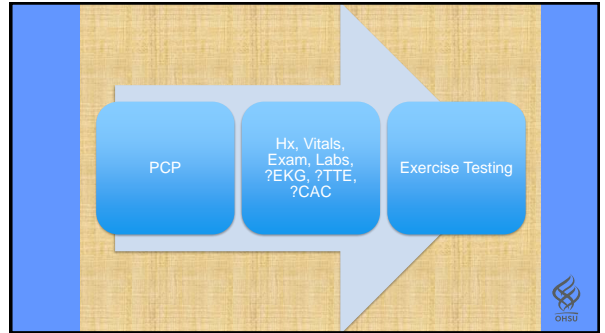
1. Cardiovascular Risk
2. Exercise Intolerance

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When one's ability to perform physical activity is limited by symptoms such as early fatigue, shortness of breath, chest pain, palpitations, or light-headedness that cannot be explained by deconditioning or a known medical condition

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Cardiovascular Disease

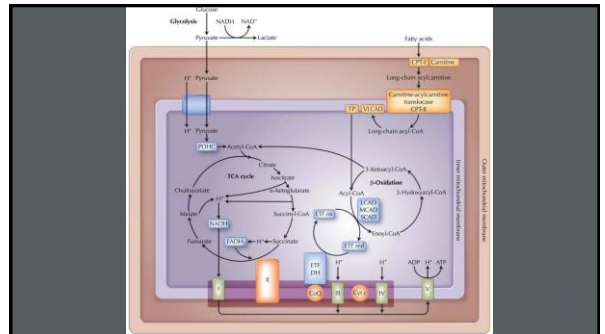
Coronary Artery Disease
 HOCM or other congenital defect
 Arrhythmia

Pulmonary obstruction or restriction

Asthma
 EIB
 Vocal cord dysfunction
 Restrictive Lung Disease

Metabolic Myopathy

Glycogen storage diseases
 Fatty acid oxidation defects
 Mitochondrial disorders



OHSU Human Performance Lab

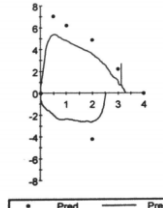
- Physical exam and History (personal and family)
- Labs (pre / post if indicated)
- EKG
- Spirometry
- Cardiopulmonary Exercise Test

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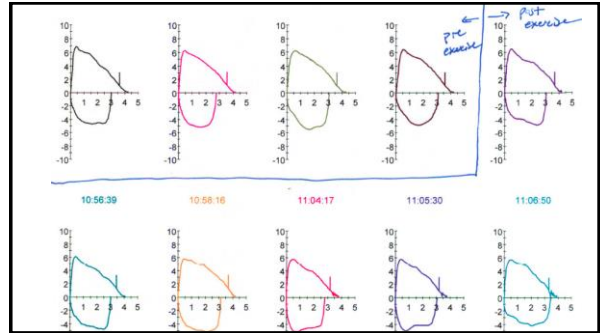


22 yo female, DOE since 9th grade

- Hx anxiety
- Negative resting spirometry
- No response to SABA
- Cardiac workup including ekg, echo, and right heart catheterization (!?!?)
- Severe post exercise stridor
- Atrovent without aero chamber



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When does your athlete need a medical work-up??

1. Cardiovascular Risk
2. Exercise Intolerance
3. Dietary Restrictions



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A bowl of healthy food including fruits, vegetables, and grains, with a large 'A+' grade overlaid.

Iron Deficiency Anemia
~~B12 deficiency~~
 Low Calcium
 Vitamin D deficiency
 GI distress
 Injury (lack of protein)

<https://medium.com/@thrive-global/whole-food-plant-based-is-the-new-clear-answer-to-many-conditions-why>

Herbivores!!!



- Should monitor iron, B12, and vitamin D levels
- Consider B12, omega 3, iron, vitamin D and zinc supplement in all vegans
- Possible to consume adequate iron and calcium without eating meat
- Total caloric intake and total protein consumption

Iron (Ferritin)

- If fatigued, vegan, or vegetarian, or starting training block for endurance or high altitude event, consider getting labs done to check for iron deficiency and/or anemia
- Ferritin and Hemoglobin
- Low iron an epidemic among endurance athletes, especially females
- IDA reduces VO₂ max
- Very low iron (even if normal hemoglobin) can lead to decreased endurance capacity and potentially associated with stress fractures
- Ferritin < 30 – supplement w/ once daily iron with 500 mg vitamin C
- Ferritin 30-50 – increase your intake of dietary iron (heme preferred)

ANEMIA, IRON DEFICIENCY, AND STRESS FRACTURES IN FEMALE COMBATANTS DURING 16 MONTHS
 Ben Galloway, Charles Hales, Craig Anderson, Stacey Jones, David J. Reardon, and the other authors.
 JAMA. 2015;313(12):1253-1261. doi:10.1001/jama.2015.11111

Iron (Ferritin)

- Ferritin < 30 – supplement w/ once daily iron with 500 mg vitamin C
- Ferritin 30-50 – increase your intake of dietary iron (heme preferred)
- High altitude athletes aim for >100
- Do not consume for 6 hours post exercise
- Vegetarians consuming non-heme forms of iron require 80% more than omnivores due to poor bioavailability
- If no improvement from oral supplementation, consider IV route



Blackstrap molasses	2 Tbsp	7.2
Lentils, cooked	1 cup	6.6
Tofu	4 ounces	6.4
Spinach, cooked	1 cup	6.4
Bagel, enriched	1 medium	6.4
Chickpeas, cooked	1 cup	4.7
Tempeh	1 cup	4.5
Lima beans, cooked	1 cup	4.5
Black-eyed peas, cooked	1 cup	4.3
Swiss chard, cooked	1 cup	4.0
Kidney beans, cooked	1 cup	3.9
Black beans, cooked	1 cup	3.6
Pinto beans, cooked	1 cup	3.6
Turnip greens, cooked	1 cup	3.2
Prune juice	8 ounces	3.0
Quinoa, cooked	1 cup	2.8



Protein: 1.2-2.0 g/kg/day

Carbohydrates: 5-10 g/kg/day

Fats: At least 20% of caloric intake

Calcium, Vitamin D, Iron

Beta-alanine, Beet juice, BCAA???

When does your athlete need a medical work-up??

1. Cardiovascular Risk
2. Exercise Intolerance
3. Dietary Restrictions
4. **RED-S and Overtraining Syndrome**



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Overtraining Syndrome...



...How will you know???



Clinical Case

- 37 year old female
- Completed first sprint triathlon in March
- Tri club participating in Olympic distance triathlon in September
- Training 4 days a week for sprint tri
- One month later, now training daily, and doubling at least 3 days a week
- Trying to loose a few pounds by watching what she eats and sticking to primarily vegetarian diet



- Resting HR 89 bpm
- Weight decreased 15 lbs in 3 months
- Spouse reports increased stress at home
- 3 muscle strains in past 1 month
- Missed last menstrual period
- Asks how she can speed up recovery between workouts
- Fatigue



Functional Overreaching (FOR)



Nonfunctional Overreaching (NFOR)



Overtraining Syndrome (OTS)



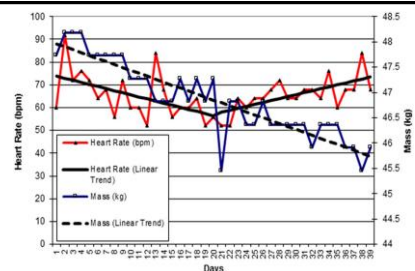
IRONMAN.

- Most commonly seen in...
- 30% non elite / 60% elite lifetime risk
- Cause unknown
- Usually results from training error – imbalance of load and recovery
- Often in combination with psychological or environmental triggers



Diagnosis of Exclusion; rule out other possible causes

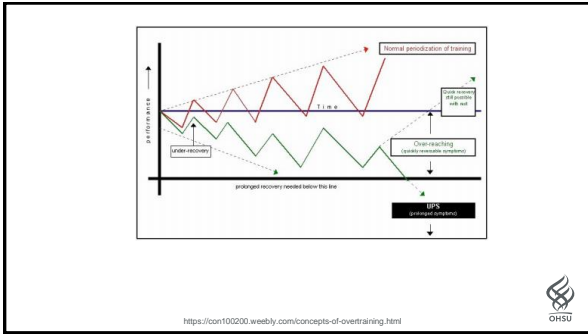
- Environmental allergies
- Exercise asthma
- Mono
- Lack of sleep
- Energy/calorie deficiency
- Mental health
- Iron deficiency
- Other causes



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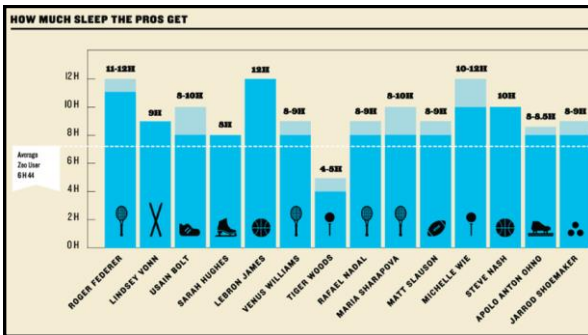
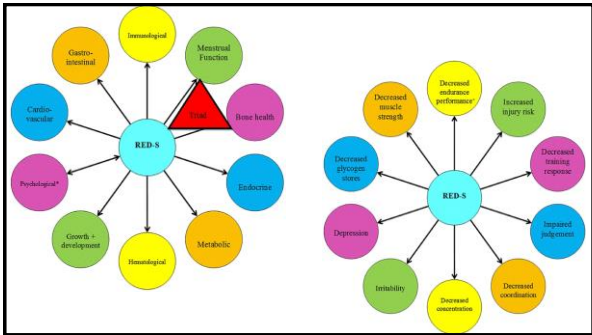
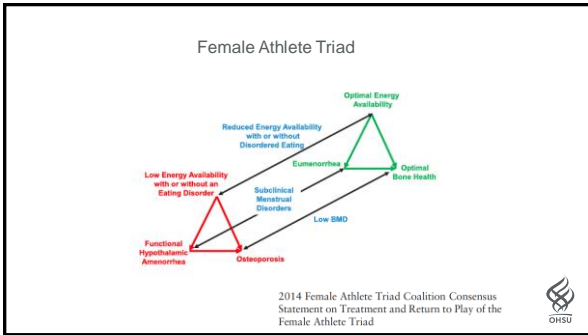
https://www.researchgate.net/figure/Graph-illustrating-a-classic-pattern-of-overtraining-This-athlete-shows-a-decreasing_fig4_311449464





The IOC consensus statement: beyond the Female Athlete Triad—Relative Energy Deficiency in Sport (RED-S)

Margo Mountjoy,¹ Jorunn Sundgot-Borgen,² Louise Burke,³ Susan Carter,⁴ Naama Constantini,⁵ Constance Lebrun,⁶ Nanna Meyer,⁷ Roberta Sherman,⁸ Kathrin Steffen,^{2,9} Richard Budgett,⁹ Arne Ljungqvist⁹



When does your athlete need a medical work-up??

1. Cardiovascular Risk
2. Exercise Intolerance
3. Dietary Restrictions
4. RED-S and Overtraining Syndrome
5. **Joint Hypermobility**



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When does your athlete need a medical work-up??

- Cardiovascular Risk
- Exercise Intolerance
- Dietary Restrictions
- RED-S and Overtraining Syndrome
- Joint Hypermobility
- **Stress Fractures**



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Stress Fractures

- Definition
- Risk factors
- The spectrum
- Diagnosis
- Grading of fractures
- High risk sites
- Return to play



Can they be prevented?

Intrinsic Risk Factors

- Growth plate
- Age (puberty and elderly)
- Level of conditioning
- Anatomical factors
- Psychological factors
- Muscle imbalance
- Foot strike
- Gait
- Menstrual irregularities
- Caucasian

Extrinsic Risk Factors

- Training workload
- Competition schedule
- Sport specialization
- Equipment
- Footwear
- Environment / playing surface
- Psychological factors
- Recovery time
- Nutrition



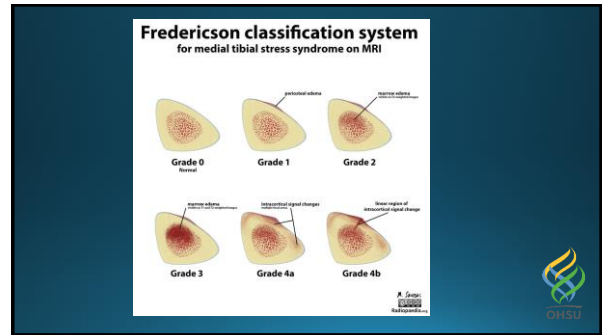
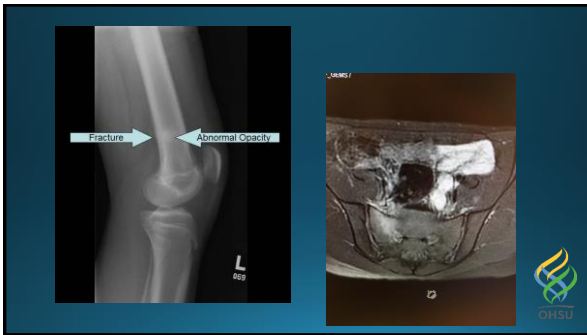
- The rate of breakdown exceeds the remodeling of bone
- Overuse / overload
- Spectrum
 - Impact > microfracture > remodeling > overuse > imbalance > stress reaction > fracture



Diagnosis

- Pain that increases during workout, or does not resolve post workout
- Cannot be explained by other cause
- Brief period of rest / rehab ineffective
- Tenderness to palpation of the bone
- Hop test (single leg)
- Xray
- Presume and treat, consider repeat xray
- High risk area, or clinically necessary, obtain MRI
- Labs and ?DEXA
- Consider nutrition and psychology





Location, location...

Low Risk



- Medial femoral neck
- Femoral shaft
- Posteromedial tibia (shin)
- Metatarsals 1-4 (feet)
- Calcaneus (heel)
- Fibula
- SI joint
- Pelvis

High Risk

- Lateral femoral neck (tension)
- Anterior tibia (shin)
- Navicular
- 5th metatarsal
- Medial malleolus

Treatment

- Low risk – at least 3-6 weeks
 - non weight bearing until able to walk pain free
 - Introduce non weight bearing / low impact activity to maintain fitness
 - 2 weeks before impact training
 - Gradual return to sport
- High risk - at least 10 -12 weeks
 - Surgical consultation
 - Non weight bearing at least 4-6 weeks
 - Partial weight bearing
 - Low impact activity


- Education
- Address risk factors
- Gradual return
- Utilize cross training to build/maintain fitness

The body's ability to withstand physical stress, and thus the volume and intensity of exercise, should be individualized to the athlete



When does your athlete need a medical work-up??

- Cardiovascular Risk
- Exercise Intolerance
- Dietary Restrictions
- RED-S and Overtraining Syndrome
- Joint Hypermobility
- Stress Fractures
- Diagnostic Imaging or Therapeutic Intervention

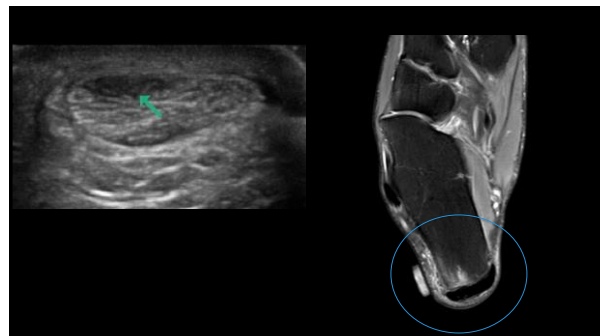


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Would an imaging study potentially change the...

Prognosis?
Treatment approach?
Psychological impact on the athlete?
Ability to participate in upcoming race/competition?


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Call to action!

PDX Sports Medicine Research Collaborative

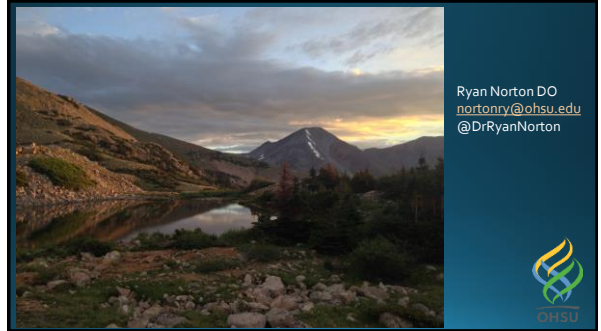
RCT: Return to running protocol for tibial stress fractures



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Thank You



References

- Overuse Physical Injuries in Youth Athletes: Risk Factors, Prevention, and Treatment Strategies. Arnold et al. [Sports Health](#). 2017 Mar;Apr;9(2):139-147. doi: 10.1177/1941738117699847
- DiIorio JP, Benjamin HJ, Brenner JS, et al. Overuse injuries and burnout in youth sports. *Br J Sports Med* 2014;48:287-288
- The occurrence of musculoskeletal complaints among professional musicians: a systematic review. Kok et al. [Int Arch Occup Environ Health](#). 2016 Apr;89(3):373-96. doi: 10.1007/s00420-015-1090-6
- A 2 yr prospective cohort study of overuse running injuries. Messier et al. *The American Journal of Sports Medicine*. 2018;46(9):2211-2221. DOI: 10.1177/0363546518773755
- Running Medicine. Wilder et al. 2017. Healthy Learning
- ACSM Sports Medicine: A comprehensive review. O'Gunter et al. 2013. American College of Sports Medicine
- Netter's Sports Medicine. Madden et al. 2010. Saunders
- RIEBE, DEBORAH; FRANKLIN, BARRY A.; THOMPSON, PAUL D.; GARBER, CAROL EWING; WHITFIELD, GEOFFREY P.; MAGAL, MEIR; FISCATELLO, LINDA S. *Medicine & Science in Sports & Exercise* 47(11):2475-2479, November 2015. doi: 10.1249/MSS.0000000000000664

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References

- <https://www.sciencedirect.com.liboff.ohsu.edu/science/article/pii/S0899900704001066?via%3DIihub>
- *JAMA Cardiol*. doi:10.1001/jamacardio.2018.4628
- *Curr Neurol Neurosci Rep*. 2010 Mar;10(2):118-26. doi: 10.1007/s11910-010-0096-4. A diagnostic algorithm for metabolic myopathies. [Berardo A](#)¹, [DiMauro S](#), [Hirano M](#).
- https://journals.lww.com/acsm-csmr/fulltext/2015/05000/Overtraining_Syndrome.7.aspx

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