# Heat, Head, & Heart: Education, Management, and Best Practice

7/18/2023
LHSAA Coaches Convention
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# Heat

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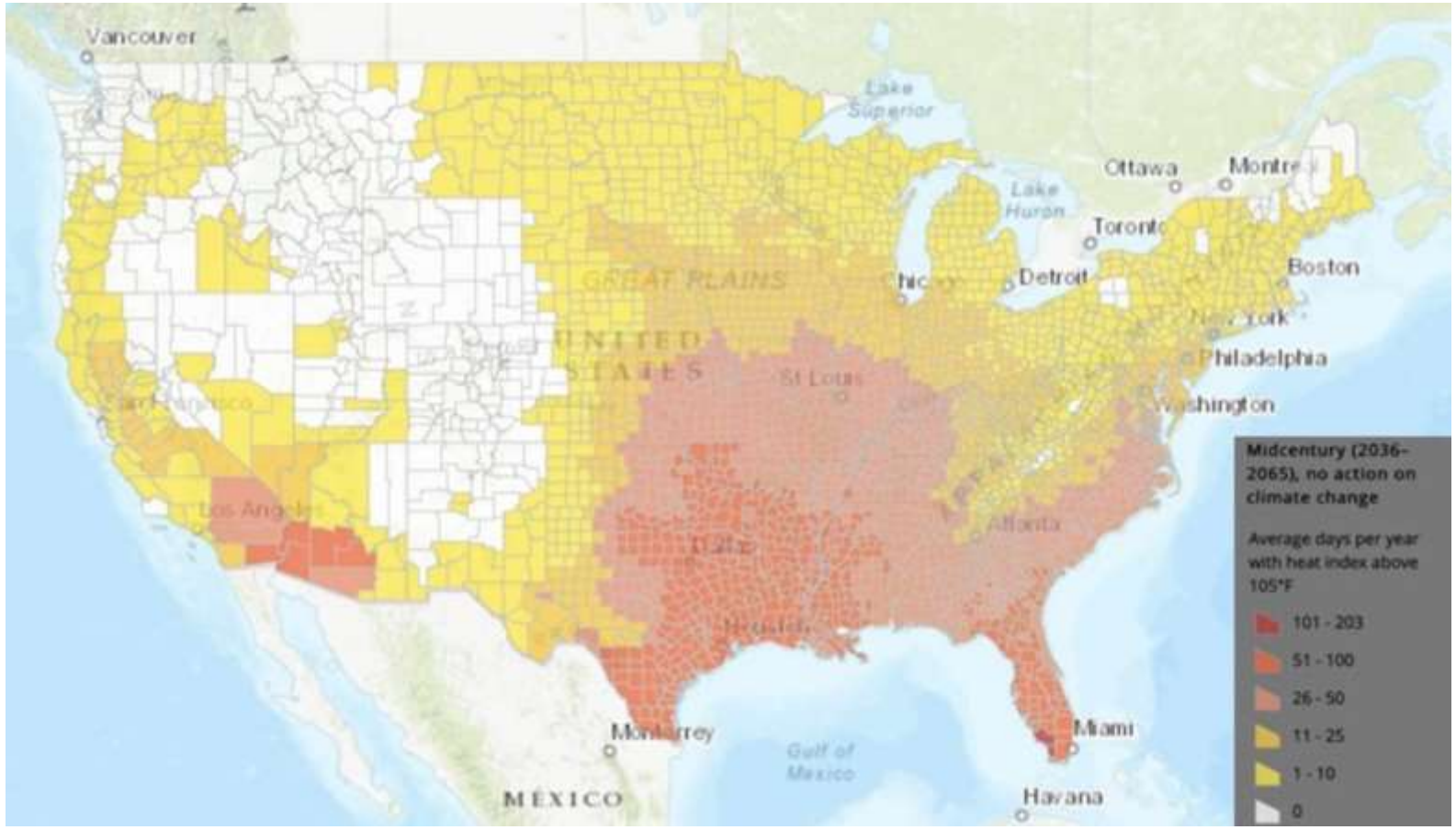
# Why We Care

- From 2004-2018,
  - 10,527 heat-related deaths in the U.S.
  - 90% May-Sept
- Over 9000 cases of exertional heat illness/yr in HS athletes[1]
- Since 2000, 30 NCAA football players have died during conditioning
  - More then 1 per year
  - Cardiac, heat, sickle cell anemia
- Over the last 30 years
  - 40+ high school athletes have died from heat related illness[2]
- American football players among most vulnerable in the sports population.


1 Vaidyanathan A, et al. Heat-Related Deaths – United States, 2004-2018. Centers for Disease Control and Prevention Morbidity and Mortality Weekly Report. June 19, 2020.
Kerr ZY, et al. Epidemiology of exertional heat illness among U.S. high school athletes. Am J Prev Med. 2013;44(1):8-14
2 National Center for Catastrophic Sport Injury Research at the University of North Carolina

# Extreme Heat Days - Louisiana

- New Orleans area has 112 days/year with heat index > 90




*Source: Union of Concerned Scientists*

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# Heat Illness:

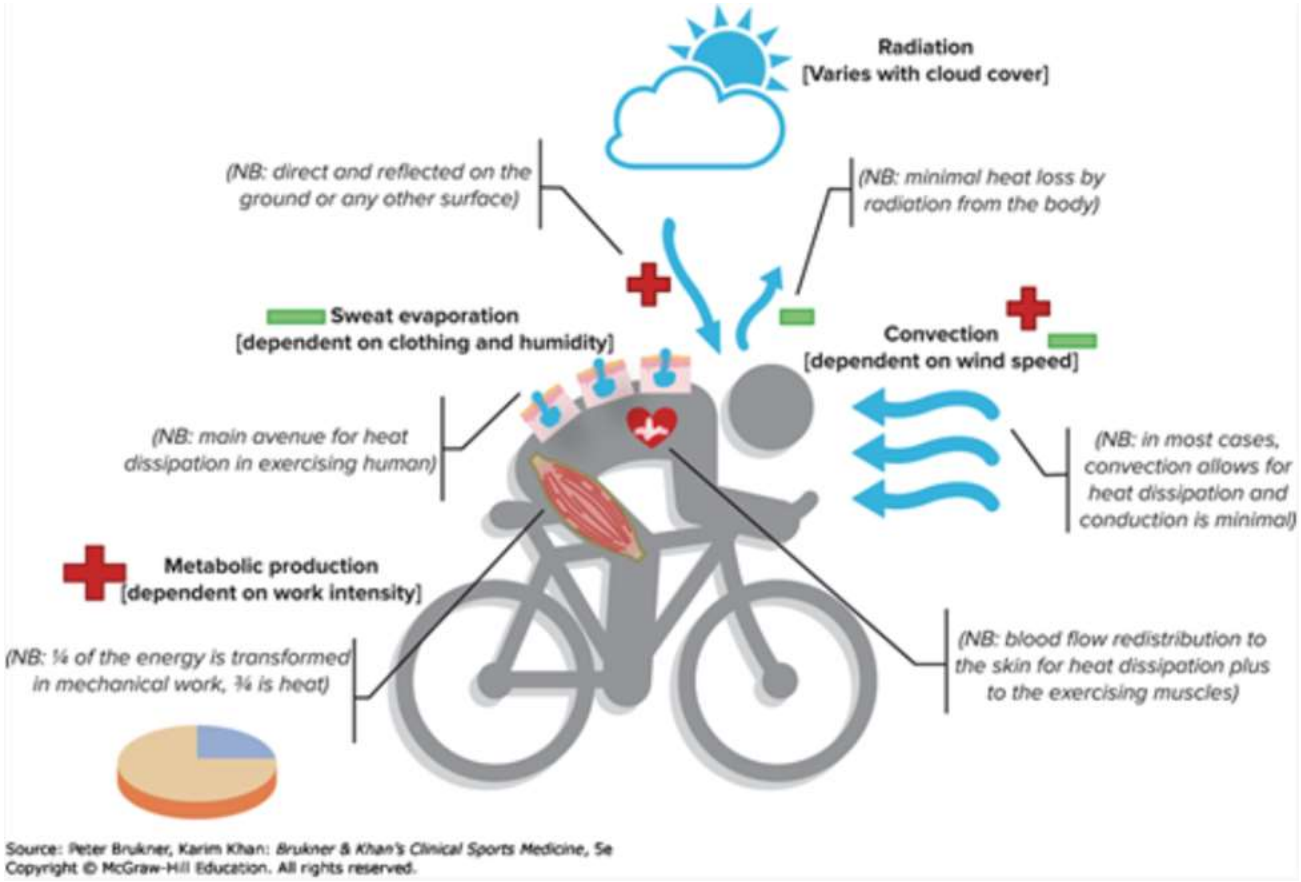
# Environmental Risk Factors

- High environmental temperatures 
- High Humidity 
- Lack of sun coverage 
- Lack of wind 

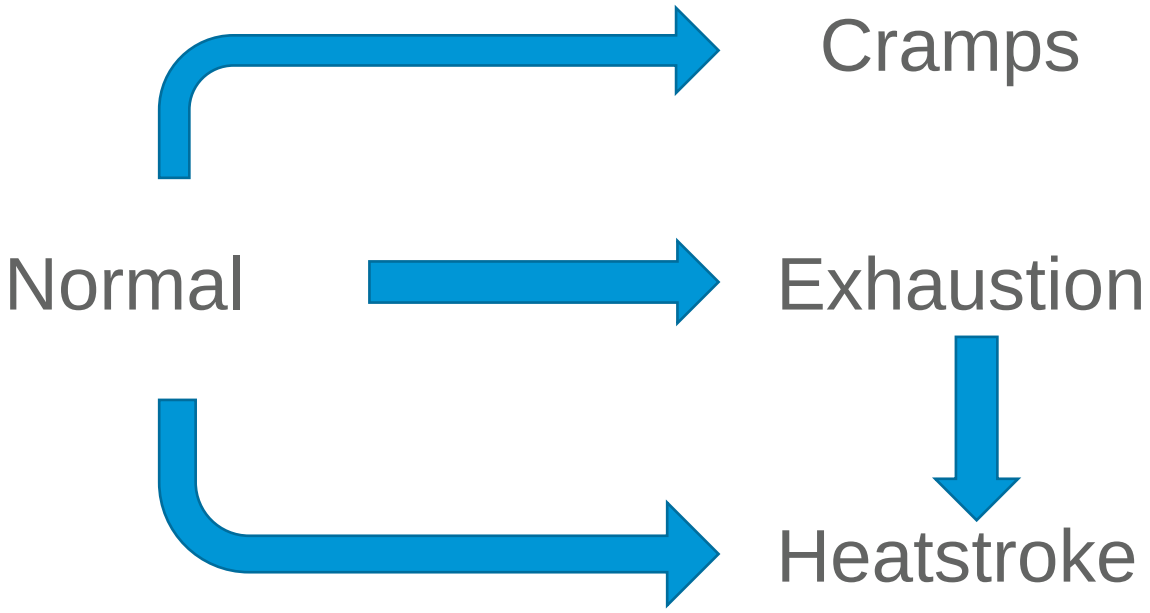
# Risk Factors in Athletes

- **High intensity or strenuous exercise in high heat index**
- **Vapor barrier clothing/equipment**
- **Sleep deprivation**
- **Cumulative effect**
- **Lack of acclimatization**
- **Obesity/ ↑BMI**
- Inadequate hydration
- Viral illness (esp GI)
- Medications
- Alcohol

# The Laws of Thermoregulation



# Spectrum of Illness?



# Exercise Associated Muscle Cramps

- Painful skeletal muscle spasms
- Proposed mechanisms:
  - Exercise induced muscle fatigue
  - Body water loss (C)
  - Large, sweat related Na+ loss (C)
- Does not necessarily correlate to overheated


Nichols AW. Heat-related illness in sports and exercise. Curr Rev Musculoskelet Med. 2014;7:355-365
Nelson NL, Churilla JR. A narrative review of exercise-associated muscle cramps: Factors that contribute to neuromuscular fatigue and management implications. Muscle & Nerve. 2016;54)2:177-85.

# Exercise Associated Muscle (Heat) Cramps

- Treatment:
  - Passive stretching
  - Rest
  - Rehydration
  - Electrolytes supplementation
  - Massage
- Prevention: Proper hydration, salt balance, acclimatization
- Return to play: Preferably a few hours after cramps subside

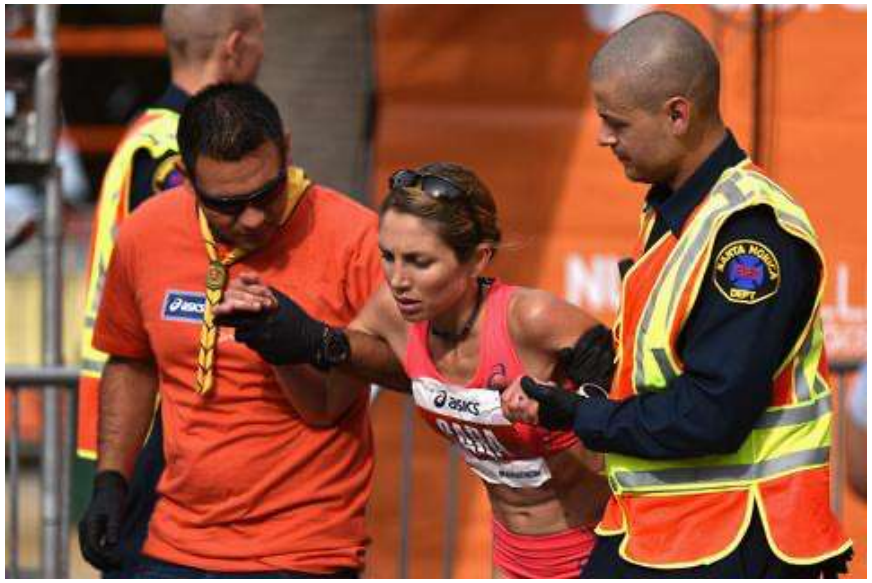

Nichols AW. Heat-related illness in sports and exercise. Curr Rev Musculoskelet Med. 2014;7:355-365
Nelson NL, Churilla JR. A narrative review of exercise-associated muscle cramps: Factors that contribute to neuromuscular fatigue and management implications. Muscle & Nerve. 2016;54)2:177-85.

# Exertional Heat Exhaustion

- Exhaustion = “inability to continue exercise”
- Most common heat-related disorder
- Characterized by significant fluid-electrolyte loss and cardiovascular insufficiency
- Risk Factors:
  - Dehydration
  - Obesity

# Exertional Heat Exhaustion

- Signs and symptoms
  - ↓ blood pressure
  - ↑ Heart rate or pulse
  - ↑ Respiratory rate or breathing
  - Sweaty, pale
  - Dizziness
  - “heat sensations”, “goose flesh”
  - ± cramps
  - Nausea or vomiting
  - Intact mental status
  - Tc < 40ºC/104ºF



# Heat Exhaustion - Treatment

- Move to shaded area
- Remove excess clothing/equipment
- Elevate legs
- Monitor mental status
- Oral hydration*
  - If someone cannot tolerate due to mental status or persistent nausea, vomiting/diarrhea, recommendations to seek immediate advanced care for evaluation and IV fluids.

# Heat Exhaustion – Return

- Same day return to play or activity is not advised.
- Recommendations are at least 24-48 hrs off for fluid equilibrium

# Exertional Heatstroke (EHS)

- Most severe of heat related illness
- Characterized by:
  - **Hyperthermia** (core >40ºC, 104ºF)
    AND
  - **"Altered Mental Status"**
    - Confusion
    - Disorientation
    - Severe Throbbing Headache
    - Personality change
    - Irrational/inappropriate behavior
    - Impaired balance
    - Seizures, Coma
- May be accompanied by multi-organ system failures

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# HEAT EXHAUSTION OR HEAT STROKE

| HEAT EXHAUSTION | HEAT STROKE |
| --- | --- |
| Faint or dizzy | Throbbing headache |
| Excessive sweating | No sweating |
| Cool, clammy skin | Red, hot, dry skin |
| Nausea or vomiting | Nausea or vomiting |
| Rapid, weak pulse | Rapid, strong pulse |
| Muscle cramps | May lose consciousness |

- Get to a cool shaded area or air-conditioned place
- Drink water if fully conscious
- Take a cool shower or use cold compresses

COUNTY OF BENTON

- **Call 9-1-1**
- Take immediate action to cool the victim by any means until help arrives (ice bath, cold towels, etc.)

# EHS - Treatment

**COOL** first, transport second (provided no other life-threatening complications)

**COOL** by any means necessary

Goal: Reduce Tc < 39ºC (102ºF) as fast as possible, ideally within 30 min from collapse

# Cold/Ice Water Immersion

- 2007 ACSM Position Stand gold standard (A)
- Achieves most rapid whole-body cooling
  - 0.15-0.35º C/min (0.5º F)
- Methods: Tank (preferred),
  - “Tarp Taco”- 30% slower in cooling
- Remove athlete once Tc < 39ºC (102ºF) to avoid overshoot

Images:
https://www.youtube.com/watch?v=Zg7P7EHgHb8
https://krcgtv.com/features/focus-on-your-health/taco-method-offers-life-saving-relief-from-heat

# Rotating Ice Packs/Soaked Towels

- Combo cools ~0.12-0.16 ºC/min
- Ice packs alone 0.04-0.08 ºC/min

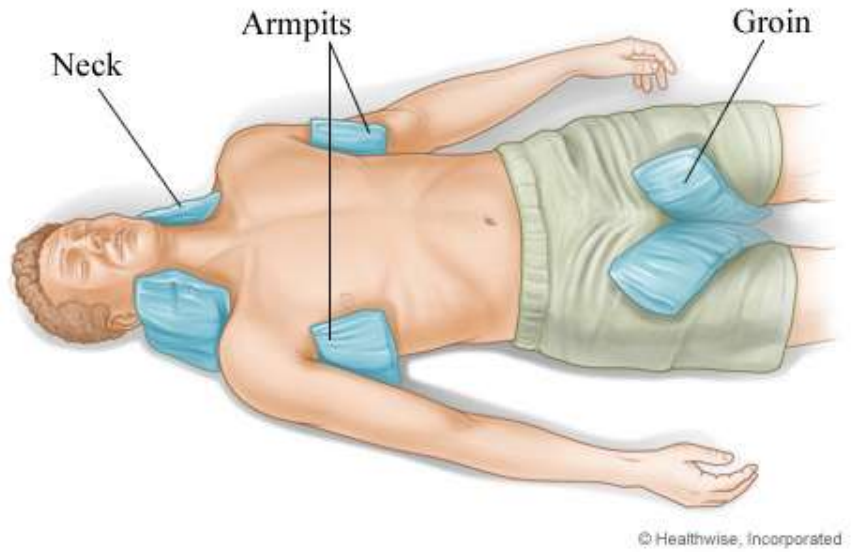



Image: https://myhealth.alberta.ca/Health/Pages/conditions.aspx?hwid=zm6161&lang=en-ca

# HEAT STROKE TREATMENT

- Remove all equipment and excess clothing
- Cool athlete ASAP (within 30 minutes)
  - Tub with ice and water – stir and add ice throughout the process
- If tub not available – shaded, cool area and rotate cold, wet towels
  - Cover as much of the body surface as possible
- Call 911, but cool athlete first
- Monitor vitals – rectal temp, HR, RR, BP, CNS
  - If rectal thermometer is not available – don't take a temp
  - Cease cooling when temp reaches 101-102
    - Allow EMS transport at this time

# EHS – Prognosis

- Prognosis more dependent on time spent above critical Tc (40ºC) or 104ºF , rather than peak Tc

- If Tc is normalized within 1 hour, most recovery fully
  - Survival 100% when Tc < 40ºC within 30 min (DeMartini et al 2015)

- Those not cooled quickly and/or exposed to the following temps are more likely to have major complications
  - > 30 min at 42.5 ºC (108.5ºF)
  - > 60 min at 41.5ºC (106.7ºF)

# Prevention of Heat Illness


- Exercise in early AM or evening
- Frequent breaks
- Adequate hydration and fluid replacement
  - Avoid caffeine and energy drinks
  - If you're thirsty, you're behind – start 2-4 hours before exercise
  - Drink on schedule – 8oz every 15-20 min
  - Small amounts frequently > large amounts rarely
- Monitor weight
- Appropriate clothing for conditions
- Acclimatization
- Limit or cancel exercise if in the "high risk" zone

# ACSM Hydration recommendations

- 1. Before exercise, make sure you are adequately hydrated:
  - a. Beverage consumption with meals will enhance fluid replacement and preexercise/event hydration.
  - b. Recovery from the previous exercise session should be 8 to 12 hours or more to enhance fluid replacement.
  - c. Tracking daily weight is helpful in evaluating hydration status because postexercise and day-to-day variations are likely from fluid loss.
  - d. Consider drinking 16 to 20 fluid oz 4 hours before exercise, especially if preexercise weight is reduced.

- 2. During exercise, drink according to your thirst sensation; no more or no less.
  - a. Drinking more than 800 mL per hour is not recommended and may increase the risk for developing dilutional hyponatremia.
  - b. During extreme weather conditions, fluid intake and pace may require additional adjustment.
  - c. For prolonged exercise, beverages containing 6% to 8% carbohydrate may provide additional benefit.

- 3. After exercise:
  - a. Drink 16 to 24 oz of fluid for every pound lost.
  - b. Postexercise meals should include fluid intake.

**Exercise and Fluid Replacement: *Brought to you by the American College of Sports Medicine www.acsm.org***

Roy, Brad A. Ph.D., FACSM, FACHE

ACSM's Health & Fitness Journal: July/August 2013 - Volume 17 - Issue 4 - p 3

A FACT SHEET FOR STUDENT-ATHLETES

# ASSESS YOUR HYDRATION STATUS

**Step 1:** Match the color of your urine to a color on the chart.

**Step 2:** Determine your level of hydration to dehydration. The lower the number, the better the result.

**Step 3:** If your urine color matches:


- Nos. 1, 2 or 3, you are hydrated.
- Nos. 4, 5 or 6, you are mildly to moderately dehydrated.
- No. 7 or darker, you are dehydrated.
- Athletes should consume water throughout the day. Do not wait until you are thirsty.
- To avoid dehydration, consume water and/or sports drinks before, during and after workouts or exercise. Be cautious of "energy drinks."
- In general, 20 ounces of fluid should be replaced for every pound lost during that exercise session.
- Certain foods, medicines and vitamins may cause the color of urine to change. If these have been consumed in large amounts, this chart may be unreliable. Report all medicines, vitamins and supplements to your sports medicine staff.
- Report any symptoms of heat illness or general medical illness to your sports medicine staff as soon as possible.

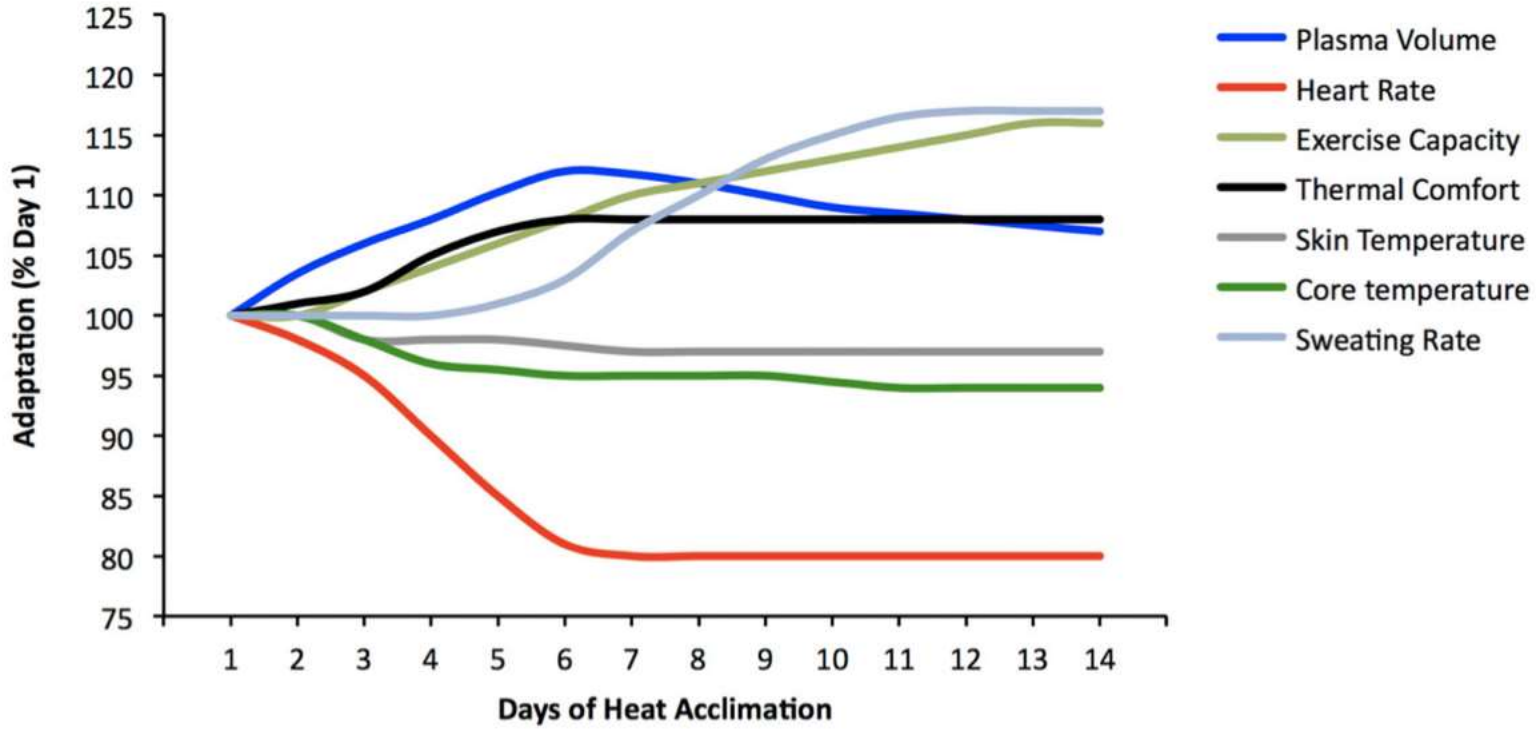
http://www.ncaa.org/sites/default/files/Assess%2BYour%2BHydration%2BStatus.pdf

# HEAT ACCLIMATIZATION

- Results in increased sweating and decreased energy expenditure with lower rise in body temp for a specific workload
- 1-2 hours of exercise daily
- Usually takes 10-14 days
  - Hot, wet environment takes longer than dry
- Will ultimately result in
  - Increases in skin vasodilation and sweating
  - Reduced core and skin temps
  - Improves fluid balance and cardiovascular stability
- Effects remain for about 2 weeks

Thermoregulation: From Basic Neuroscience to Clinical Neurology, Part II, Kenny GP et al. Handbook of Clinical Neurology. 2018

# Heat Acclimatization




Périard JD, Racinais S, Sawka MN. Adaptations and mechanisms of human heat acclimation: Applications for competitive athletes and sports. Scand J Med Sci Sports. 2015;25(Supp 1):20-38

| AREA OF PRACTICE MODIFICATION | PRACTICES 1-5 | | PRACTICES 6-14 |
|---|---|---|---|
| | Days 1-2 | Days 3-5 | |
| # of Practices Permitted Per Day | 1 | | 2, only every other day |
| Equipment | Helmets only | Helmets & Shoulder Pads | Full Equipment |
| Maximum Duration of Single Practice Session | 2 hours | 3 hours | 3 hours (a total maximum of 5 hours on double session days) |
| Permitted Walk Through Time (not included as practice time) | 1 hour (but must be separated from practice for 3 continuous hours) | | |
| Contact | No Contact | Contact only with blocking sleds/dummies | Full, 100% live contact drills |

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# WET BULB GLOBE TEMPERATURE

- MEASURE OF HEAT STRESS IN DIRECT SUNLIGHT
  - TEMPERATURE
  - HUMIDITY
  - WIND SPEED
  - SUN ANGLE
  - CLOUD COVERAGE
- DIFFERS FROM HEAT INDEX
  - CALCULATED FOR SHADY AREAS
  - TEMPERATURE
  - HUMIDITY

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## Wet Bulb Globe Temperature (WBGT) from Temperature and Relative Humidity

Temperature in Degrees Fahrenheit

| Relative Humidity (%) | 68.0 | 71.6 | 75.2 | 78.8 | 82.4 | 86.0 | 89.6 | 93.2 | 96.8 | 100.4 | 104.0 | 107.6 | 111.2 | 114.8 | 118.4 | 122.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 58.6 | 60.9 | 64.3 | 65.5 | 67.7 | 69.9 | 72.1 | 74.3 | 76.4 | 78.5 | 80.6 | 82.6 | 84.7 | 86.6 | 88.6 | 90.5 |
| 5 | 59.6 | 62.1 | 65.6 | 67.0 | 69.3 | 71.7 | 74.0 | 76.4 | 78.6 | 80.9 | 83.1 | 85.3 | 87.5 | 89.9 | 92.1 | 94.2 |
| 10 | 60.7 | 63.3 | 66.9 | 68.4 | 70.8 | 73.3 | 75.8 | 78.2 | 80.7 | 83.0 | 85.5 | 88.0 | 90.3 | 92.8 | 95.1 | 97.6 |
| 15 | 61.7 | 64.5 | 68.1 | 69.6 | 72.2 | 74.8 | 77.4 | 80.0 | 82.6 | 85.2 | 87.8 | 90.2 | 92.8 | 95.4 | 98.0 | |
| 20 | 62.7 | 65.6 | 69.4 | 70.9 | 73.6 | 76.3 | 79.2 | 81.8 | 84.5 | 87.1 | 89.8 | 92.5 | 95.2 | 97.8 | | |
| 25 | 63.8 | 66.7 | 70.5 | 72.2 | 75.1 | 77.8 | 80.6 | 83.4 | 86.2 | 89.0 | 91.8 | 94.6 | 97.4 | | | |
| 30 | 64.8 | 67.6 | 71.7 | 73.4 | 76.3 | 79.2 | 82.1 | 84.9 | 87.8 | 90.8 | 93.6 | 96.6 | 99.4 | | | |
| 35 | 65.6 | 68.6 | 72.7 | 74.6 | 77.5 | 80.5 | 83.5 | 86.4 | 89.4 | 92.4 | 95.3 | 98.3 | | | | |
| 40 | 66.7 | 69.6 | 73.8 | 75.7 | 78.8 | 81.8 | 84.8 | 87.8 | 90.9 | 94.0 | 97.0 | | | | | |
| 45 | 67.5 | 70.6 | 74.8 | 76.8 | 79.9 | 83.0 | 86.1 | 89.2 | 92.3 | 95.4 | 98.6 | | | | | |
| 50 | 68.4 | 71.5 | 75.8 | 77.8 | 81.1 | 84.1 | 87.4 | 90.5 | 93.7 | 96.9 | | | | | | |
| 55 | 69.3 | 72.4 | 76.7 | 78.8 | 82.1 | 85.3 | 88.5 | 91.9 | 95.1 | 98.3 | | | | | | |
| 60 | 70.1 | 73.3 | 77.7 | 79.8 | 83.2 | 86.4 | 89.8 | 93.1 | 96.3 | 99.6 | | | | | | |
| 65 | 70.9 | 73.8 | 78.6 | 80.9 | 84.2 | 87.5 | 90.8 | 94.1 | 97.5 | | | | | | | |
| 70 | 71.7 | 75.0 | 79.5 | 81.7 | 84.9 | 88.6 | 91.9 | 95.3 | 98.6 | | | | | | | |
| 75 | 72.4 | 75.9 | 80.3 | 82.7 | 86.1 | 89.6 | 92.9 | 96.4 | | | | | | | | |
| 80 | 73.2 | 76.7 | 81.2 | 83.6 | 87.1 | 90.4 | 93.9 | 97.4 | | | | | | | | |
| 85 | 74.0 | 77.4 | 82.0 | 84.5 | 88.0 | 91.5 | 94.9 | 98.5 | | | | | | | | |
| 90 | 74.7 | 78.2 | 82.9 | 85.3 | 88.9 | 92.3 | 95.9 | 99.4 | | | | | | | | |
| 95 | 75.5 | 78.9 | 83.6 | 86.1 | 89.6 | 93.2 | 96.8 | | | | | | | | | |
| 100 | 76.1 | 79.7 | 84.4 | 86.9 | 90.5 | 94.1 | 97.7 | | | | | | | | | |

NOTE: This chart is calculated using temperature and humidity, assuming a very clear sky (maximal solar load), and atmospheric pressure of 1ATA (760 mmHg). Chart A was developed by Professor Yoram Epstein to be used in Ariel's Checklist for hikers in Israel.

When the WBGT reading is >85.0°, cold-water immersion tubs or equivalent should be available to aid in the cooling process within the shaded area

| WBGT | ACTIVITY GUIDELINES | REST BREAK GUIDELINES |
|---|---|---|
| Under 82.0°F | Normal Activities | Provide at least three separate rests breaks each hour with a minimum duration of 3 minutes each during the workout. |
| 82.0-86.9°F | Use discretion for intense or prolonged exercise; watch at-risk players carefully. | Provide at least three separate rest breaks each hour with a minimum duration of 4 minutes each. |
| 87.0-89.9°F | Maximum practice time is 2 hours. Players are restricted to helmet, shoulder pads, and shorts during practice, and all protective equipment must be removed during conditioning activities. If the WBGT rises to this level during practice, players may continue to work out wearing football pants without changing to shorts. | Provide at least four separate rest breaks each hour with a minimum duration of 4 minutes each. |
| 90.0 - 92.0°F | Maximum practice time is 1 hour. No protective equipment may be worn during practice, and there may be no conditioning activities. | There must be 20 minutes of rest breaks distributed throughout the hour of practice. |
| Over 92.1°F | No outdoor workouts. Delay practice until a cooler WBGT level is reached. | |

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# Heat Conclusion

- Recognize the symptoms of heat exhaustion and stroke
- Acclimatization is essential
- Start hydrating early
- Cold water immersion saves lives

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# Head

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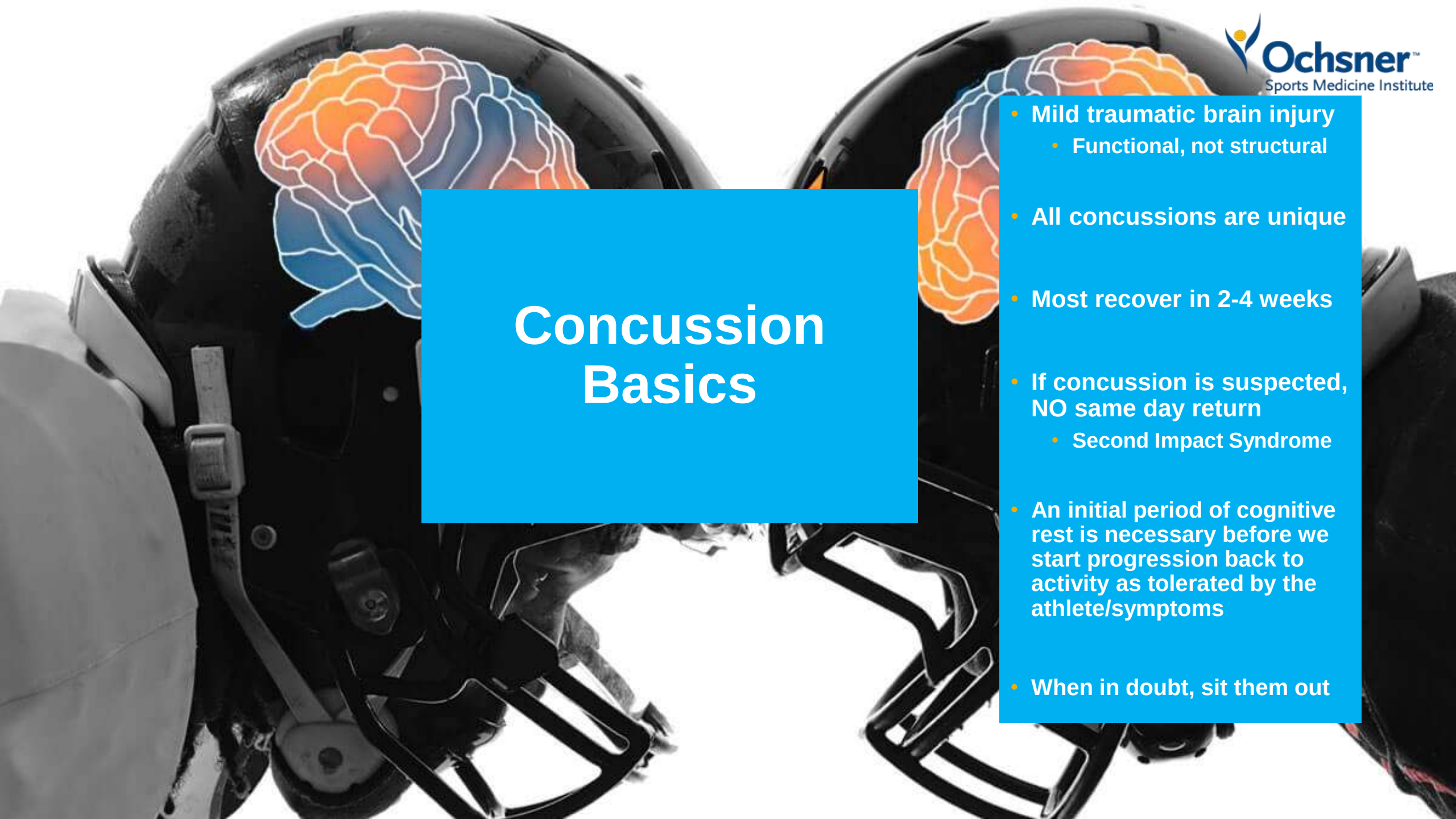

# Concussion Basics

- Mild traumatic brain injury
  - Functional, not structural
- All concussions are unique
- Most recover in 2-4 weeks
- If concussion is suspected, NO same day return
  - Second Impact Syndrome
- An initial period of cognitive rest is necessary before we start progression back to activity as tolerated by the athlete/symptoms
- When in doubt, sit them out

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# History of Concussion

HEARS FOOTBALL MEN

Coaches in Conference with President Roosevelt.

WOULD PUT END TO BRUTALITY

"Reforming" Football.

There is a great deal of talk about the reformation of football, especially since concussion of the brain, broken back and other injuries on the football field were particularly numerous during the season just ended. But you can't reform football. The only way of reforming a bad dog is by cutting his tail off close behind the ears, and that's the way with football. When football is abolished, it will be "reformed" and not before. Meantime, concussion of the brain will flourish and broken backs will interfere with the regular course of study at our institution of learning.

TOPIQUE.

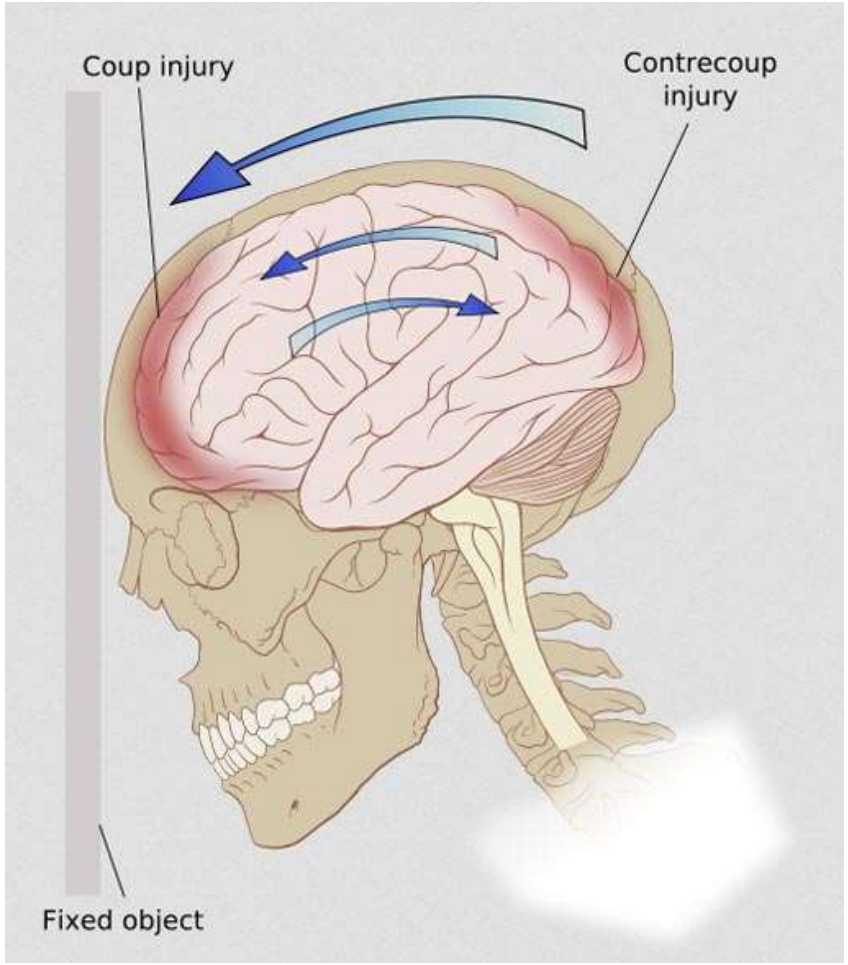
1905 Article. Pennsylvania Grit 12/7/1905 Williamsport, PA

# How common are concussions?

- mTBI (mild traumatic brain injury) accounts for 80-90% of all TBI
  - SRC (sports related concussion) accounts for >25%
- Current estimates are 3.8 million annually (4.17 per 10,000 AE)
  - 1.0-1.8 million in 0-18 y.o.
  - 400,000 in high school athletes
  - 2-15% of athletes participating in sport will suffer a concussion in 1 season
- Females more likely than males
  - Also higher for recurrent concussions
- Sports
  - Football (10.40 per 10,000 AE)
  - Soccer = females

Harmon KG, Clugston JR, Dec K, et al. American Medical Society for Sports Medicine position statement on concussion in sport. Br J Sports Med. 2019 Feb;53(4):213-225.
Ferry B, DeCastro A. Concussion. [Updated 2021 Apr 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-.
Scorza KA, Cole W. Current Concepts in Concussion: Initial Evaluation and Management. Am Fam Physician. 2019 Apr 1;99(7):426-434.

# How is it Diagnosed?




https://www.labmedica.com/immunology/articles/294767728/brain-protein-may-help-assess-recovery-time-following-concussion.html

## Diagnosing Concussion

- Clinical Diagnosis
  - No imaging, labs say “positive for concussion”
- Based off symptoms, exam, MOI
  - SCAT 6→ Amsterdam update!
  - BESS (balance) testing
  - VOMS (eye) testing
  - Cognitive testing (ImPACT)
- Evolving injury

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Headache | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| "Pressure in head" | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Neck Pain | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Nausea or vomiting | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Dizziness | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Blurred vision | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Balance problems | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Sensitivity to light | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Sensitivity to noise | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Feeling slowed down | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Feeling like "in a fog" | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| "Don't feel right" | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Difficulty concentrating | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Difficulty remembering | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Fatigue or low energy | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Confusion | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Drowsiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Trouble falling asleep | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| More emotional | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Irritability | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Nervous or Anxious | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

**22 total symptoms, maximum score of 132**

# Concussion Symptoms

- Headache
- Neck pain
- Nausea/vomiting
- Sensitivity to light/sound
- Feeling slowed down
- Difficulty concentrating/remembering
- Irritability/sadness/anxious
- Dizziness
- Blurred vision
- Balance problem

# Concussion Prevention

| Coaching | Equipment | Rule changes |
| --- | --- | --- |
| • Tackling technique<br>• Culture<br>• Cervical strengthening<br>• Post-concussion Neuromuscular training? | • Proper size, worn correctly<br>• Guardian Cap?<br>• Position Specific helmets?<br>• Q collar? | • The blindside block<br>• Kickoffs<br>• Penalties for dangerous hits<br>• ATC spotters<br>• Sensors/video review |

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# Ochsner Andrews Sports Medicine Institute Concussion Management

https://cdn11.bigcommerce.com/s-du14j3o/images/stencil/original/uploaded_images/post-concussion-syndrome-symptoms.jpg?t=1525907961

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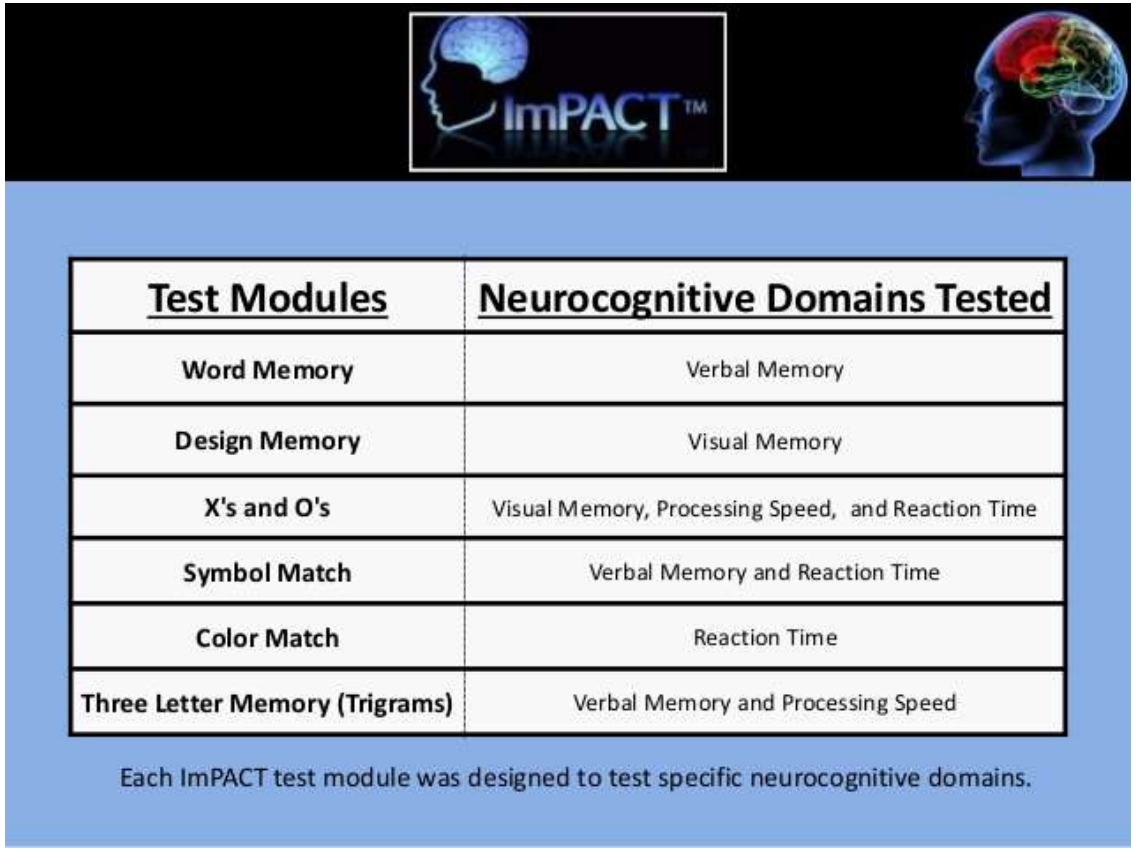
# Baseline Concussion Testing




| Test Modules | Neurocognitive Domains Tested |
|---|---|
| Word Memory | Verbal Memory |
| Design Memory | Visual Memory |
| X's and O's | Visual Memory, Processing Speed, and Reaction Time |
| Symbol Match | Verbal Memory and Reaction Time |
| Color Match | Reaction Time |
| Three Letter Memory (Trigrams) | Verbal Memory and Processing Speed |

Each ImPACT test module was designed to test specific neurocognitive domains.

https://pennaudiology.com/wp-content/uploads/2020/05/prior-concussion-injuries-influence-recovery-time-in-college-athletes-7-638-1.jpg

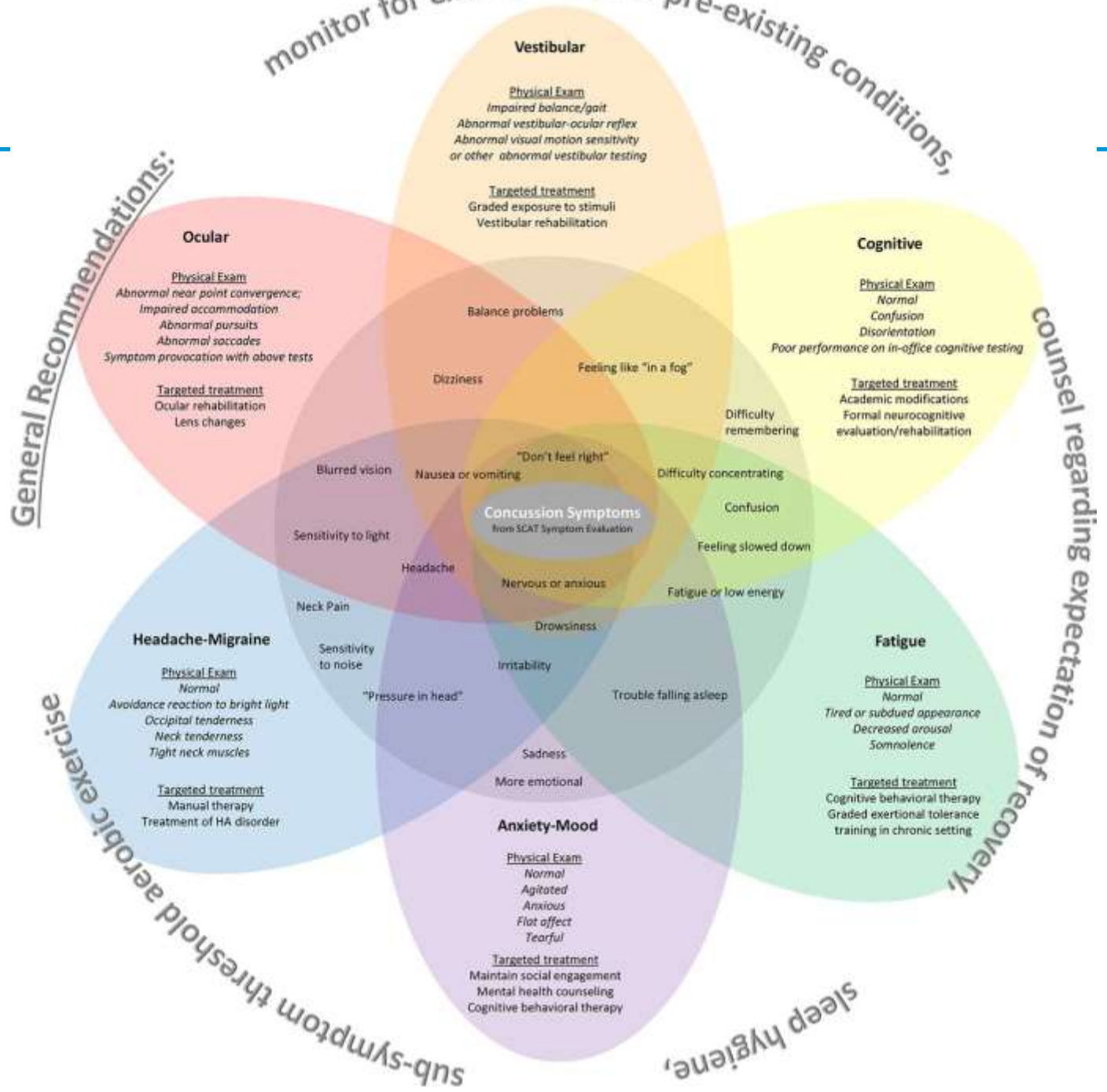
- Baseline data helps with return to play
  - Goal – get them back safely and quickly
- Some athletes will never be 0/22, 0/132
  - Want to get back to their “normal”
- BESS, VOMS
- ImPACT or similar (twice during HS career)
- **Tools that collectively help us decide**

## Group Versus Individual Administration Affects Baseline Neurocognitive Test Performance

Rosemarie Scolaro Moser, PhD*, Philip Schatz, PhD, Katherine Neidzwski, BS, Summer D. Ott, PsyD Show less

First Published August 9, 2011 | Research Article | Find in PubMed | Check for updates

- Cohort Study, AJSM 2011
- HS athletes completed preseason baseline IMPACT either in group setting or individually at a neuropsychological clinic
- Results: Athletes in group setting scored significantly lower on:
  - verbal memory
  - visual memory
  - motor processing speed
  - reaction time
- Conclusion
  - Administration of baseline neurocognitive testing to athletes in a group setting may introduce extraneous error, negatively affecting test performance


General Recommendations:
monitor for exacerbation of pre-existing conditions,
counsel regarding expectation of recovery,
sleep hygiene,
sub-symptom threshold aerobic exercise
Vestibular
Physical Exam
Impaired balance/gait
Abnormal vestibular-ocular reflex
Abnormal visual motion sensitivity
or other abnormal vestibular testing
Targeted treatment
Graded exposure to stimuli
Vestibular rehabilitation
Ocular
Physical Exam
Abnormal near point convergence;
Impaired accommodation
Abnormal pursuits
Abnormal saccades
Symptom provocation with above tests
Targeted treatment
Ocular rehabilitation
Lens changes
Cognitive
Physical Exam
Normal
Confusion
Disorientation
Poor performance on in-office cognitive testing
Targeted treatment
Academic modifications
Formal neurocognitive
evaluation/rehabilitation
Balance problems
Dizziness
Feeling like "in a fog"
Difficulty remembering
"Don't feel right"
Blurred vision
Nausea or vomiting
Difficulty concentrating
Confusion
Concussion Symptoms
from SCAT Symptom Evaluation
Sensitivity to light
Feeling slowed down
Headache
Nervous or anxious
Fatigue or low energy
Neck Pain
Drowsiness
Headache-Migraine
Physical Exam
Normal
Avoidance reaction to bright light
Occipital tenderness
Neck tenderness
Tight neck muscles
Targeted treatment
Manual therapy
Treatment of HA disorder
Sensitivity to noise
Irritability
"Pressure in head"
Trouble falling asleep
Fatigue
Physical Exam
Normal
Tired or subdued appearance
Decreased arousal
Somnolence
Targeted treatment
Cognitive behavioral therapy
Graded exertional tolerance
training in chronic setting
Sadness
More emotional
Anxiety-Mood
Physical Exam
Normal
Agitated
Anxious
Flat affect
Tearful
Targeted treatment
Maintain social engagement
Mental health counseling
Cognitive behavioral therapy

# When To Send To The Hospital

- Examination findings suspicious for skull fracture
- Post-traumatic seizure
- Acute worsening of symptoms – may suggest bleed
  - Nausea/vomiting (>1 episode since injury)
  - Focal neurological deficit
  - Deteriorating Neurological Status: somnolence, slurred speech, difficulty walking, worsening mental status
- LOC or amnesia with history of bleeding/clotting disorder, dangerous mechanism of injury OR > 30 minutes of retrograde amnesia of events immediately before injury.

- If you're uncomfortable with the situation, defer to ATC or MD/DO

# Future of sideline care

**ABBOTT RECEIVES FDA 510(K) CLEARANCE FOR THE FIRST RAPID HANDHELD BLOOD TEST FOR CONCUSSIONS**

- The test to help evaluate mild traumatic brain injury (TBI), commonly known as concussion, produces a result within 15 minutes after a plasma sample is inserted and will run on Abbott's i-STAT™ Alinity™ handheld device

- Having a blood test available could help eliminate wait time in the emergency room and could reduce the number of unnecessary CT scans by up to 40%

- The test simultaneously measures biomarkers UCH-L1 and GFAP, proteins found in the blood after a concussion or head trauma

- Building on this initial clearance, Abbott is also working on a test that would use whole blood on i-STAT at the point of care, and developing a test for its Alinity™ i and ARCHITECT® core laboratory instruments under FDA breakthrough designation

- Rapid point of care device
  - 15 mins
- Test for two proteins in peripheral blood known to be present after acute head injuries
  - UCH-L1 (ubiquitin C-terminal hydrolase-L1)
  - GFAP (glial fibrillary acidic protein)
- Negative predictive value- 99.6% for intracranial injury with negative test
- NOT A CONCUSSION DIAGOSIS TOOL

Bazarian JJ, Biberthaler P, Welch RD, et al.; Serum GFAP and UCH-L1 for prediction of absence of intracranial injuries on head CT (ALERT-TBI): a multicentre observational study. *Lancet Neurol.* 2018;17(9):782-789.

# Initial Concussion Management

https://bloximages.chicago2.vip.townnews.com/buffalonews.com/content/tncms/assets/v3/editorial/7/d3/7d30bba5-260b-5575-a20b-2969729574d5/5ef3adbbd123a.image.jpg?crop=1567%2C1175%2C98%2C0&resize=1567%2C1175&order=crop%2Cresize

- REST 24-48 hours
- Evaluation by concussion specialist
- Buffalo Treadmill Concussion
  - Need treadmill or bike with resistance
- Decision on whether they can begin RTP
  - Frequent and open discussion with ATCs
- Weekly follow ups

# Return To Learn Protocol

Ochsner Sports Medicine Institute

1221 S. Clearview Pkwy, New Orleans, LA 70121

504-736-4800

## Return To Learn Protocol

1. Prepare to return to academic activities
    a. Begin ***light mental activity*** for short periods of time (about 15 minutes several times/day)
    b. Limit other mental/cognitive activities, especially those that worsen symptoms
        i. For example, computers, phones, video games
2. Begin light activity academics
    a. Return to class
        i. This may be a single class, or limited number of classes at first
        ii. See if a classmate can take notes while you work on paying attention
        iii. Change seating arrangement to limit distractions/stimulation
    b. Work on short/small assignments
        i. Work for short periods with rest in between
        ii. Avoid computer, if able, due to the risk of eye strain, headache, or neck tension
    c. Continue to limit problematic cognitive activities
        i. Computer, texting, watching TV, etc
3. Increase academic work load
    a. Return to more/all classes
        i. Begin taking notes
        ii. Work on major assignments, tests, and projects
4. Return to normal academic work load
    a. Return to ALL classes
    b. Arrange to take tests and complete missed work, if any


https://image.shutterstock.com/z/stock-photo-adorable-young-boy-rubbing-his-temples-thinking-hard-while-studying-in-the-class-at-elementary-669822871.jpg

# Return To Play Protocol

Ochsner™
Sports Medicine Institute

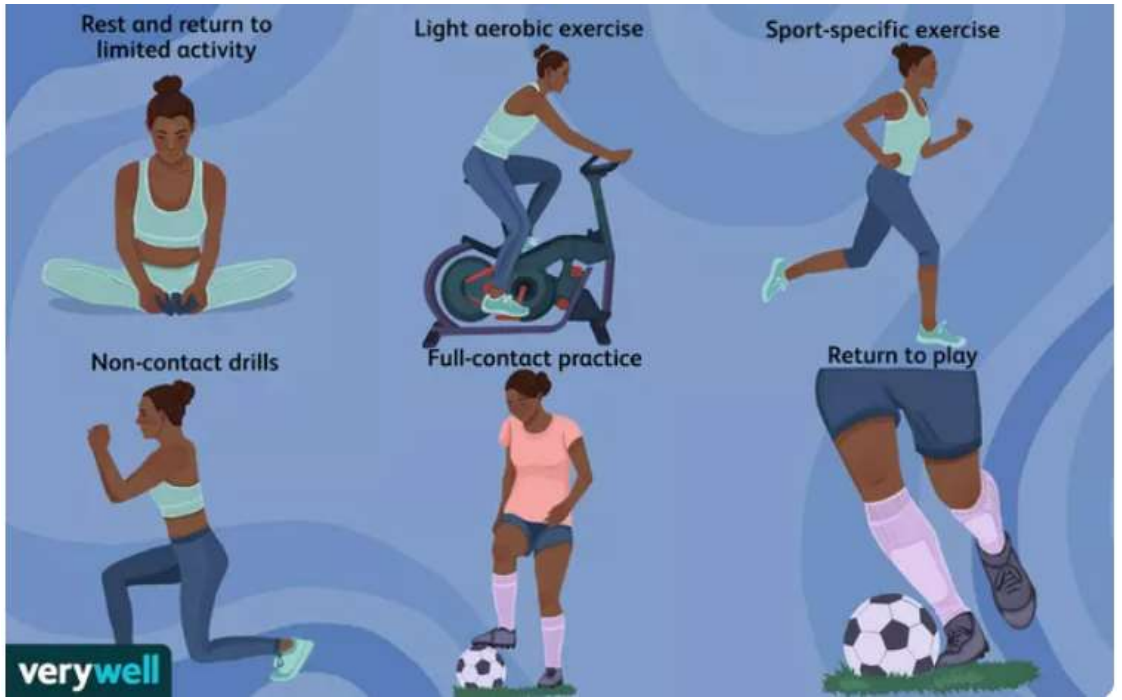
1221 S. Clearview Pkwy, New Orleans, LA 70121

504-736-4800

## Return To Play Protocol

| Rehabilitation Stage | Functional Exercise at Each Stage of Rehabilitation | Objective of Each Stage |
|---|---|---|
| 1. No Activity | Symptom limited physical and cognitive rest | Recovery |
| 2. Light aerobic exercise | Walking, swimming, or stationary cycling keeping intensity <70% maximum permitted heart rate | Increase heart rate<br>Perform for 30 minutes |
| 3. Sport-specific exercise | Skating drills in hockey.<br>Running drills in soccer.<br>No head impact activities. | Add movement<br>Perform for 30 minutes |
| 4. Non-contact training drills | Progression to more complex training drills. For example, passing drills in football and soccer | Improve exercise, coordination, and increase cognitive load |
| 5. Full contact practice | Following medical clearance participate in normal training activities | Restore confidence and assess functional skills by coaching staff |
| 6. Return to play | Normal game play | |

If at any point concussion symptoms present or worsen, the player is to stop athletic activity and return to the prior step. Once the prior step is completed without symptoms, the player may progress to the next step to try and complete it again.




https://www.verywellhealth.com/thmb/MXZ_9Ww-vAdn5La5Twf0Ej-GhxI=/1500x1000/filters:no_upscale():max_bytes(150000):strip_icc()/zhansen_concussion-protocol-5195083_final-bb6b9f202739426893a4d5c18f130f77.jpg

# Athlete Return

## LHSAA Return to Competition Form

**LHSAA rules require a written statement from a physician in order for an athlete to return to competition who apparently had a concussion.**

*"If a competitor is determined to have a concussion, he/she shall not be permitted to continue practice or competition the same day. Written approval of a physician shall be required for the athlete to return to competition. If a physician recommends an athlete not continue, he/she shall not be overruled".*

**The undersigned attending physician has examined the student athlete identified below and gives permission for the student athlete to return to competition on the date and in the sport identified.**

ATHLETE: _____

SCHOOL: _____

SPORT: _____ *DATE of CONCUSSION* _____

ACTIVITY: _____ *DATE to RETURN* _____

Attending Physician Name (print) _____ LA Medical License _____

Attending Physician Signature _____ Date signed _____

- The LHSAA requires a written statement from a physician in order for an athlete to return to competition after sustaining a concussion
- If a physician recommends an athlete not continue, he shall not be overruled

https://www.childrens.com/wps/wcm/connect/childrenspublic/969c35ad-6592-44f8-9249-a16c2b3f9305/Micah%28J180629113%29_800x480.jpg?MOD=AJPERES&CVID=

https://images.emedicinehealth.com/images/article/main_image/concussion-2.jpg

# Concussion Complications


https://www.limitlesstherapyandwellness.com/wp-content/uploads/2021/02/Concussions-ManagementandRehabilitation-e1613803130881.jpg

https://images.everydayhealth.com/images/concussion-symptoms-722x406.jpg

# Post concussion syndrome


https://images.fosterwebmarketing.com/983/post-concussive%20syndrome%20treatment%20kansas%20city%20missouri%20lawyer.jpg

Post Concussion Syndrome:

- Symptoms lasting longer than the expected recovery timeframe
  - Weeks? Months?
  - Depends on age
  - Frustration for students, parents, coaches

- Treatment based on symptoms that persist
  - Vestibular therapy
  - Counseling
  - Neurology

# Second Impact Syndrome

https://www.brainandspinalcord.org/wp-content/uploads/2016/03/Human-Brain_Brain-Injuries_Head-Injuries_Head-Trauma_Brain-and-Head-Injury-Information_2.jpg

- Rapid cerebral edema (swelling) and bleeding after a SECOND impact to the brain while a person is still symptomatic from a recent concussion
- This can occur days or weeks after initial concussion diagnosis
- After the second event the brain's blood supply regulation is lost
  - Increased ICP → brain herniation
- Commonly fatal (50%)
  - Can cause death or permanent disability
- Most common in high school and college-aged athletes

# Chronic Traumatic Encephalopathy

**Much remains unknown about CTE**

- Correlation with concussion
- No defined number of hits

**Retired NFL players with 3+ concussions:**

- 5x increase in mild cognitive impairment
- 3x increase in memory impairment
- 3x more likely to have depression

**Symptoms recognized decades after injury**

❖Rare, progressive brain condition thought to be caused by repetitive blows to the head and repeated episodes of concussion

❖Recognized since early 1900's

➢Very small number of cases

**Table 2**
**Clinical symptoms associated with chronic traumatic encephalopathy**

| Cognitive | Mood | Behavioral | Neurologic |
|---|---|---|---|
| Memory deficits | Apathy | Poor impulse control | Dysarthria |
| Attention deficits | Depression | Substance abuse | Parkinsonian features |
| Executive function deficits | Suicidality | Violence | Chronic traumatic encephalomyelopathy |

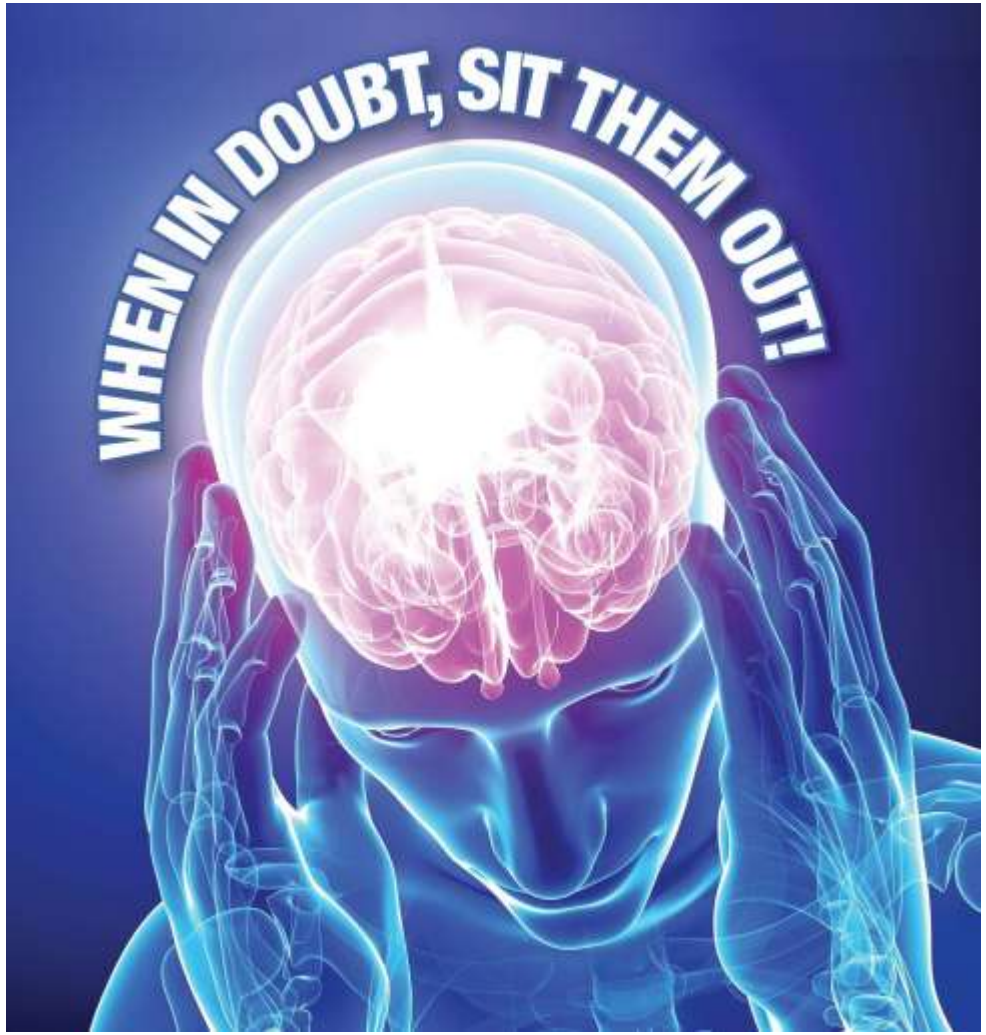
Kaufman MS, et al. *Phys Med Rehabil Clin N Am*. 2014, 25: 707-722

D'Hemecourt, P. CJSM 2011; 30: 63-72
McCrory, P. CJSM 2011; 21: 6-12
Guskiewicz, K, et al. Neurosurg 2005; 57: 719-726
Guskiewicz, K, et al. Med Sci Sports Exerc. 2007; 39: 903-909

# Retirement From Sport

- Specific number of concussions has not been established – only expert opinion
- Repetitive concussions are associated with neuro-cognitive deficits
- Things to Consider for Retirement From Sport:
  - Prolonged or unresolved post-concussion symptoms,
  - Permanent neurologic signs or symptoms,
  - Neuropsych testing that has not returned to baseline, or
  - Decrease in academic performance should not return to sports
- Red Flags:
  - Less force resulting in concussion
  - Longer recovery after concussion (>3 months)

# Head Conclusion

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- Become comfortable with identifying the signs/symptoms of concussion
- Return to learn and play depends on each individual's injury → cannot compare to prior or other athletes
- When in doubt, sit them out!

Ochsner™
Sports Medicine Institute

# Heart

Ochsner
Orthopaedics & Sports
Medicine Institute

ANDREWS INSTITUTE
ORTHOPAEDICS & SPORTS MEDICINE

# The day Denmark stood still: Christian


*was gone". This is the story about the heroes of Copenhagen and how Eriksen's life was saved - and what it meant for the nation.*

# Sudden Cardiac Death

Ochsner Sports Medicine Institute

**Table** Causes of Common Cardiac Death in Young Athletes

| Structurally Normal Heart | Structurally Abnormal Heart |
|---|---|
| Brugada syndrome | Hypertrophic cardiomyopathy |
| Long QT syndrome | Arrhythmogenic right ventricular cardiomyopathy |
| Catecholaminergic polymorphic ventricular tachycardia | Dilated cardiomyopathy |
| Commotio cordis | Left ventricular noncompaction |
| Other channelopathies | Congenital abnormalities of the coronary arteries |
| Electrolyte abnormalities | Marfan syndrome |
| Wolf Parkinson White syndrome | Valvular heart disease |
| | Myocarditis |
| | Coronary artery disease (athletes >35 years old) |

https://www.acc.org/latest-in-cardiology/articles/2019/12/01/24/42/focus-on-ep-sudden-cardiac-death-in-athletes

# Cardiac Examination

## Most important part of the pre-participation physical

- Cardiac history (personal, family)
  - History of fainting/syncope?
  - Family history of sudden, early cardiac death?
- Recent viral infection (including Covid)?
  - Additional cardiac clearance?

## Examination

- Heart auscultation
  - Any atypical sounds warrant further discussion and workup
- Pulses – wrist, ankle
- Blood pressure

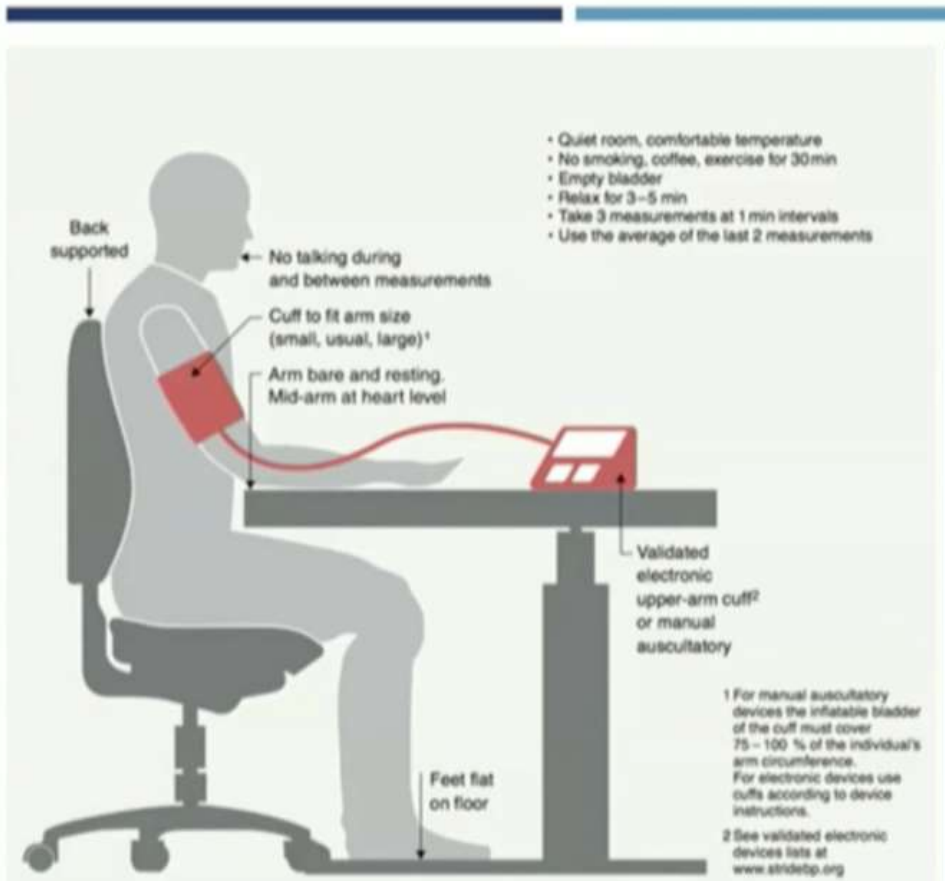
# Blood Pressure

## HYPERTENSION

- **>130 / >80 now considered HTN**
- Now “whitecoat HTN” requires more surveillance
  - Increased risk of heart attack and stroke
- **Lifestyle modifications** recommended first
  - Diet and exercise

## OSMI BLOOD PRESSURE RECOMMENDATIONS

- <120/<80 - Normal - CLEARED - no further action
- 120-129/<80 - Elevated - CLEARED - no further action
- 130-179/80-119 - Elevated - CLEARED and **workup needed**
- >180/120 or greater - hypertensive urgency or hypertensive emergency (if symptoms are present) - **NOT CLEARED** and they need a proper clinic work-up




Thomas Unger. Hypertension. 2020 International Society of Hypertension Global Hypertension Practice Guidelines, Volume: 75, Issue: 6, Pages: 1334-1357

# STANDARDS FOR ACCURATE BP MEASUREMENT

- Automated machine, fidelity check at www.validateBP.org
- Consider leg BP measurement and brachial-femoral delay assessment
- 2-3 measures and average the values
- Wait an hour after exercise
- Confirm ≥ 2 occasions
- Home BP measurement (HBPM)

Buffalo Bills player Damar Hamlin is in

Monday in Cincinnati.

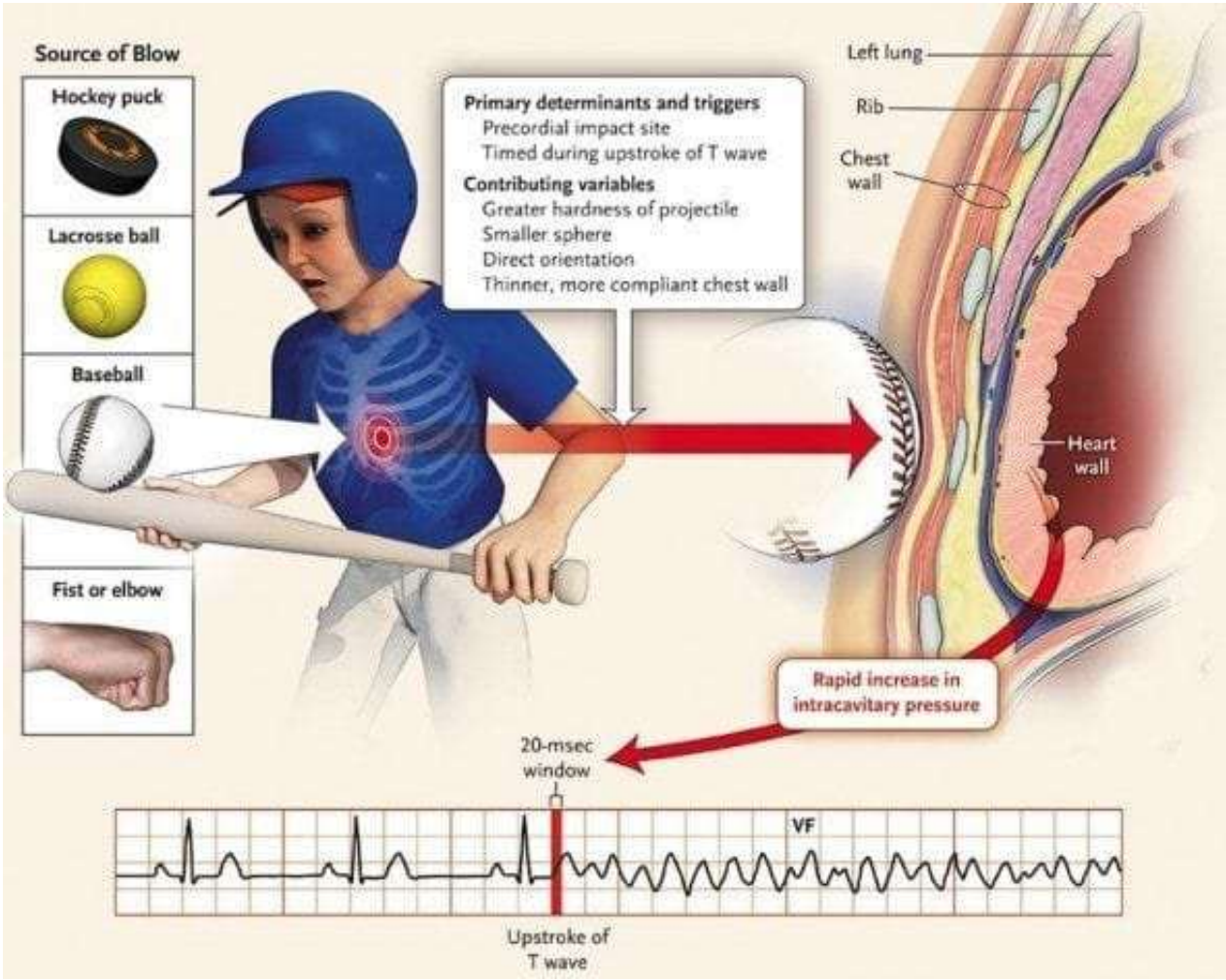
*Jeff Dean/AP*

# Commotio Cordis

5-15 years old

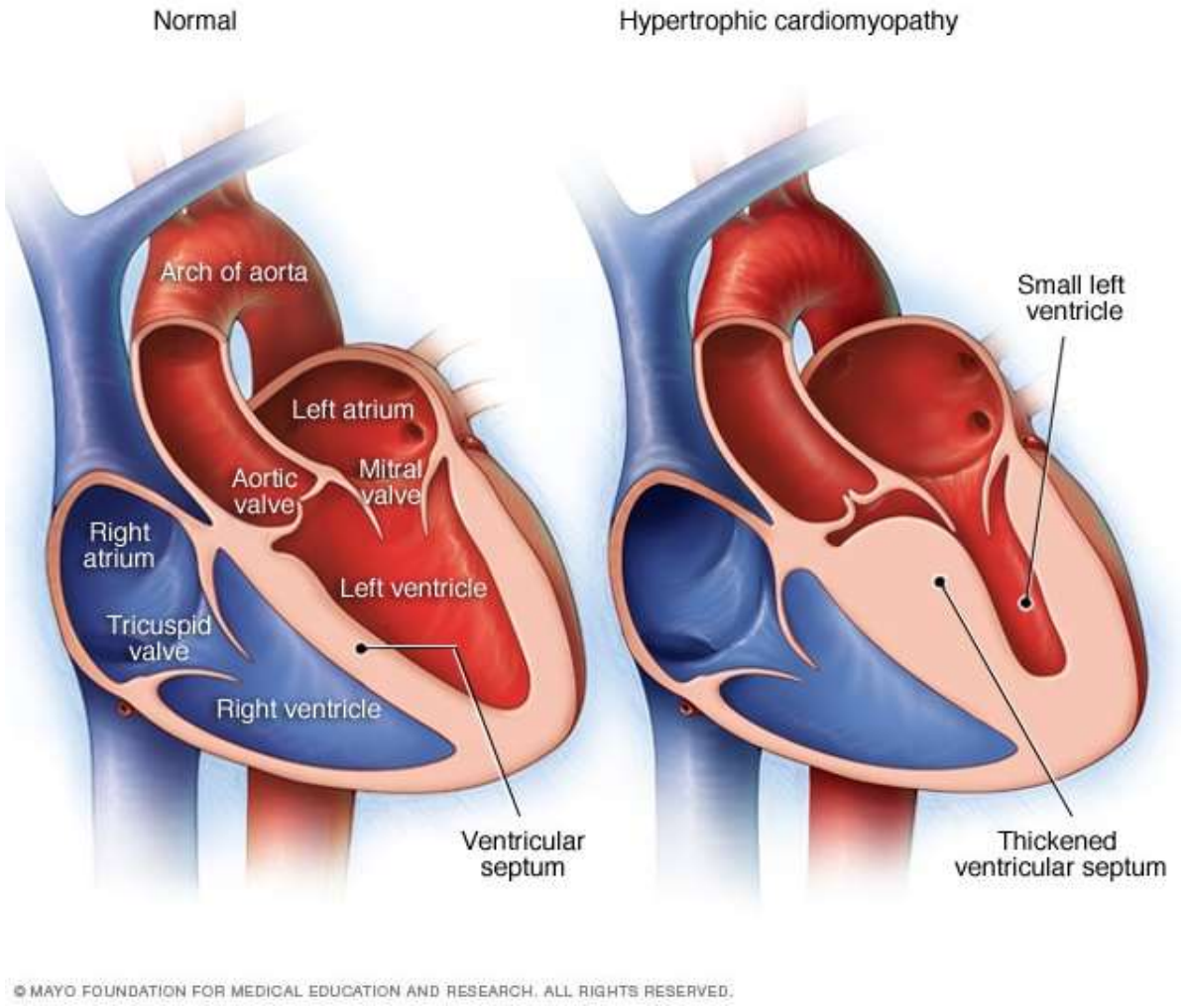
Ventricular fibrillation – AED

35% chance of resuscitation




https://www.grepmed.com/images/5372/cordis-cardiac-sudden-pathophysiology-commotio

# Hypertrophic Cardiomyopathy (HCOM)






https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.mayoclinic.org%2Fdiseases-conditions%2Fhypertrophic-cardiomyopathy%2Fsymptoms-causes%2Fsyc-20350198&psig=AOvVaw1wAmIh5DqhokbPiHTtZgAz&ust=1626663755211000&source=images&cd=vfe&ved=0CAwQjhxqFwoTCPCZue3Q6_ECFQAAAAAdAAAAABAD

- Generally asymptomatic
  - Occasional history of syncope/chest pain with sports
- See a physician if they're experiencing symptoms with sports
- Family history is common

# Automated External Defibrillator

Ochsner Sports Medicine Institute

# AED Facts

- Most effective within 3 minutes of arrest
  - Make sure it's close and ready to operate
  - Understand what steps to take
- Restart the heart, prevent brain damage (time is tissue)
- If used before EMS arrives → 2.6x greater chance of survival
- Survival jumps to about 67% (CPR+AED) from 43% (no AED)
- EAPs important to review locations/access
  - Point person to get the device
  - Know what it looks like

# Florida star Kevontae Johnson critical


and rushed to Tallahassee Memorial for evaluation.

# Myocarditis & Pericarditis

## Inflammation of/around the heart

## Can be seen following viral infections

## COVID-19 and myocarditis

- Rare complication post infection
- Extremely rare complication post vaccination
  - More common in boys, Moderna/Pfizer
- Currently following CDC guidelines for RTP

## Treatment

- Rest, time → can take up to 6 months
  - Limit exercise activity due to the risk of arrhythmia

# Heart Conclusions

- Education and awareness is essential
- Athletic decisions should focus on the present and future
- AEDs save lives
- Preparation, even if redundant, will make the difference
- This will never happen to you … until it does

# Questions?