Prevention Recognition and Tx of EHS & Recognition and Treatment of SCA

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KINESIOLOGY

Disclosures

- Dr. Eason is an employee at the University of Connecticut's Korey Stringer Institute which is a 501.3(c) not for profit. KSI works with corporate partners listed below who help fund the initiatives of KSI from a health and safety perspective.
- Grant Research Support:
  - National Athletic Trainers' Assoc.
  - National Football League
  - Brainscope Inc.
  - AmpHuman

Korey Stringer Institute

- In August 2001, Korey Stringer, a Minnesota Vikings offensive lineman, passed away from exertional heat stroke.
- Since the time of Korey's death, his wife, Kelci, worked tirelessly to develop an exertional heat stroke prevention institute to honor her husband's legacy.
- To that end, she joined forces with exertional heat stroke expert Douglas Casa, Ph.D, ATC at the University of Connecticut to make this dream a reality and the institute came to fruition in April 2010.

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- UNIVERSITY OF CONNECTICUT
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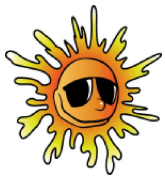
Notable Publications (Partial List):
- Eason CM, Gilchrist S, Pryor RR, Wiggins RA, Cao B, Stearns RL (2024) Factors Influencing Athletic Training Services in California Secondary Schools: A Partial Update. *Journal of Athletic Training* 59(1): 112-118. doi: 10.4085/1062-6050-0372.24.
- Martin, D., **Eason, CM**., Hughes, S. A., Tutt, D., Casa, D., (2024). Emergency medical planning for an ultra-marathon: a review with case examples of Swim Tuff. *Current Sports Medicine Reports*. 23(6), 216-223. doi: 10.1249/JSR.0000000000001077.
- Carlson, R., Henry, G., Roquet, S., Casa, D., Collins, K., **Eason, C.**, Ellis, G., Ellis, J., Fitch, W., Hunter, R., Nye, J., Jones, K. L., Mondello, M., Murphy, K., O'Neal, C., Pickney, R., Rafferty, K., Stevens-Miller, S., Silva, A. (2024). Medical time out trial. *Journal of Sports Medicine*, 58:768-776. Doi: 10.1136/bjsports-2024-108369

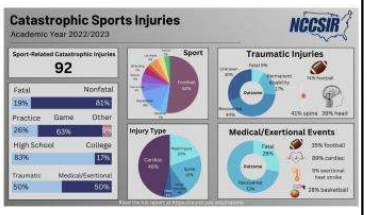
1. Provide brief overview of exertional heat stroke and differentiate from classic (non-exertional) heat stroke
2. Discuss EHS prevention strategies and treatment
   1. Heat Acclimatization
   2. Environmental Monitoring
   3. Cold Water Immersion and Cool First Transport Second
3. Describe best-practices for diagnosing EHS



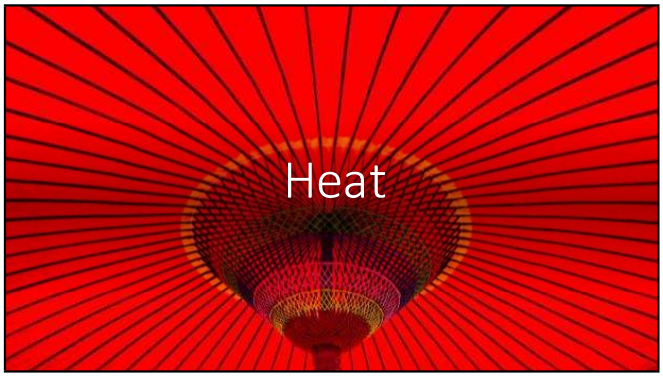
- Provide brief overview of SCA in youth athletes
  - Highlighting high school epidemiology
- Discuss recognition and treatment strategies of SCA

Catastrophic Injuries/Illness in Sport

- 92 sport-related catastrophic events were recorded from July 1, 2022 – June 30, 2023, during sport-related activities.[1]
  - Most of these events (83%) were at the high school level.[1]
- During a 40+ year period (1982-2023), 79% of catastrophic events occurred among high school participants.[1]



1. Kucera, K.L., Cantu, R.C. (2021). Catastrophic Sport Injury Research; Forty-First Annu al Report: Fall 1982-Spring 2023. The University of North Carolina at Chapel Hill.



Maximal Exercise in the Heat: A Physiological Dilemma

- Thermoregulatory
  - Body mitigates hyperthermia
    - example: ↑ skin blood flow, ↑ sweat rate
  - Fluid Demand (Muscles vs. Skin vs. Organs)
- Muscular
  - body rises to metabolic challenge
    - ↑ blood flow to muscles
- Cardiovascular
  - ↑ cardiac output to meet demands
  - Can NOT meet maximal demands of all systems
  - BP maintained at expense of others

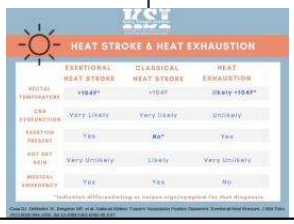
Not all Heat Stroke is the Same

Exertional Heat Stroke

Exertion, intense physical activity

Classic Heat Stroke

Passive, caused by environmental exposure

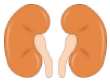


EHS's Impact on the Body

Thermoregulatory System

Musdes

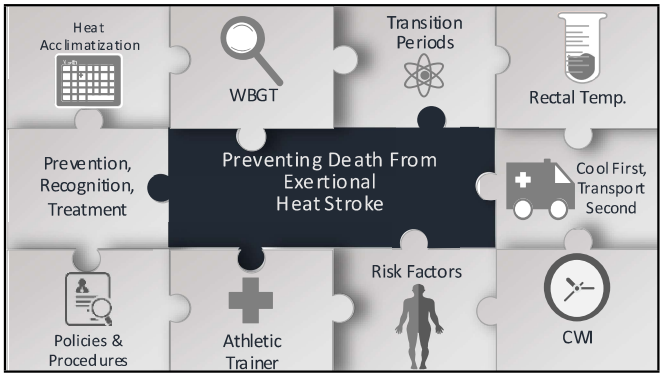
Kidneys



Liver

Brain Function

Heart



Heat Acclimatization

Heat Acclimatization

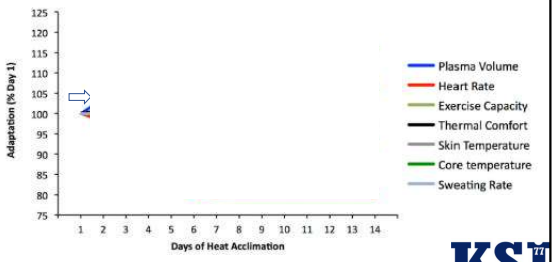
DID YOU KNOW

- Athletes are 10x more likely to have a heat illness when practice exceeds 3 hours and on double practice days.
- Heat acclimatization has been shown to reduce cardiac, sickle cell, and heat related deaths.
- Adaptations gained through heat acclimatization have been shown to improve performance.

What is Heat Acclimatization?

The process of improving heat tolerance and performance that comes from gradually increasing intensity and/or duration of activity in the heat. The best way to acclimatize is to gradually increase workload in the heat over a two week period.

Heat Acclimatization



Periard, Scand J Med Sci Sports 2015: 25 (Suppl. 1): 20–38

Heat Acclimatization

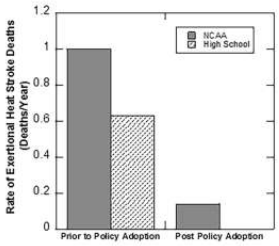
Area of Practice Modification	Practices 1-5		Practices 6-14
	Days 1-2	Days 3-5	
# of Practices Permitted Per Day	1		2, only every other day
Equipment	Helmets only	Helmets & Shoulder Pads	Full Equipment
Maximum Duration of Single Practice Session	3 hours		3 hours (a total maximum of 5 hours on double 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

NOTE: warm-up, stretching, cool-down, conditioning, and weight-room activities are included as part of practice time

Secondary School Guidelines

Preseason Heat-Acclimatization Guidelines for Secondary School Athletics. Journal of Athletic Training. 2009;44(3):332-33.

Heat Acclimatization Reduces EHS Deaths



States that mandate heat acclimatization observe a 55% reduction in exertional heat illness (compared to states that do not mandate)

- Kerr et al. Environment & Health Perspectives, 2019

Casa DJ, Hosokawa Y, Belval LN, Adams WM, Stearns RL. Preventing death from exertional heat stroke – The long road from evidence to policy. *Kinesiology Reviews*. 2017; 6:99-109.

Korey Stringer Institute
University of Connecticut

Environmental Monitoring

$WBGT=0.7T_W+0.2T_G+0.1T_D$

T_W is the wet bulb temperature, which indicates humidity

T_G is the globe temperature, which indicates radiant heat

T_D is the ambient air (dry) temperature

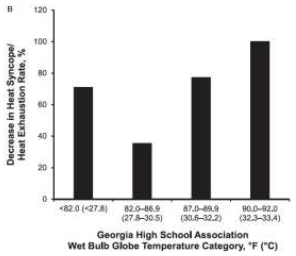
Environmental Monitoring

Cat 3	Cat 2	Cat 1	Activity Guidelines
< 82.0°F <27.8°C	< 79.7°F <26.5°C	< 76.1°F <24.5°C	Normal Activities – Provide at least three separate rest breaks each hour with a minimum duration of 3 min each during the workout.
82.2 - 86.9°F 27.9-30.5°C	79.9 - 84.6°F 26.6-29.2°C	76.3 - 81.0°F 24.6-27.2°C	Use discretion for intense or prolonged exercise; Provide at least three separate rest breaks each hour with a minimum duration of 4 min each.
87.1 - 90.0°F 30.6-32.2°C	84.7 - 87.6°F 29.3-30.9°C	81.1 - 84.0°F 27.3-28.9°C	Maximum practice time is 2 h. For Football: players are restricted to helmet, shoulder pads, and shorts during practice. If the WBGT rises to this level during practice, players may continue to work out wearing football pants without changing to shorts. For All Sports: Provide at least four separate rest breaks each hour with a minimum duration of 4 min each.
90.1 - 91.9°F 32.2-33.3°C	87.8 - 89.6°F 31.0-32.0°C	84.2 - 86.0°F 29.0-30.0°C	Maximum practice time is 1 h. For Football: No protective equipment may be worn during practice, and there may be no conditioning activities. For All Sports: There must be 20 min of rest breaks distributed throughout the hour of practice.
≥ 92.1°F ≥ 33.4°C	≥ 89.8°F ≥32.1°C	≥ 86.2°F ≥30.1°C	No outdoor workouts. Delay practice until a cooler WBGT is reached.

Fig. 2. Heat safety regions.

Environmental Monitoring

A WBGT Policy Reduces Heat Illness Rates by 35-100% in Warm & Hot Temperatures



Cooper ER et al. Heat policy revision for Georgia high school football practices based on data driven research. *JAT. 2020*

Environmental Monitoring – What About Games

The NSIAA Heat Participation Policy applies to both practices and games.

At least 30 minutes prior to the start of a game, the officials must be informed of the on-site WBGT reading and the recommended modifications if the WBGT reaches an Orange flag or Red flag (e.g. built-in water breaks).

There have been very few documented medical events during games; likely due to the nature of games having built-in extra breaks already (e.g. quarters and half-time).

Therefore, **modifications during games should include increased water breaks, access to fluids, and cooling zones.** Protective equipment must be removed during game according to the rule book however, for sports requiring protective equipment, the equipment must be removed and active cooling (e.g. cold towel rotation, misting fan) initiated during the built-in water breaks.

Keep in mind that acclimatization takes place during the preseason acclimatization period and it records demonstrates, therefore, must also follow the Heat Participation Activity Guidelines.

If the **WBGT reaches a Black Flag during the game, the game must be postponed for 30 minutes** followed by another WBGT reading (similar to the lightning rule). The game may not resume until the WBGT is below a Black Flag.

Prehospital Care of Patients with EHS

The Golden ½ Hour

Cells in our body can only survive at critically high temperatures for ~30 minutes, so rapid cooling is essential for survival.

EHS is a medical emergency

After initiating cooling, call 911 and contact onsite medical provider (if available) in the event of a suspected exertional heat stroke.

What to Do if You Suspect EHS

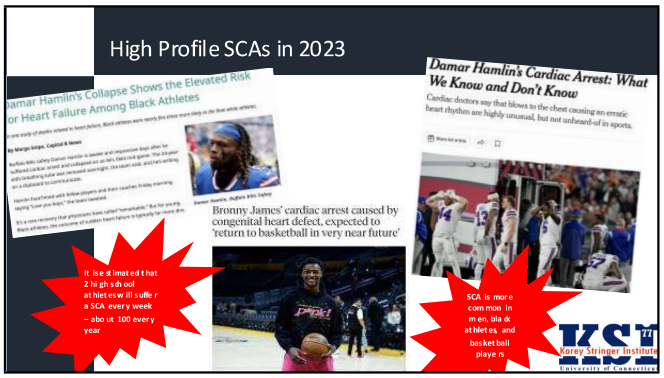
- Remove equipment and excess clothing
- Cool as quickly as possible via whole body ice water immersion
- Call 911 once cooling has been initiated
- Monitor vital signs
- Continue cooling until core temperature has reached 103°F
  - If unable to take rectal temperature continue cooling for 20 minutes, even if EMS arrives.

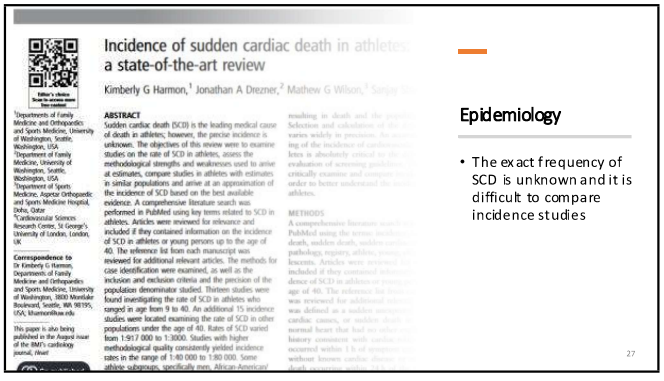
Let's Talk a Little Bit About Rectal Temperatures

	EHS	Heat Cramp	Heat Syncope	Ex Heat Exhaustion	Ex Hypo-natremia	Ex Sickling	Head Injury	Cardiac	Respiratory	Shock
CNS Dys	X		X	X	X	X	X	X	X	X
Dizziness	X		X	X	X		X	X	X	
Drowsy	X				X		X			X
Fatigue	X	X	X	X	X	X	X	X	X	X
Headache	X			X	X		X			
Light Head			X	X	X		X	X		X
Stagger	X			X	X	X	X	X	X	
Syncope	X		X	X				X	X	
Tunnel Vis			X					X		
Pers Change	X			X	X	X	X			
Lethargy						X	X	X	X	X
< 40C		X	X	X	X	X	X	X	X	X
> 40C	X									

Resources

NFL Health and Wellness Video




Incidence of sudden cardiac death in athletes: a state-of-the-art review

Kimberly G Harmon,[1] Jonathan A Drezner,[2] Mathew G Wilson,[3]

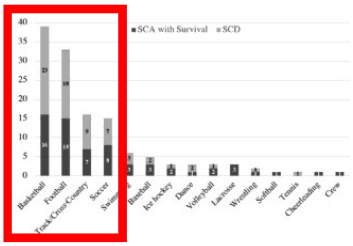
ABSTRACT

Sudden cardiac death (SCD) is the leading medical cause of death in athletes; however, the precise incidence is unknown. The objectives of this review were to examine studies on the rate of SCD in athletes, assess the methodological strengths and weaknesses used to arrive at estimates, compare studies in athletes with estimates in similar populations and arrive at an approximation of the incidence of SCD based on the best available evidence. A comprehensive literature search was performed in PubMed using key terms related to SCD in athletes. Articles were reviewed for relevance and included if they contained information on the incidence of SCD in athletes or young persons up to the age of 40. The reference list from each manuscript was reviewed for additional relevant articles. The methods for case identification were examined, as well as the inclusion and exclusion criteria and the precision of the population denominator studied. Thirteen studies were found investigating the rate of SCD in athletes who ranged in age from 9 to 40. An additional 15 incidence studies were located examining the rate of SCD in other populations under the age of 40. Rates of SCD varied from 1:917 000 to 1:3000. Studies with higher methodological quality consistently yielded incidence rates in the range of 1:40 000 to 1:80 000. Some athlete subgroups, specifically men, African-American

Epidemiology

- The exact frequency of SCD is unknown and it is difficult to compare incidence studies

Rates of SCA by Sport (Where does it happen?)

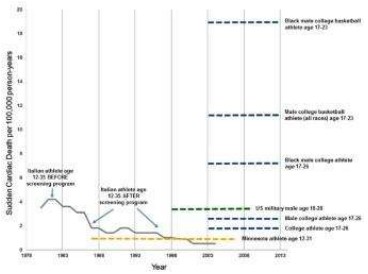


Top 4 sports account for 78% of all cases:

- BBK (30%)
- FB (25%)
- Track/XC (12%)
- Soccer (11%)

Drezner JA, Patterson DF, Siebert DM et al. Survival After Exercise-Related Sudden Cardiac Arrest in Young Athletes: Can We Do Better? Sports Health. 2019;11(1):91-98.

Rates of SCA (Who does it impact most?)



On Average:
~100 HS SCAs/yr
~1 every 3 days

Annual SCD Risk

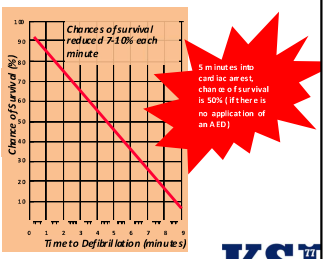
- 1 in 16,000 black male college athletes
- 1 in 9,000 male basketball athletes
- 1 in 4,000 male black basketball athletes

Drezner JA, Harmon KG, Asif IM, et al. Why cardiovascular screening in young athletes can save lives: a critical review. Br J Sports Med. 2016;50:1376-1378.

Why we advocate for AEDs, Emergency Action Plans (EAPs), on-site Athletic Trainers, and Coaching Education

Being Prepared to Treat SCA

- 1 in 70 high schools will have SCA on campus, almost half in athletes
- Over 85% survivable if:
  1. Witnessed
  2. EAP established and
  3. AED promptly applied
- EAP improves survival rate by 35%
- While 72% are trained in AED use only 34% of coaches practice EAP



Drezner JA, Torres dahl BG, Rao AL, Husd i E, Harmon KG. Outcomes from sudden cardiac arrest in US high schools: a 2-year prospective study from the National Registry for AED Use in Sports. Br J Sports Med.2013 Dec;47(18):1179-83.
Cummins RO. Annals Emer Med.1989;18:1269-1275

HS SCA Outcomes (How many can we save?)

- 1 in 70 high schools will have SCA on campus, almost half in athletes
- Over 89% survivable if:
  1. Witnessed
  2. EAP established and
  3. AED promptly applied
- EAP improves survival rate by 35%
- 34% of coaches practice EAP when 72% are trained in AED use

Drezner JA, Torres dahl BG, Rao AL, Husd i E, Harmon KG. Outcomes from sudden cardiac arrest in US high schools: a 2-year prospective study from the National Registry for AED Use in Sports. Br J Sports Med. 2013 Dec;47(18):1179-83.

The Smart Heart Sports Coalition

HEARTS Act and More State Legislation

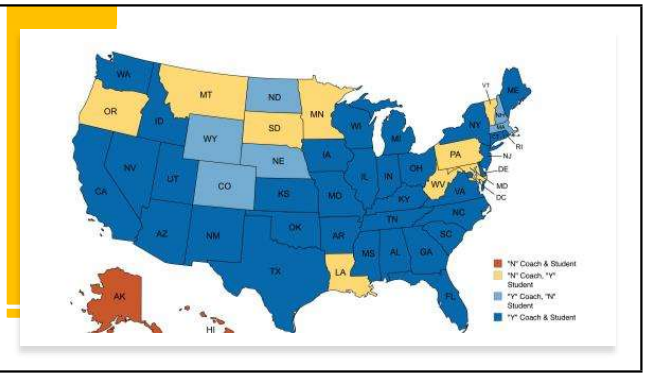
President Biden signs bipartisan HEARTS Act into law

The American Heart Association says bill will save lives in schools nationwide

Gov. Lee Signs Smart Heart Act Into Law

Tuesday, May 21, 2024

NASHVILLE, Tenn. - Today, Tennessee Governor Bill Lee signed the Smart Heart Act, legislation that requires automatic defibrillators in schools and establishes response protocols for cardiac-related medical emergencies. The bill received unanimous, bipartisan legislative support.



* Tale of Two Cities *

AED Helps Save Life of Loyola Blakefield (Md.) Lacrosse Player

Lawyer who filed wrongful death lawsuit of St. Henry soccer player Matthew Mangine Jr:

"The athletic director of St. Henry thought that the emergency action plan was a suggestion or guidance."

"She didn't know that it was Kentucky law."

12 minutes 'til AED Applied

State High School Sports Safety Policy Evaluation

Sudden Cardiac Arrest			20
	Screening (PPE questions and Physician clearance)		4
	Require 4th Edition PPE forms from American Academy of Pediatrics or equivalent	Y	4
	AED onsite at each venue or accessible within 1-3 minutes		16
	1A. AEDs are to be used under the advice and consent of a physician by individuals with proper training and certification	Y	2
	2A. AED should be stored in a safe place	Y	2
	3A. All athletic trainers, coaches, administrators, school nurses, and physical education teachers should have access to an AED on school property	Y	2
	4A. Institutions sponsoring athletic events/activities should have a AED on site or access to one at each athletic venue for practices, games, or other athletic events	Y	2
	5A. Individuals (all personnel involved with sponsored athletic events/activities) should be provided annual training and certification in cardiopulmonary resuscitation (CPR) and AED use	Y	2
	6A. Location of AED should be well marked, publicized, accessible and known among trained staff	Y	2
	7A. The AED should be used only after enacting the EMS system.	Y	2
	8A. AEDs should be inspected frequently to ensure proper working order. This includes making sure the batteries are charged, and wires and electrodes are in good condition	Y	2

Korey Stringer Institute
University of Connecticut

Advocacy Strategies that We Utilize

Korey Stringer Institute
University of Connecticut

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