

## The Practical Guide to Heat Stress and Emergency Incident Rehab

*What it is, what it isn't and how to get it done.*



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### Disclaimer

*There are many ways to skin a cat ... they are all bad for the cat*

We do not endorse any particular product. Involve your medical director and the person who writes the checks to determine what works in your situation.



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## Does heat stress really happen?

- "Heat injuries hit 7 FFs at Ft Bragg Fire"
- "Mo. Firefighters Overcome by Heat"
- "A 26-year-old Houston firefighter trainee who collapsed and later died of heat stroke after a 4.4-mile run in April 2009 probably would have survived if department trainers had provided water during the run or an ice water immersion facility to lower his body temperature, a federal safety investigation concluded."
- Three HazMat technicians treated for exertional heat illness at a tanker roll over.



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## What is rehab?

- An opportunity to correct the unwanted effects of work in the heat.
- Incidents **AND** training
- Structured vs. unstructured
- Incident vs. post incident



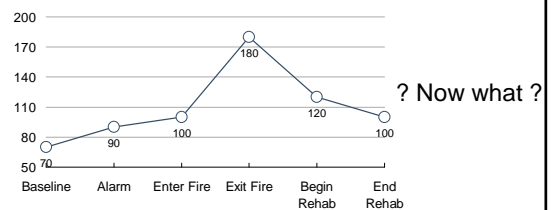
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## What are the effects of heavy exertion in the heat?

- "Uncompensable heat stress"
- Rising heart rate
- Rising core and skin temperature
- Platelet activation



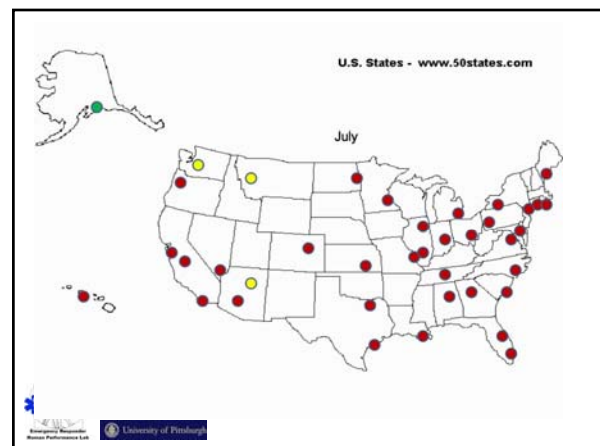
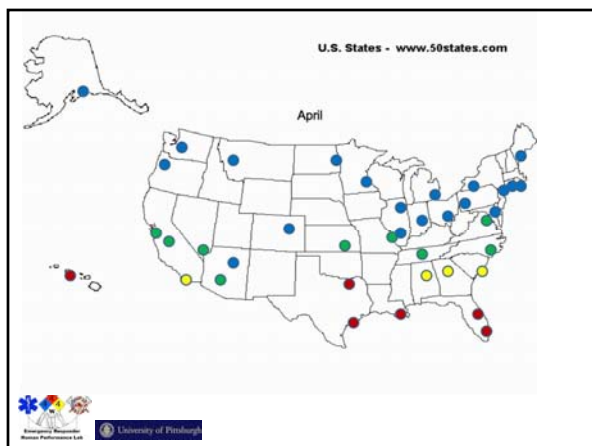
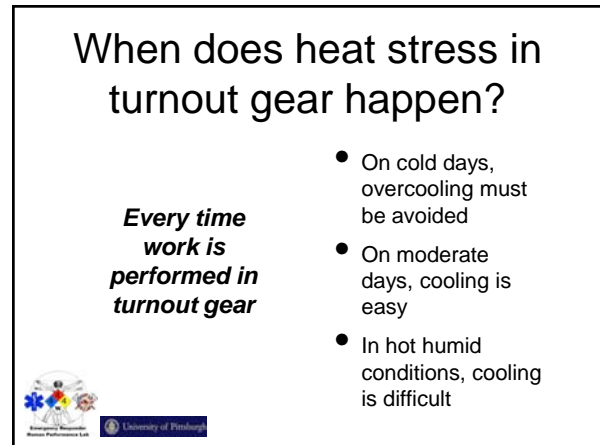
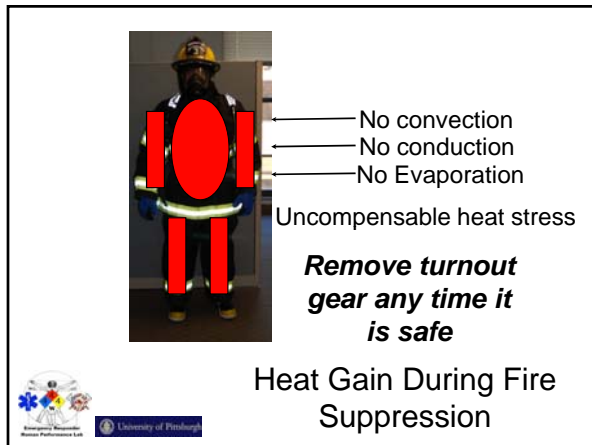
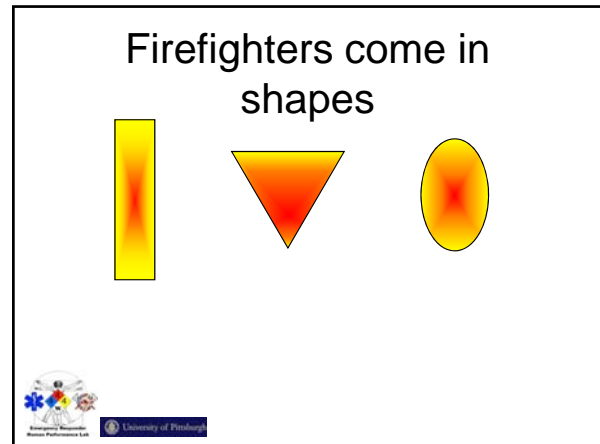
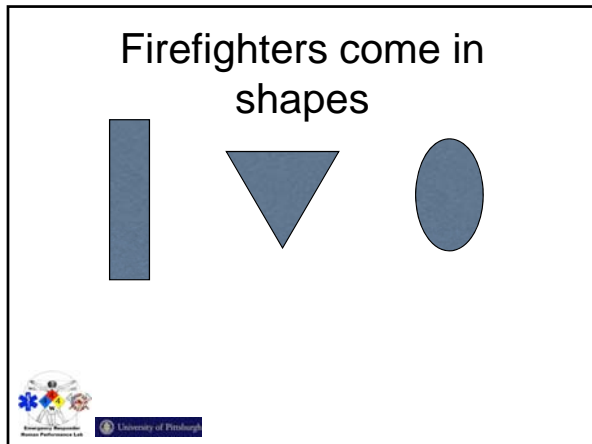
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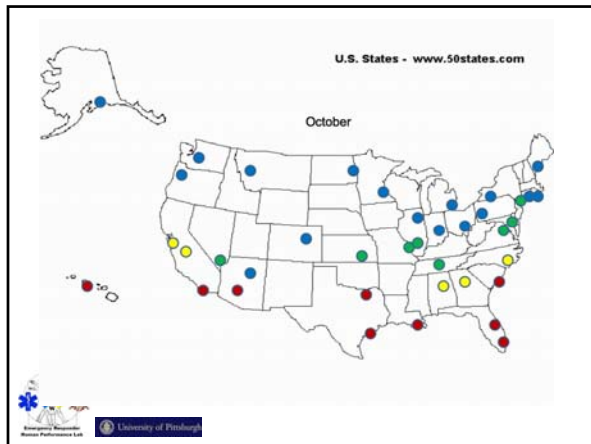


Heart Rate During Fire Suppression



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# Do the environmental conditions alter your operations?

## Elements of Rehab

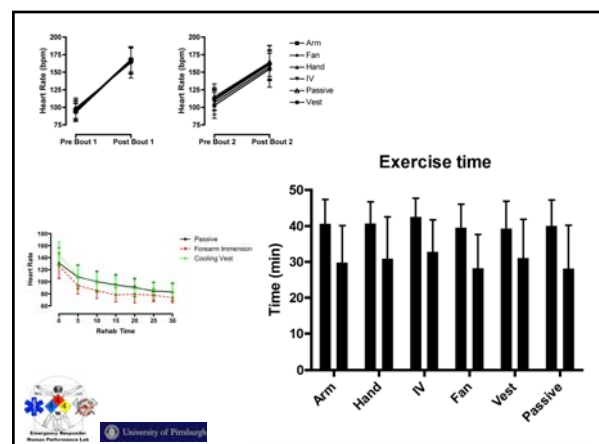
- Rest
- Rehydrate
- Recover

## Rest


- Helps heart rate recovery
- Allows time for core temperature recovery

## When & How Much?

- NFPA 1584
- Two 30-minute cylinders
- One 60-minute cylinder
- 45 minutes continuous work



- Scene dictates conditions
- You cannot work beyond your body's limits
- On scene with hard exertion
- 20-30 minutes (incomplete recovery)
- Post incident / Multiple incidents



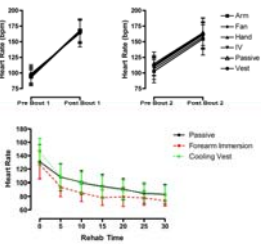

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### How many training exposures is too many?

Kory Stringer died after his second EHS exposure...

ERHPL lab studies: a second bout of work after 20 minute rehab is almost always limited by heart rate


Live fire studies: 20 minutes of fire suppression results in **significant** exertional heat stress that cannot be corrected in 30 minutes

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“The notion that *esprits de corps* can somehow defeat the principles of physiology is not only wrong but it is dangerously wrong.”

- Sir Roger Bannister 1989



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### Rehydration

**Prehydration is important**

Fire suppression: Firefighters responsibility



HazMat: Drink while screening and dressing

In the absence of certain medicines or vitamins, urine color is a reasonable estimate of hydration status



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### Which fluid to use?

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### Which fluid to use?

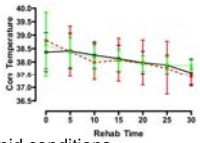



- On **average**, a firefighter will lose 700 - 1000 mL of fluid during 20 minutes of fire attack.
- For **full replacement**, 105% of loss must be consumed.
- Water is equivalent to sport drink in terms of performance.
- Full strength sport drink is acceptable.
- Taste matters.
  - Counter for hypoglycemia?
- It may not be possible to keep up with losses at each break.



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## Cooling

- Mother nature built a good machine
- Passive cooling is as good as active cooling **if conditions are favorable**
  - Cool temperatures
  - Low humidity
  - Turnout gear removed
- Active cooling required for hot humid conditions
  - Convection (moving air or water)
  - Conduction (still water)









Hungry firefighters are mean firefighters  
- Chief Larry Johnson




## Nutrition

- Consider nutrition on every incident
- Provide nutrition on multi hour incidents
- Not Good
  - High fat foods
  - Fast food
  - Pure carbohydrate
- Good
  - Sport bars or cereal bars
  - Mixture of carbohydrate and protein

## What rehab is not









## How is rehab done?





## Levels of rehab

- Awareness
- Operations
- Technician
- Specialist

## Rehab is scaleable

Awareness	Operations	Technician
Few personnel Bottled water Vehicle/Shade shelter Buddy monitoring	Coolers Tents/Busses Designated EMS crew	Major incident Continuous water supply Structures Multiple EMS crews


## Conditions and resources dictate cooling strategies

Cold	Moderate	Hot		
Shelter/Remove Gear	Shade/Remove Gear	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>1) Air Conditioning</td> </tr> <tr> <td>2) Cooling Devices</td> </tr> </table>	1) Air Conditioning	2) Cooling Devices
1) Air Conditioning				
2) Cooling Devices				


## Awareness

- “Company Level rehab”
  - 2-6 firefighters
- Every call where work was performed
  - Intensity varies with conditions
- Rescue company after extrication on hot day
- Be aware of number of responses
  - Consider “crew rest” as needed

## Awareness



- Monitoring
  - Vital signs
- Hydration
  - Water on trucks
  - Water on SCBA cylinders
- Cooling
  - Remove lots of turnout gear
  - Short pants in summer
  - Shade
  - Air conditioning in truck
- Post incident
  - Finish rehab before cleaning



## Awareness level cooling

1. Remove turnout gear
2. Air conditioning
3. Booster line
4. Tarp for shade
5. Ventilation fan



## Operations

- Longer and multi-company incidents
  - Residential structure fire
  - Major rescue incident (eg trench collapse)
- May be handled by EMS or rehab company
- Should employ an accountability system
- Should keep records of activity

## Operations

- May be a regional or department resource
- Preplan response
- Can you handle two companies at once?
- What is the surge plan?



## Operations



- Bring fluids
- Water or sport drink
- IV fluids only for extreme cases or medical emergencies
- Bring ice
- Can you "bring" a good environment?
- Bring something to sit on
- Shelter
  - Inflatable tents
  - EZ Up tents
  - Tarps



## Operations level cooling

- Manufactured



## Operations level cooling

- Home made



## A word about medical monitoring in the rehab sector

- Firefighters and HazMat technicians in rehab are not patients
- Presumably healthy
- Just completed some quantity of heavy physical exertion



## A word about medical monitoring in the rehab sector

- Everyone...
- looks bad when entering rehab
- is hot
- is tired
- has a high heart rate



## Use good clinical judgement

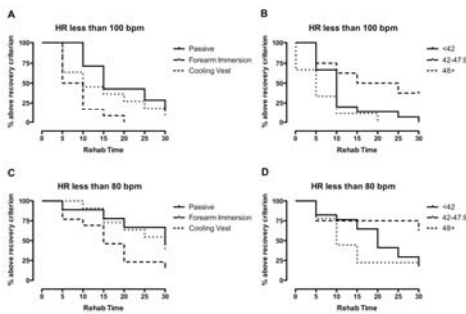
- High heart rate and temperature when removing turnout gear or HazMat ensemble **is normal**.
- Heart rates of 90-100 after 30 minutes is probably normal **but not necessarily recovered**.
- High heart rates and temperature beyond 40-45 minutes is **probably not normal**
  - Have you provided adequate cooling?
  - Have you provided adequate rehydration?
  - Is there an underlying medical condition?



## The other question you wanted to know...



## What is the relationship between fitness and rehab recovery??



## Conclusions

- We must agree that fireground rehab is important
- Reasons
  - Protects the public interest
  - Protects the responder
  - Protects the fire department



## Conclusions

- Responders cannot simply work through heat stress with a good outcome



## Conclusions

- There are multiple deliveries for emergency incident rehab
- Rehab is not difficult but it must be planned
- Perform a needs analysis
  - What conditions do most incidents occur in?
  - What are the worst conditions I respond in?
  - What resources can I bring to every incident?
  - How can I ramp up resources for larger incidents?





## People who make it possible

- Gavin Horn, PhD
- Denise Smith, PhD
- FEMA AFG FP&S EMW-2006-FP-02245
- Riana Czapla, MS
- Jennifer Seitz, MS



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## Thank you

- Dave Hostler, PhD
- Joe Suyama, MD
- Frank Guyette, MD
- Steve Reis, MD
- For more information about fireground rehab and emergency responder health and safety visit [www.firefighterresearch.org](http://www.firefighterresearch.org) or [www.erhpl.org](http://www.erhpl.org)



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