



**MINISTÈRE
DES ARMÉES**

*Liberté
Égalité
Fraternité*



EXERTIONAL HEAT STROKE

2022 Octobre 21st



13^e CMA
109^e AM Saint Maixent

What we will talk about ?

- Theoretical
- Support at the Acute Phase
- Practices

**EXERTIONAL HEAT STROKE (EHS) : TIME IS LIVER so
BE READY FOR COLD WATER IMMERSION (CWI) ... and
make sure YOUR GUYS ARE**

Exertional heat stroke (EHS) tripod:

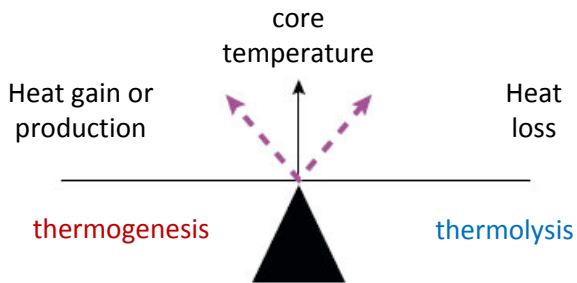
- ✓ consciousness disturbance
(from confusion to coma)
- ✓ hyperthermia
- ✓ During an intense and prolonged activity.
(end of a need-performance activity+++)















Pathophysiology

Normal conditions



Heat removal

- Radiation**
Infrared radiation


- Evaporation**



- Convection**
Solid-fluid


- Conduction**
Solid-solid




Adapted from : Pr SAGUI E. Jeudi de l'urgence, Marseille, le 16 novembre 2017



Why ?



F. intrinsic



F. extrinsic

- ambient temperature
- hygrometrie
- dress code

rushing



threshold

- medicine, drug
- sleep deprivation
- intercurrent pathology

predisposing

EHS

Exhaustion



Normal

Adapted from : Pr SAGUI E. Jeudi de l'urgence, Marseille, le 16 novembre 2017

EHS' Severity ?

> [Mil Med Res](#). 2020 Aug 27;7(1):40. doi: 10.1186/s40779-020-00269-1.

Establishment and effectiveness evaluation of a scoring system for exertional heat stroke by retrospective analysis

Meng-Meng Yang ^{# 1}, Lu Wang ^{# 2}, Yu Zhang ², Rui Yuan ², Yan Zhao ¹, Jie Hu ¹, Fei-Hu Zhou ¹, Hong-Jun Kang ³

Affiliations + expand

PMID: 32854781 PMCID: PMC7453553 DOI: 10.1186/s40779-020-00269

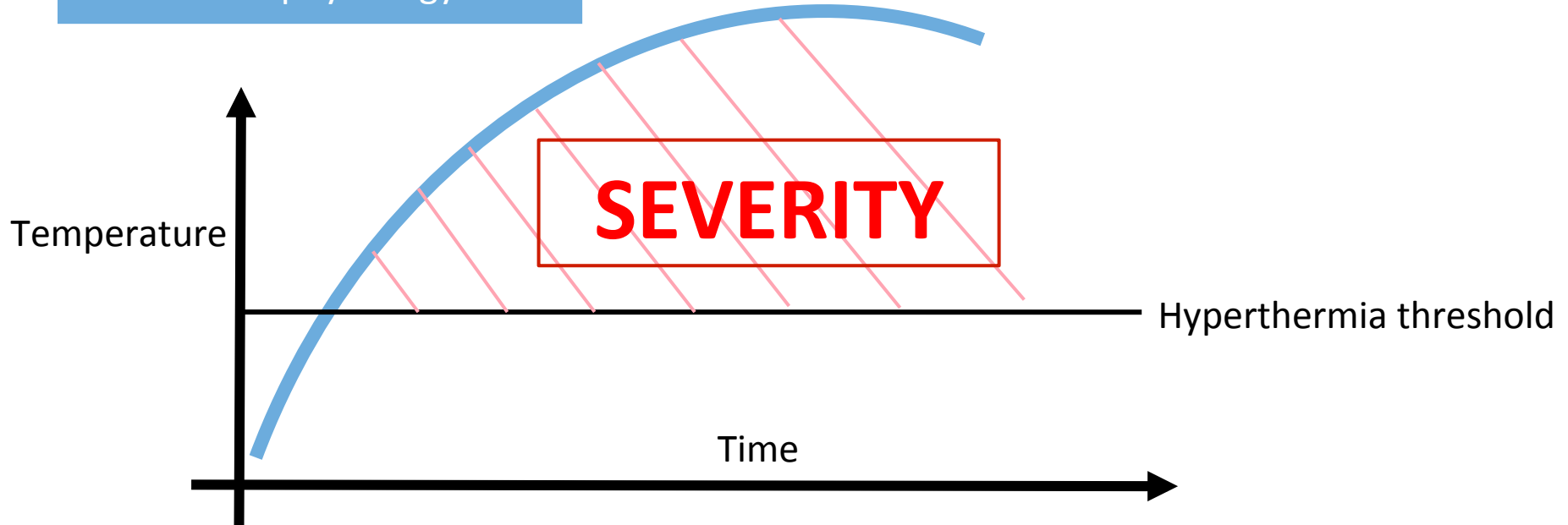
> [Am J Emerg Med](#). 2021 Dec;50:352-355. doi: 10.1016/j.ajem.2021.08.036. Epub 2021 Aug 18.

The value of the exertional heat stroke score for the prognosis of patients with exertional heat stroke

Pu Li ¹, Liu Yang ², Rui Liu ¹, Rui-Lin Chen ³

Affiliations + expand

PMID: 34454398 DOI: 10.1016/j.ajem.2021.08.036



Severity is correlated to the area under the temperature duration curve

Heled Y, Rav-Acha M, Shani Y, Epstein Y, Moran DS: The “golden hour” for heatstroke treatment. *Mil Med* 2004; 169(3): 184–6. 10.7205/MILMED.169.3.184.

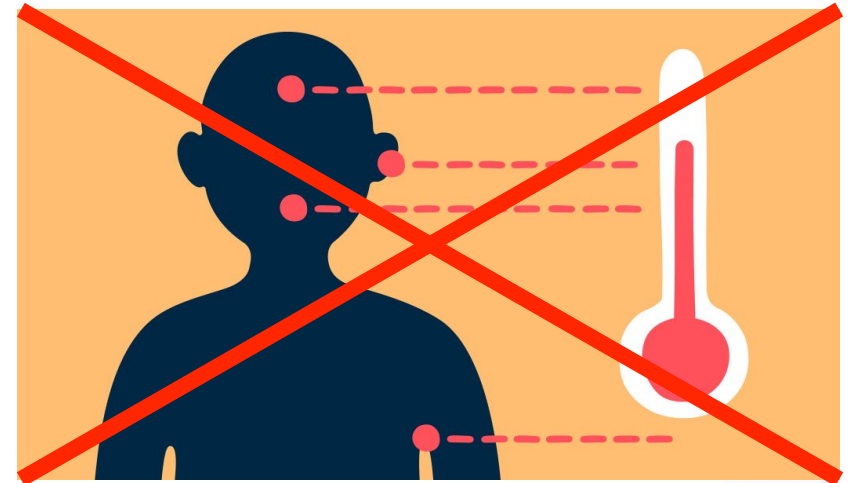
EHS' Severity: acute liver failure and acute renal failure ... after acute neurological failure

Firing: low heat 2 min each side



Hélène Windeck. Description des données biologiques dans le coup de chaleur d'exercice en milieu militaire. Sciences du Vivant [q-bio]. 2021. dumas-03475100

Which modality to measure central temperature ?



-Casa DJ, Armstrong LE, Ganio MS, Yeargin SW: Exertional heat stroke in competitive athletes. *Curr Sports Med Rep* 2005; 4(6): 309–17. 10.1097/01.CSMR.0000306292.64954.da

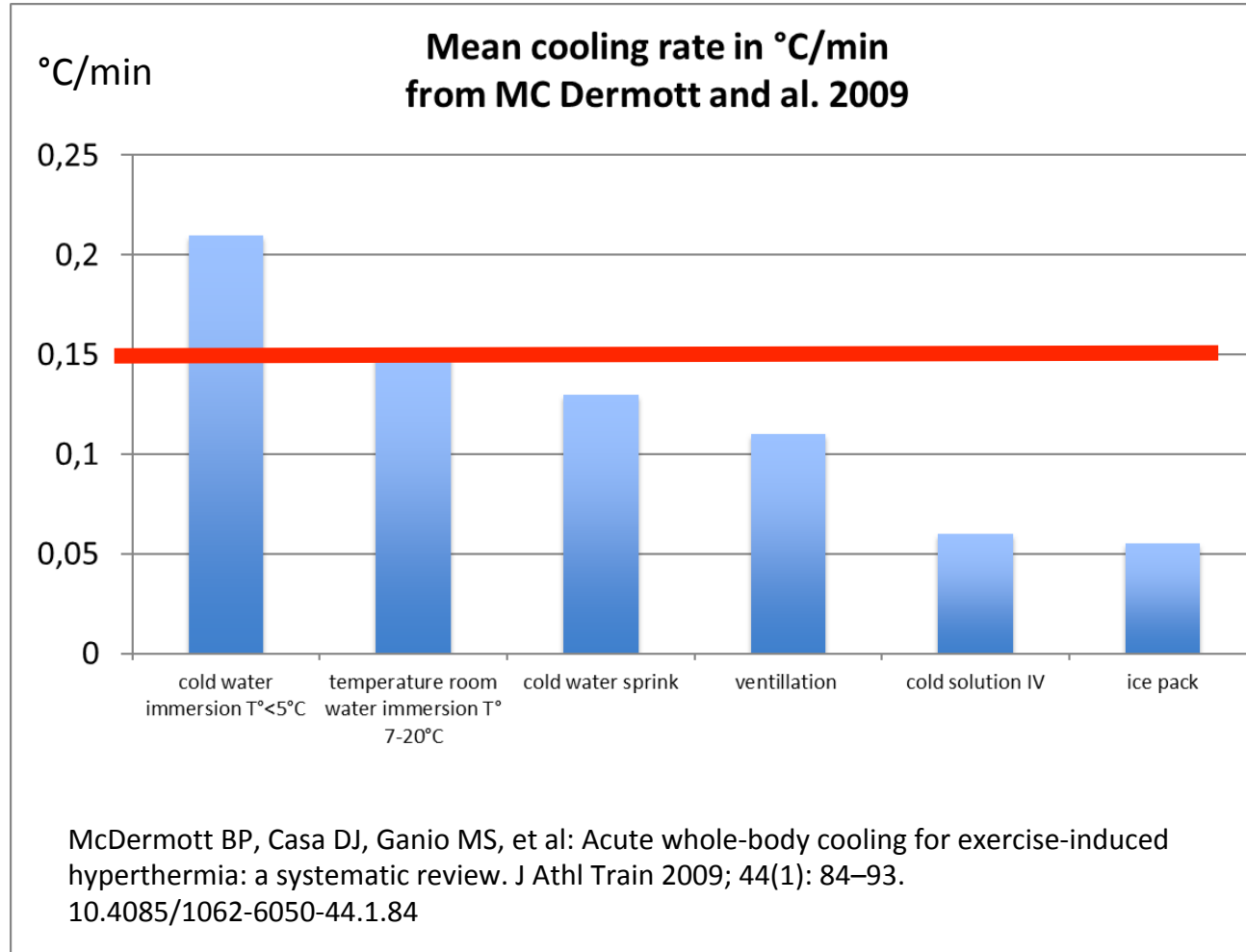
-Lee SM, Williams WJ, Fortney Schneider SM: Core temperature measurement during supine exercise: esophageal, rectal, and intestinal temperatures. *Aviat Space Environ Med* 2000; 71(9): 939–45

-Hosokawa Y, et al: Prehospital management of exertional heat stroke at sports competitions: International Olympic Committee Adverse Weather Impact Expert Working Group for the Olympic Games Tokyo 2020. *Br J Sports Med* 2021; 55(24): 1405–10. 10.1136/bjsports-2020-103854

Acute phase support

Acute phase support
recommendations:

- ✓ T°: intrarectale
- ✓ Cooling:
 - . early
 - . aggressive $>0,15^{\circ}\text{C}/\text{min}$



> [Medicina \(Kaunas\)](#). 2020 Nov 5;56(11):589. doi: 10.3390/medicina56110589.

Exertional Heat Stroke, Modality Cooling Rate, and Survival Outcomes: A Systematic Review

Erica M Filep ¹, Yuki Murata ², Brad D Endres ¹, Gyujin Kim ¹, Rebecca L Stearns ¹,
Douglas J Casa ¹

Affiliations + expand

PMID: 33167534 PMCID: [PMC7694459](#) DOI: [10.3390/medicina56110589](#)

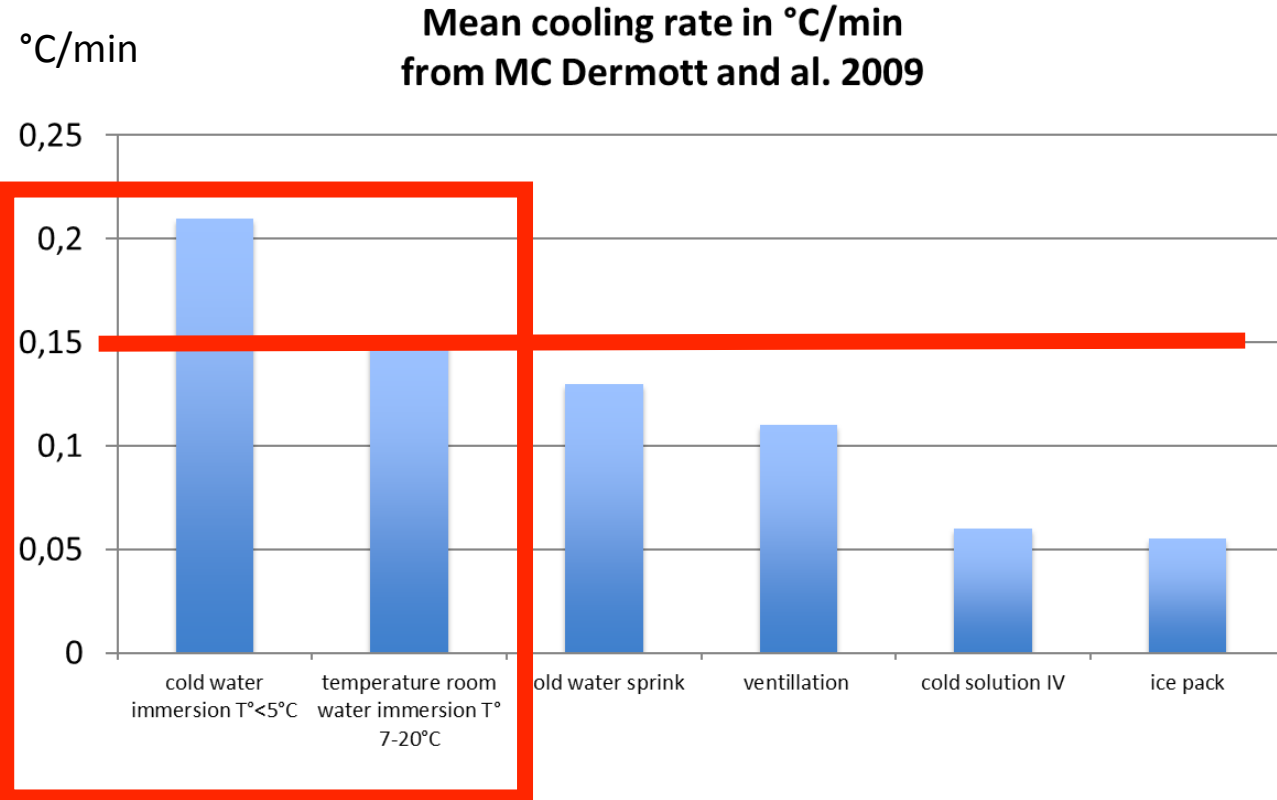
Total : 521 patients	Died	Survived with médical complication
Adequate cooling rate (>0,15°C/min)	0	23 (4.41%)
Insuficient cooling	4 (0.77%)	117 (22.46%)

Acute phase support

Acute phase support
recommendations:

- ✓ T°: intrarectale
- ✓ Cooling:
 - . early
 - . aggressive $>0,15^{\circ}\text{C}/\text{min}$

IMMERSION



McDermott BP, Casa DJ, Ganio MS, et al: Acute whole-body cooling for exercise-induced hyperthermia: a systematic review. *J Athl Train* 2009; 44(1): 84–93.
10.4085/1062-6050-44.1.84

Acute phase support

Acute phase support recommendations:

- ✓ T°: intrarectale
- ✓ Cooling:
 - . As soon as possible
 - . Immersion as cold as possible
 - . => STOP the firing



TIME IS LIVER

When to stop cooling ? No evidence based medicine

- ✓ If consciousness comes normal
- ✓ If the patient thrills (back from a thermoregulation and central core down)
- ✓ Not before $T^{\circ} < 38^{\circ}\text{C}$ if consciousness is still disturbed
- ✓ If T° is normal (differential diagnosis)

Acute phase support recommendations:

- ✓ T°: intrarectale
- ✓ Cooling: Immersion as soon and cold as possible

**TIME IS LIVER so
BE READY FOR CWI**

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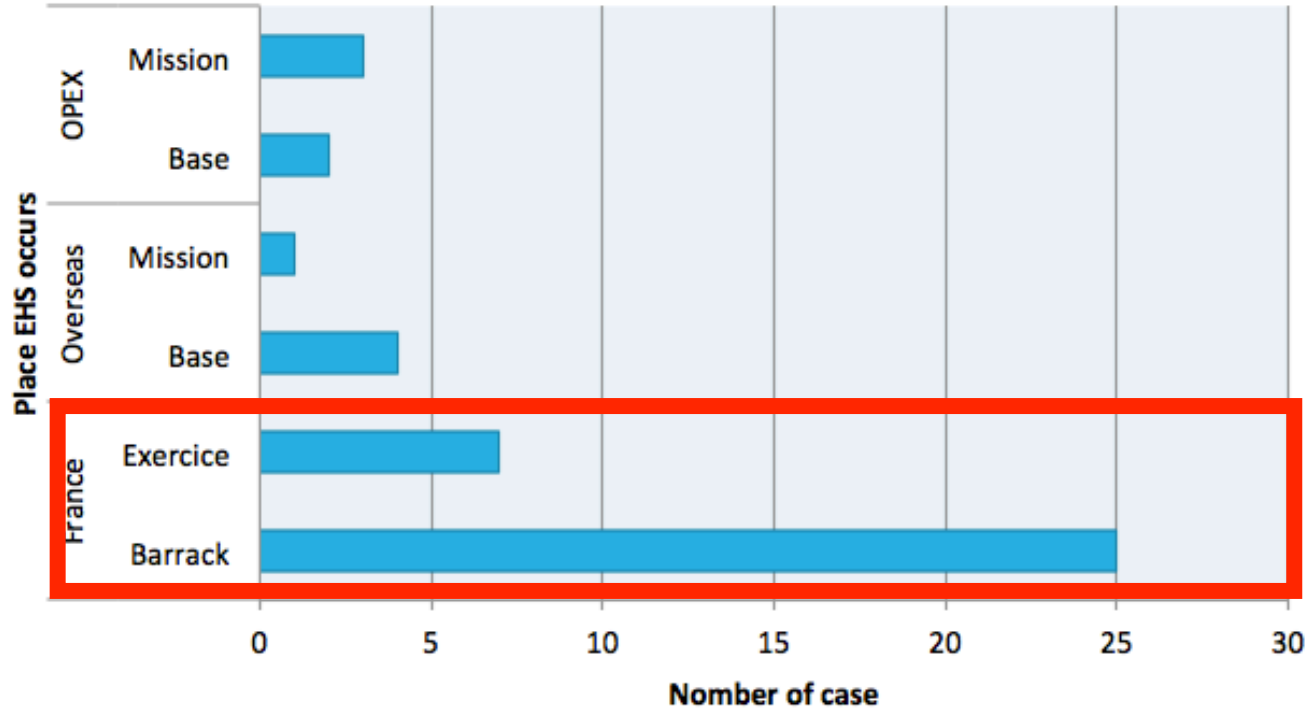
> [Mil Med. 2022 Aug 25;usac252. doi: 10.1093/milmed/usac252. Online ahead of print.](#)

Exertional Heatstroke Support at the Acute Phase: Assessment of Professional Practices in the French Military Forces

Thomas Gasc ¹, Alexandra Henrionnet ², Nicolas Cazes ³, Marie-Anne Haus ⁴,
Laurent Thefenne ⁵, Luc Aigle ⁶, Arnaud-Xavier Jouvion ⁵, Bertrand Lavenir ⁷

Place EHS occurs

In France



Gasc T, Henrionnet A, Cazes N, Haus MA, Thefenne L, Aigle L, Jouvion AX, Lavenir B. Exertional Heatstroke Support at the Acute Phase: Assessment of Professional Practices in the French Military Forces. *Mil Med.* 2022 Aug 25;usac252. doi: 10.1093/milmed/usac252. Epub ahead of print. PMID: 36004718.

Theoretical

Support at the Acute Phase

Practices

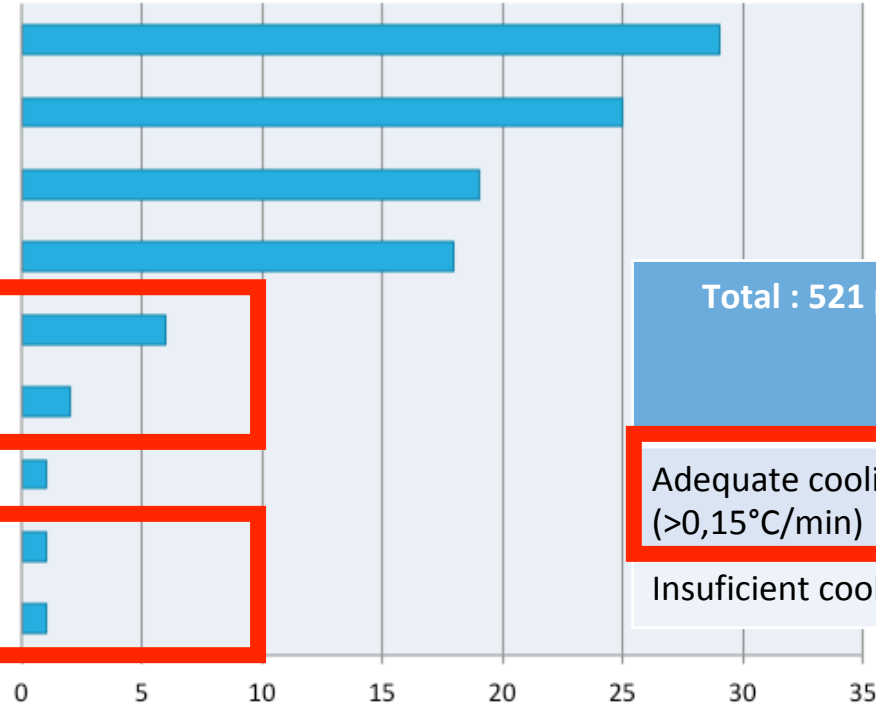
perspectives

Cooling techniques used

cooling method

cold water spink
ventilation
cold solution IV
Ice pack

cold water immersion
cold water immersion + cold solution IV
refrigerated tunnel
temperature room water immersion
temperature room water immersion + cold solution IV



Number of patients

Total : 521 patients

Died

Survived with
médical
complication

Adequate cooling rate
($>0,15^{\circ}\text{C}/\text{min}$)

0

23 (4.41%)

Insufficient cooling

4 (0.77%)

117 (22.46%)

Gasc T, Henrionnet A, Cazes N, Haus MA, Thefenne L, Aigle L, Jouvion AX, Lavenir B. Exertional Heatstroke Support at the Acute Phase: Assessment of Professional Practices in the French Military Forces. *Mil Med.* 2022 Aug 25;usac252. doi: 10.1093/milmed/usac252. Epub ahead of print. PMID: 36004718.

Acute phase support:

- ✓ Lacking of adequate logistic means in 90,7% (29/32)
- ✓ First responder is not a practitioner in 66,7% (28/42)
=> Are your guys ready ?

Gasc T, Henrionnet A, Cazes N, Haus MA, Thefenne L, Aigle L, Jouvion AX, Lavenir B. Exertional Heatstroke Support at the Acute Phase: Assessment of Professional Practices in the French Military Forces. *Mil Med.* 2022 Aug 25:usac252. doi: 10.1093/milmed/usac252. Epub ahead of print. PMID: 36004718.

Conclusion EHS



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Thank you for your attention



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