Hypothermia
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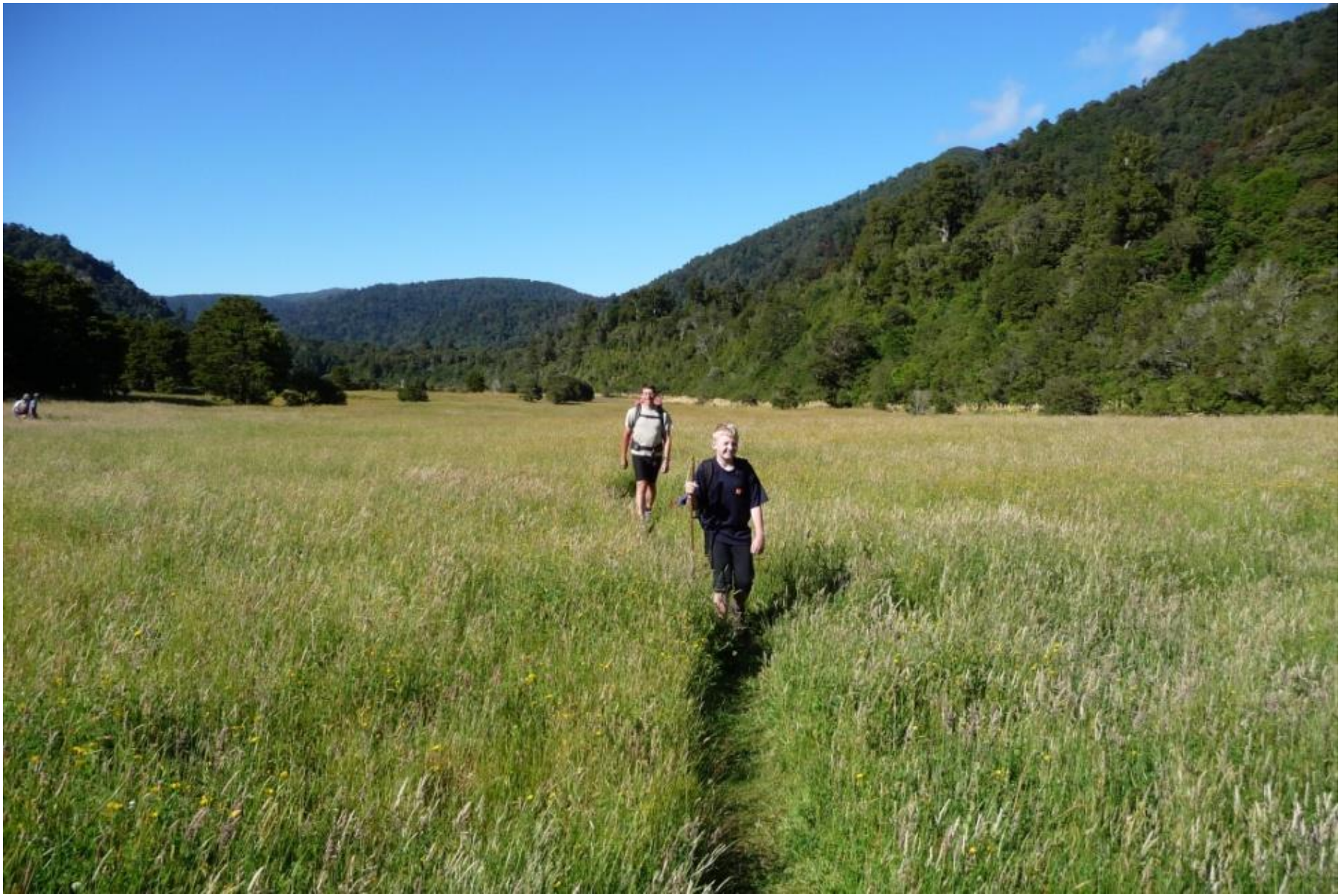
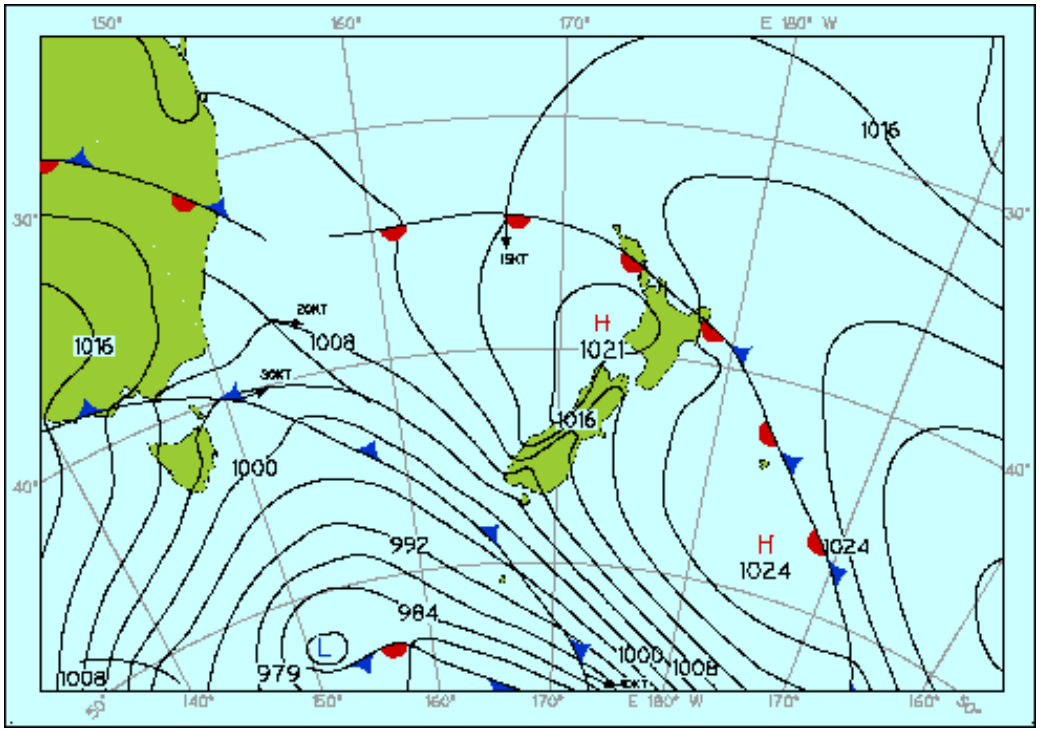
Dr Jenny Visser

Dept. Primary Health Care and General Practice



Outline

- What is hypothermia?
- How to recognise it
- How to prevent it
- How to treat it




X4

Nepal: Machermo Rescue Post and Porter Shelter: 4500m alt

WILDERNESS & ENVIRONMENTAL MEDICINE, 25, 401–408 (2014)

ORIGINAL RESEARCH

New Zealand Land Search and Rescue Operations: An Analysis of Medical and Traumatic Conditions

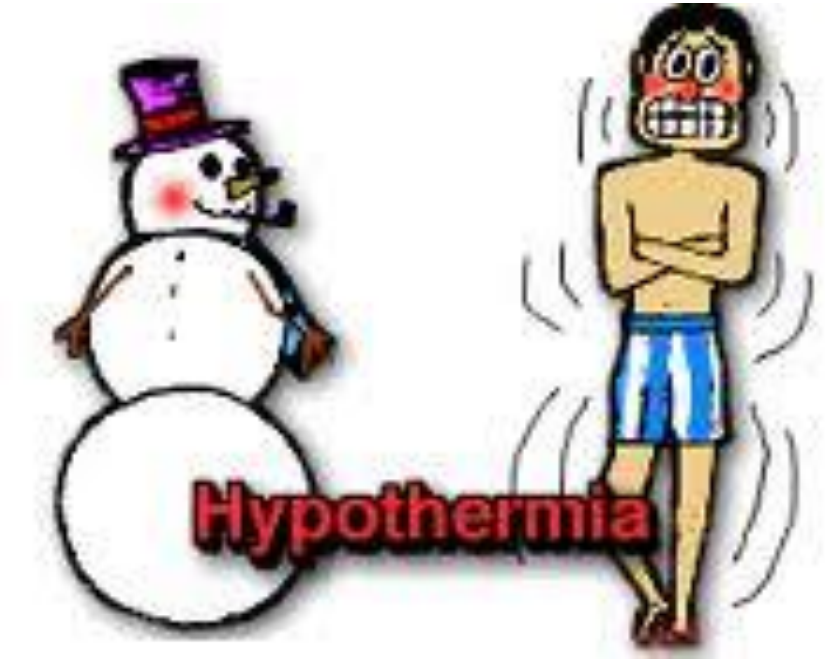
Jenny T. Visser, MbChB, MTravMed; Adam F.R. Campbell

From the Department of Primary Health Care and General Practice, University of Otago, Wellington, New Zealand (Dr Visser); Medical Student, University of Otago, Wellington, New Zealand (Mr Campbell).

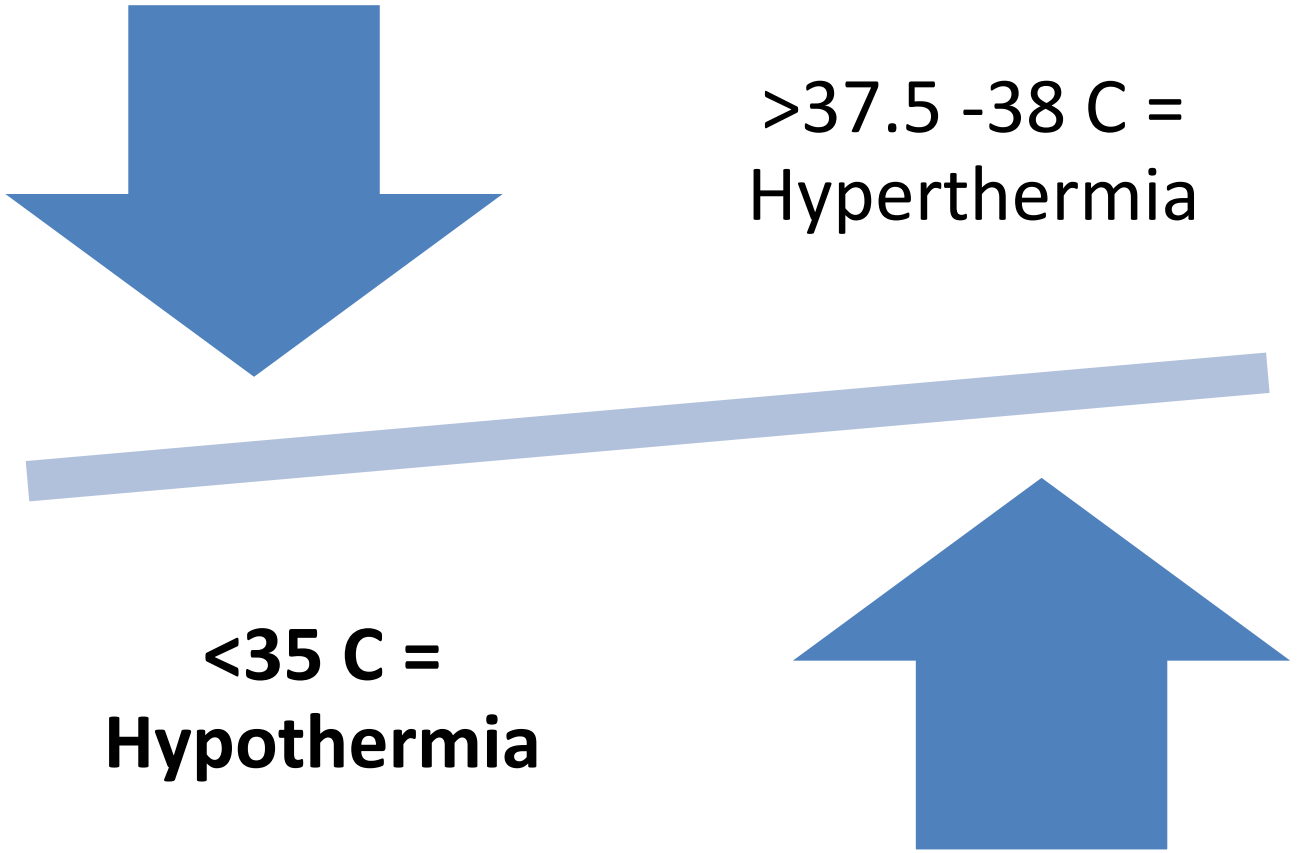
Hypothermia: 9.3% of all medical conditions in all SAR operations

Thermoregulation

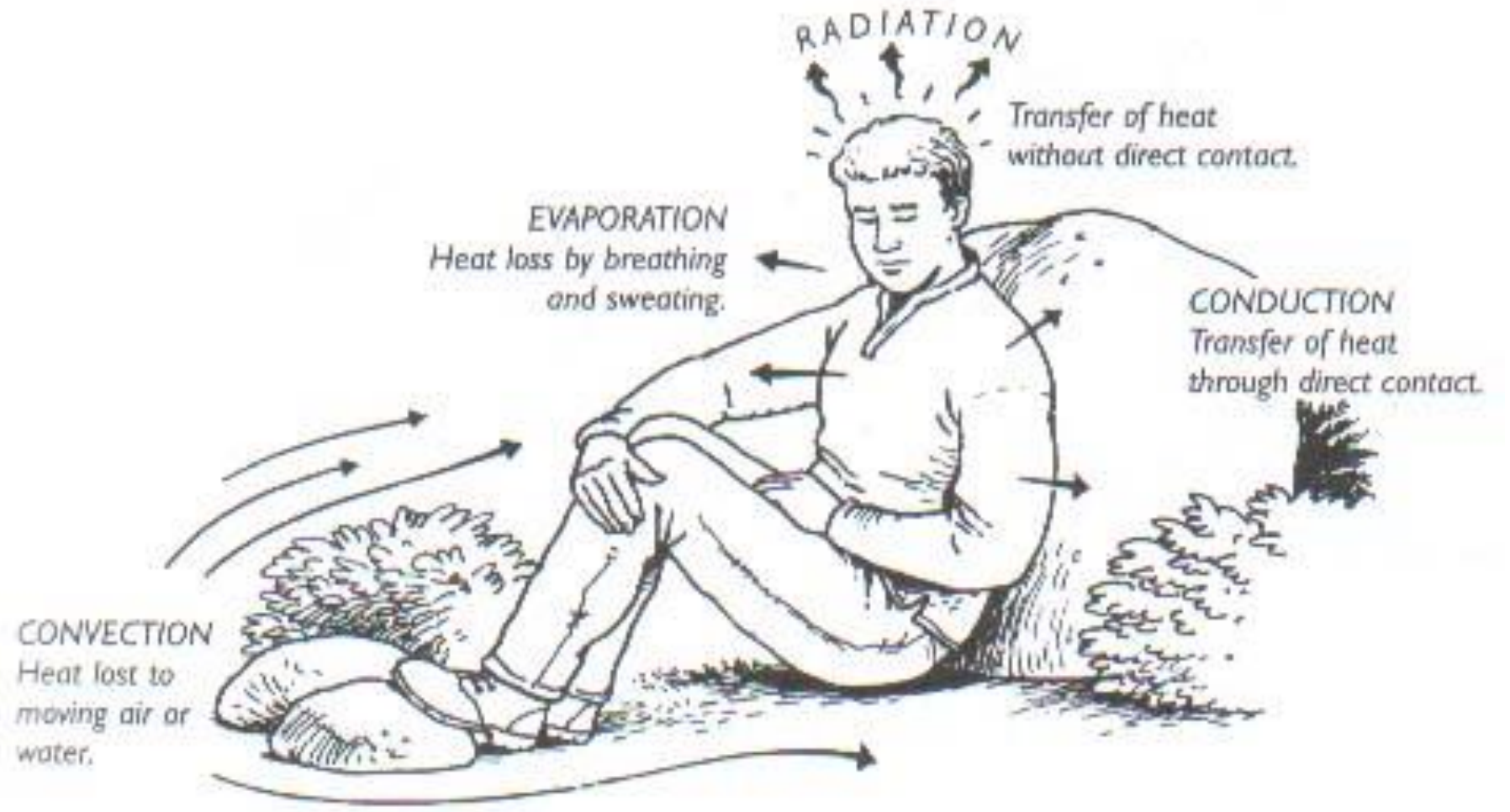
- Human body performs best at core temperature (Tc) around **37 (+/- ≈ 0.5)**
- **Hypo**thermia: develops when heat loss exceeds heat production
- **Hyper**thermia: develops when heat gain exceeds heat loss



Heat & Cold Illness & Injury



Thermoregulation



Out of the Jungle….

- Humans originated in tropics
  - Better equipped to deal with excesses of heat
  - Limited physiological ability to respond to cold
    - Exercise & shivering can only go so far…
    - Rely on **clothing, shelter & behaviour**

Hypothermia: Definition

- **35 °C -37 °C:** Not hypothermic. “Cold Stressed”
- **35 °C - 32 °C:** Mild hypothermia
- **32 °C – 28 °C:** Moderate hypothermia
- **< 28 °C :** Severe hypothermia

But….

- Definition based on measuring temperatures not much use in the outdoors
- Difficult to accurately measure core temp in the outdoors (even for medics)
- Variability between individuals
- So **estimate temp using observable findings**
  - **E.g. Original "Swiss Staging System" based on Level of Consciousness and Shivering**
- And in 2022 some suggested move to using **Level of Consciousness alone**

International Commission for Alpine Rescue Revised "Swiss System"

	Stage 1	Stage 2	Stage 3	Stage 4
Clinical findings[a]	"Alert" from AVPU	"Verbal" from AVPU	"Painful'' or "Unconscious" from AVPU **AND** Vital signs present	"Unconscious" from AVPU **AND** No detectable vital signs[b]
Risk of cardiac arrest[c]	**Low**	**Moderate**	**High**	**Hypothermic cardiac arrest**

"AVPU"

Hypothermia: Signs

- **35 °C -37 °C : Alert**, may be shivering
- **35 °C - 32 °C : Alert**, vigorous shivering
- **32 °C– 28 °C: ↓ level of consciousness (V, P, U)**, decreasing intensity shivering & may cease (**usually at around 30 °C)**
- **< 28 °C: Unconscious**, not shivering

The Importance of **Shivering**

- ↑ metabolism: generating heat due to muscle contraction
- ↑ heat production 5-6 fold over resting metabolic rate
- ↑ core temp by 3-4 °C
- BUT…
  - **Uses large amount of energy**
  - Stresses the cardiovascular system
  - Uncomfortable
- **Shivering usually stops around Tc 30 °C but lots of variability**

Shivering

- Shivering
  - "Passive rewarming"
  - Needs a source of energy: Carbohydrate rich **FOOD**
- Once shivering stops
  - Person can no longer generate heat/self heat → will continue to lose heat.
  - Person can only be actively rewarmed using exogenous heat sources: external or internal

Hypothermia: Who & When at risk?

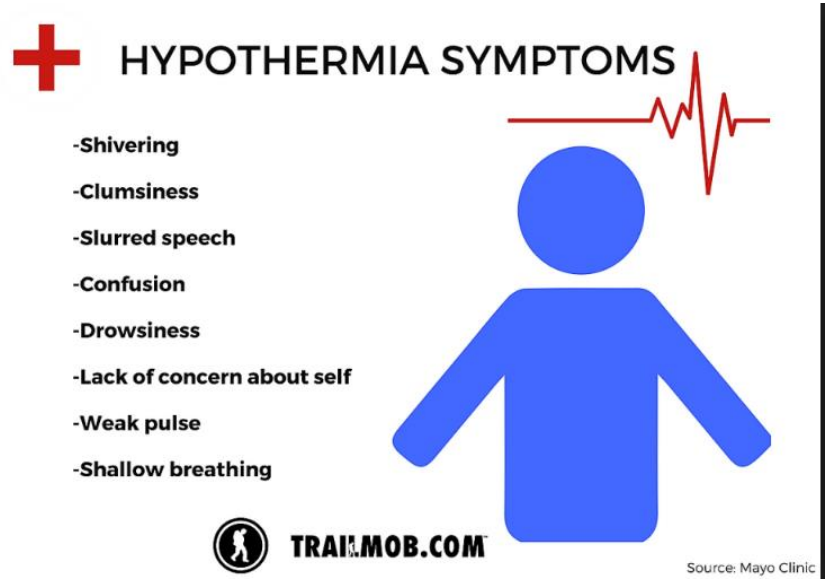
- **Cold environment, especially wet and wind**
  - But can occur in tropical/warm climate
- Ill prepared & inexperienced
- Injured & Anxious
- Recent illness
- Altitude
- Certain medications

Hypothermia: Signs: “Umbles”

- Mumbles
- Grumbles
- Fumbles
- Stumbles

Hypothermia: Symptoms

- Feel cold
- Muscle stiffness
- Fatigue
- Shiver
- “umbles”
- Pass urine: “Cold diruesis”



Prevention of Hypothermia:

Experience, fitness & acclimatisation

Have the right gear

Stay dry

- **Water & windproof gear**
- **Avoid over heating (clothing getting wet via sweat), wear multiple layers**
- **Be prepared to stop to add more layers & to remove replace wet gear**

Stay out of the wind

- **Reduce the impact of wind**

Stay well fed & well hydrated

Avoid cooling off during rest stops

Treatment of Mild Hypothermia:

Recognise early signs & act on them

Stop-if practical

Seek/make shelter

- Get out of the wind & rain

Replace wet with dry clothing (once in shelter)

- Head, neck & torso

Vapour barrier & Insulate (NB ground)

Support shivering /Feed carbohydrate rich foods

Wait at least 30 mins before exercising/continuing

If one member affected, assume all are at risk

Ads · Shop rab new zealand

RAB Group Shelter 2

$102.00 ~~$120~~

Outdoor Act…

★★★★½ (25)

Rab Emergency…

$279.99

Dwights Ou…

Rab Emergency…

$119.95

Outfitters NZ

Free delivery

Rab Emergency…

$194.99

Dwights Ou…

Rab Emergency…

$114.99

Dwights Ou…

Rab 2 Person Group Shelter

$99.99

Trade Me

More on Google →

Treatment of Moderate & Severe Hypothermia:

As per mild hypothermia plus….

Hypothermia wrap

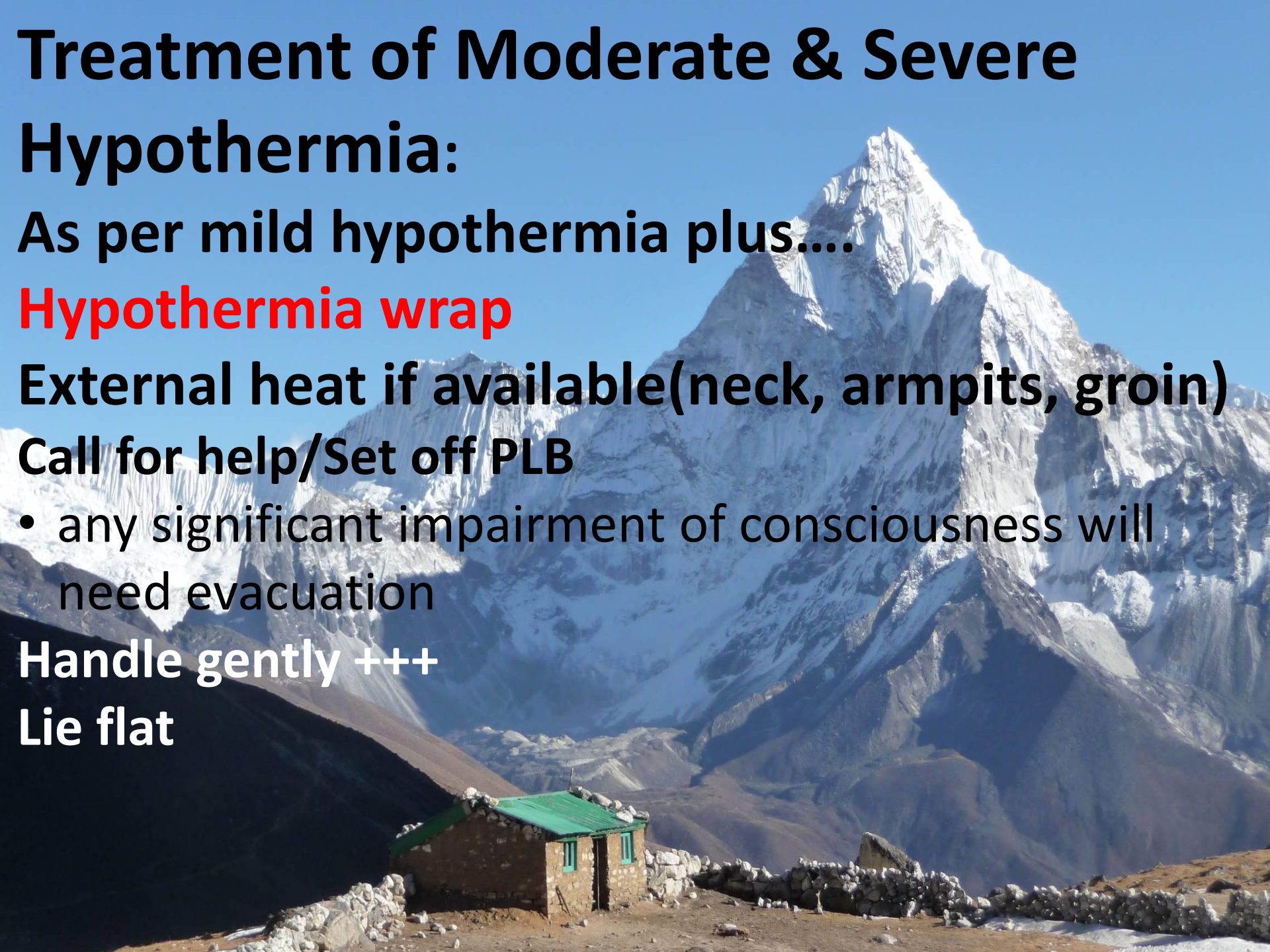
External heat if available(neck, armpits, groin)

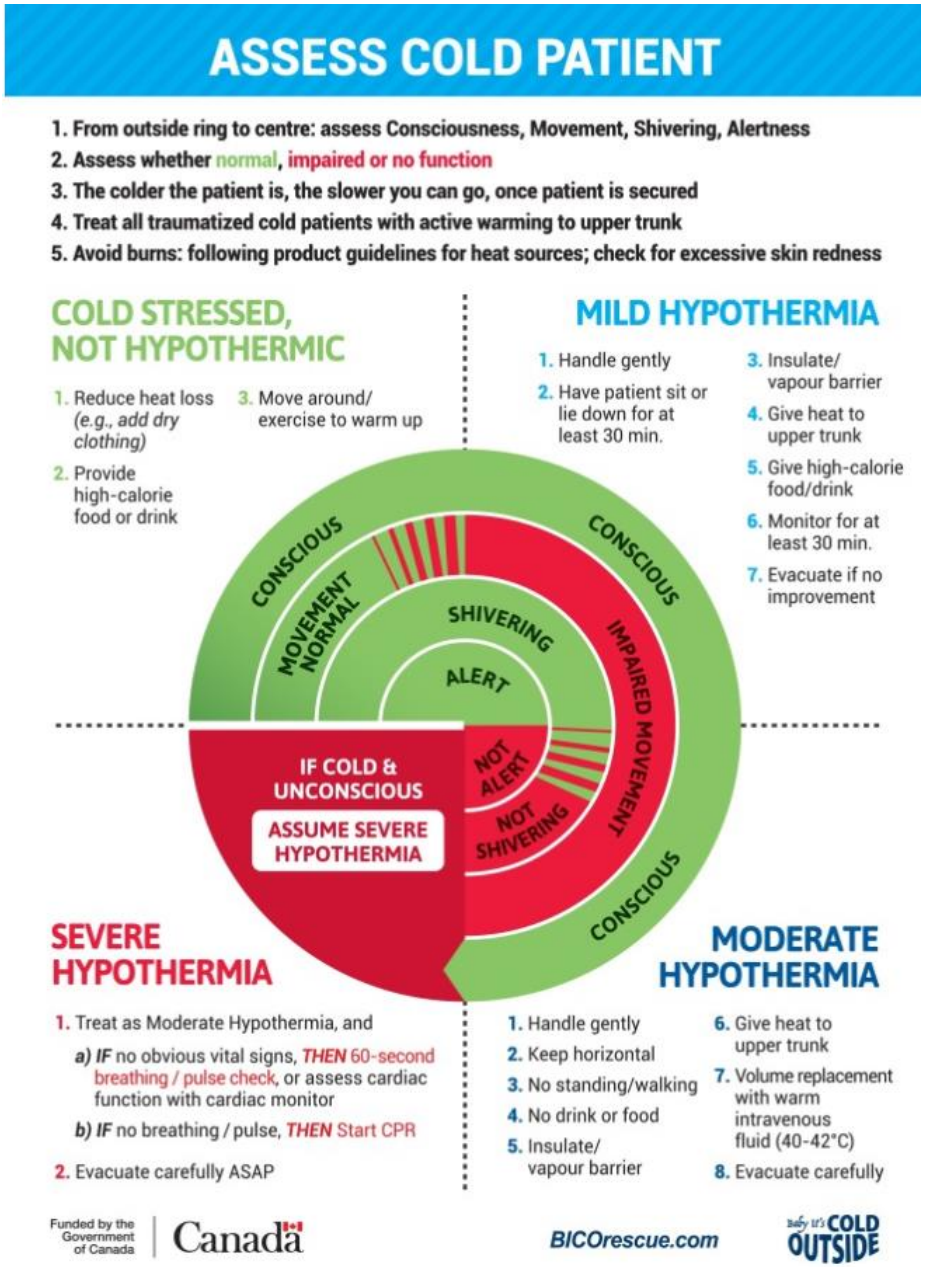
Call for help/Set off PLB

- any significant impairment of consciousness will need evacuation

Handle gently +++

Lie flat





Canadian “Cold Card”

https://www.sciencedirect.com/science/article/pii/S1080603218301212

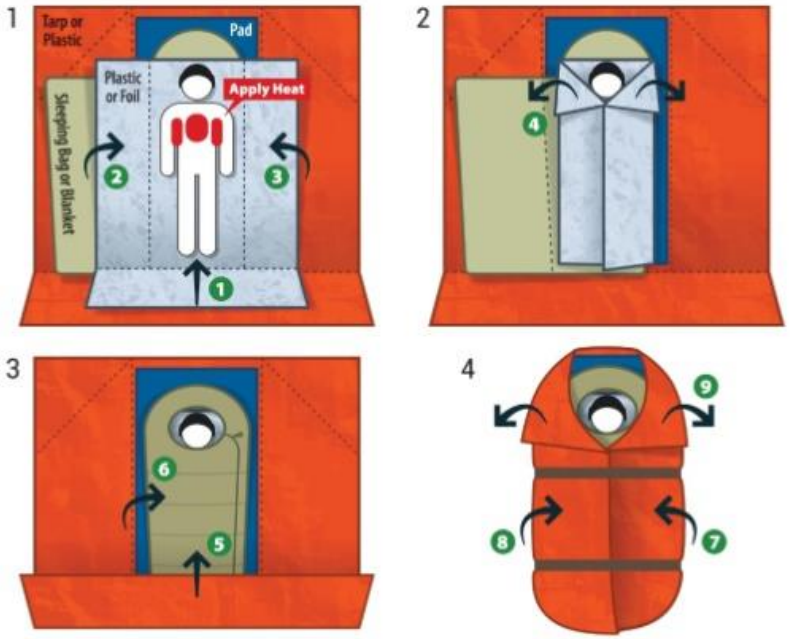
CARE FOR COLD PATIENT

SUGGESTED SUPPLIES FOR SEARCH/RESPONSE TEAMS IN COLD ENVIRONMENTS:

- **1** - Tarp or plastic sheet for vapour barrier outside sleeping bag
- **1** - Insulated ground pad
- **1** - Hooded sleeping bag (or equivalent)
- **1** - Plastic or foil sheet (2 x 3 m) for vapour barrier placed inside sleeping bag
- **1** - Source of heat ***for each team member*** *(e.g., chemical heating pads, or warm water in a bottle or hydration bladder),* or ***each team*** *(e.g., charcoal heater, chemical / electrical heating blanket, or military style Hypothermia Prevention and Management Kit [HPMK])*

INSTRUCTIONS FOR HYPOTHERMIA WRAP "The Burrito"

1. *Dry or damp clothing:* *Leave clothing on*
2. *Very wet clothing:*
   - ***IF*** Shelter / Transport is ***less than*** 30 minutes away, ***THEN*** *Wrap immediately*
   - ***IF*** Shelter / Transport is ***more than*** 30 minutes away, ***THEN*** *Protect patient from environment, remove wet clothing and wrap*
3. *Avoid burns: follow product instructions; place thin material between heat and skin; check hourly for excess redness*



Sources: BICOrescue.com; Zafren, Giesbrecht, Danzl et al. Wilderness Environ Med. 2014, 25:S66-85.

Hypothermia Wrap

Things NOT to do…

- Do NOT give alcohol
- Do NOT put in front fire (but do use fire to heat hut)
  - Evidence it worsens “after drop”
- Avoid extensive skin to skin or body to body exposure
  - Evidence it worsens “after drop”
  - Better to wrap up warmly
  - Can use body heat around the core

Afterdrop

- The core temperature continues to drop after initiation of rewarming
- Due to
  - Ongoing conduction of heat from warm core to cold periphery
  - Cool blood being returned to the heart
    - Movement of limbs
    - As reheating stimulates increased circulation
- Occurs with all methods of rewarming

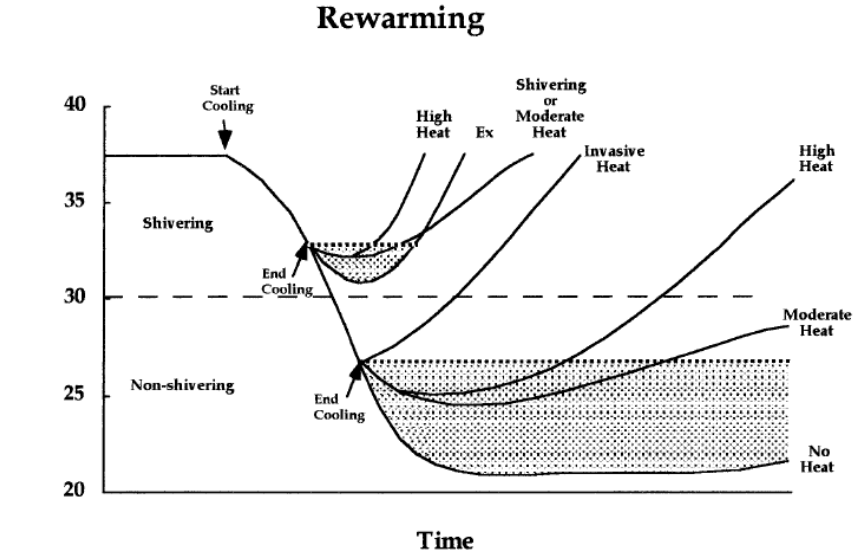


Figure 2. Schematic representation of relative effectiveness of various types of rewarming protocols for shivering and non-shivering patients.

Wet clothing: To remove or not?

- Traditional teaching has been to always “remove all wet clothing and replace with dry”
- Evidence that this might lead to a nett heat loss in severely hypothermic
- Some rescue guidelines now advise against removing wet clothing & instead advocate covering with a vapour barrier, add insulation & protect from wind
- **Will depend very much on where you are and time to rescue**
  - If rescue imminent (< 30 minutes), then probably best not to remove wet clothing
  - **In the NZ setting, in most situations, stick to the old guidelines. BUT, only remove wet clothing if you have shelter**

Why is it so difficult to get consensus?

- Lack of human studies
- Human studies usually of induced hypothermia in controlled environments
- Case reports

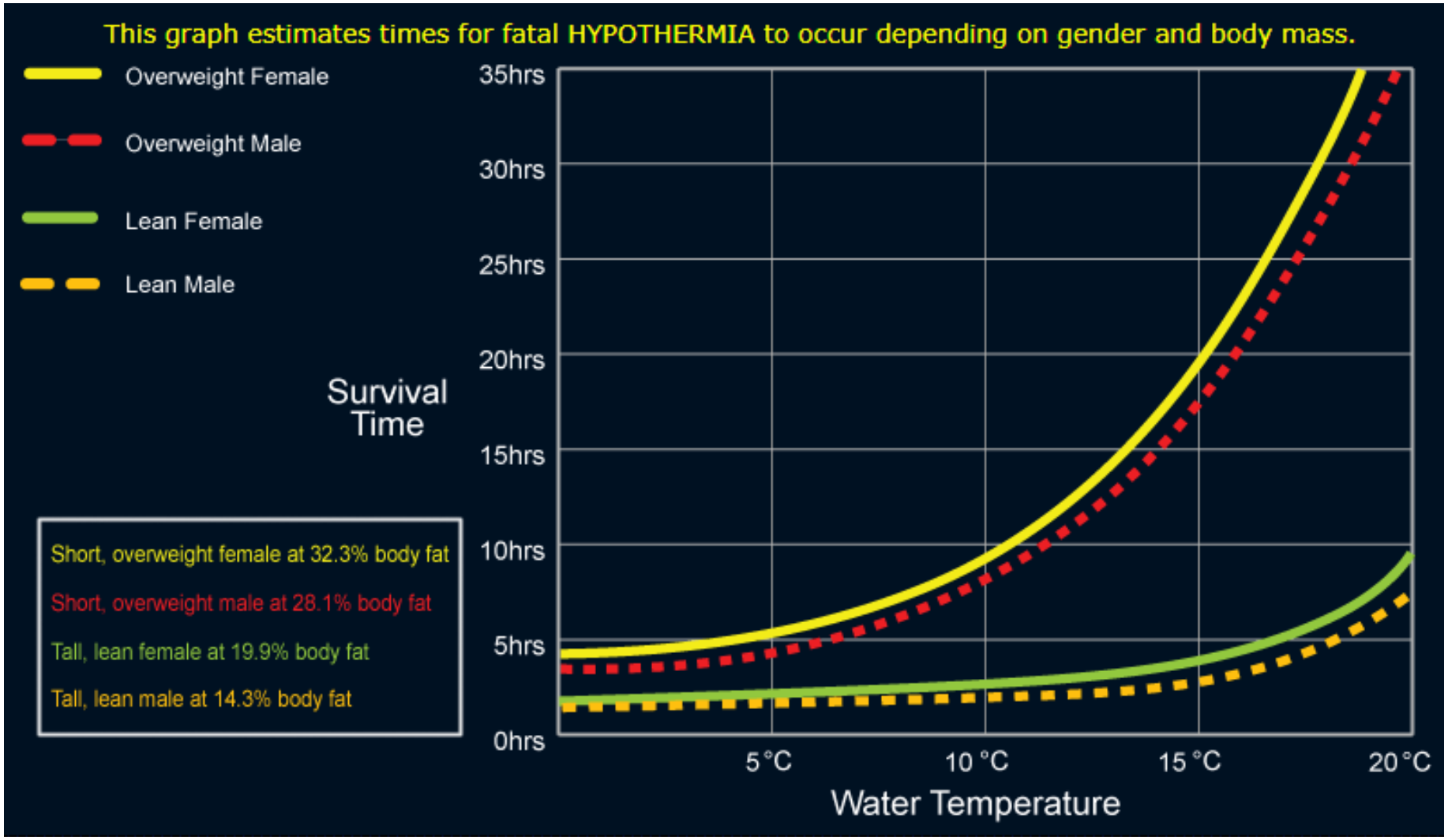
- **Consensus guidelines**

What about CPR?

- Signs of life/Vital signs difficult to detect in the hypothermic victim
- Take time to check for vitals (at least 1 minute)
- Check carotid pulse
- If no signs of life give 1 min rescue breathing & check again
- If still no signs of life, commence CPR
- **<u>Intermittent CPR is OK & some evidence it is beneficial</u>**
- **Severely hypothermic patients have been successfully revived after hours of cardiac arrest**

Cold Water Immersion

- 1-10-1 rule
- 1 min: Cold Shock: Gasp & Hyperventilation
  - Concentrate on breathing & keeping head above water. Floatation device which keeps head above water essential.
- 10 min: Cold incapacitation:
  - Use this time for self rescue if possible
- 1 hour: Hypothermia: even in coldest water will take about **1 hour** for core temperature in most to drop to life threatening levels


This graph estimates times for fatal HYPOTHERMIA to occur depending on gender and body mass.
Overweight Female
Overweight Male
Lean Female
Lean Male
Survival Time
35hrs
30hrs
25hrs
20hrs
15hrs
10hrs
5hrs
0hrs
Short, overweight female at 32.3% body fat
Short, overweight male at 28.1% body fat
Tall, lean female at 19.9% body fat
Tall, lean male at 14.3% body fat
5 °C
10 °C
15 °C
20 °C
Water Temperature

http://www.coldwaterbootcamp.com/pages/home.html