

HYPOTHERMIA

ACCIDENTAL HYPOTHERMIA

- **Core temp < 35°C**
- **Can occur in any season, greatest risk in cold/wet climates**
- **Associated with urban homelessness, particularly with the use of alcohol and other intoxicating substances**
- **Prevention mostly depends on behavior: wearing insulating clothing and using shelter**



Dow J, Giesbrecht GG, Danzl DF, et al. Wilderness Medical Society Clinical Practice Guidelines for the Out-of-Hospital Evaluation and Treatment of Accidental Hypothermia: 2019 Update. Wilderness & Environmental Medicine. 2019;30(4_suppl):S47-S69. doi:10.1016/j.wem.2019.10.002

HYPOTHERMIA

PATHOPHYSIOLOGY

- **Normally, cool temps —> shivering —> thermogenesis & increased metabolism**
  - **Shivering stops ~30°C**
- **Brain activity begins to decline with core temp 33-34°C**
  - **Irritability, confusion, apathy, poor decision making, lethargy, somnolence, eventual coma**
  - **Decreased ventilatory response to CO_2 leads to hypoventilation, respiratory acidosis**
  - **Decreased cerebral O2 requirement: transiently protective in anoxic conditions (ie: cold-induced cardiac standstill, cold-water drowning)**
- **Cardiovascular changes with decreasing temperature:**
  - **Cold diuresis + extravascular plasma shift + dehydration = reduced circulating blood volume**
  - **Bradycardia, decreased cardiac output**
  - **Cardiac dysrhythmias: PAC/PVCs, afib, VF**
  - **Below 28°C, VF can be triggered by acidosis, hypocarbia, hypoxia, or movement**



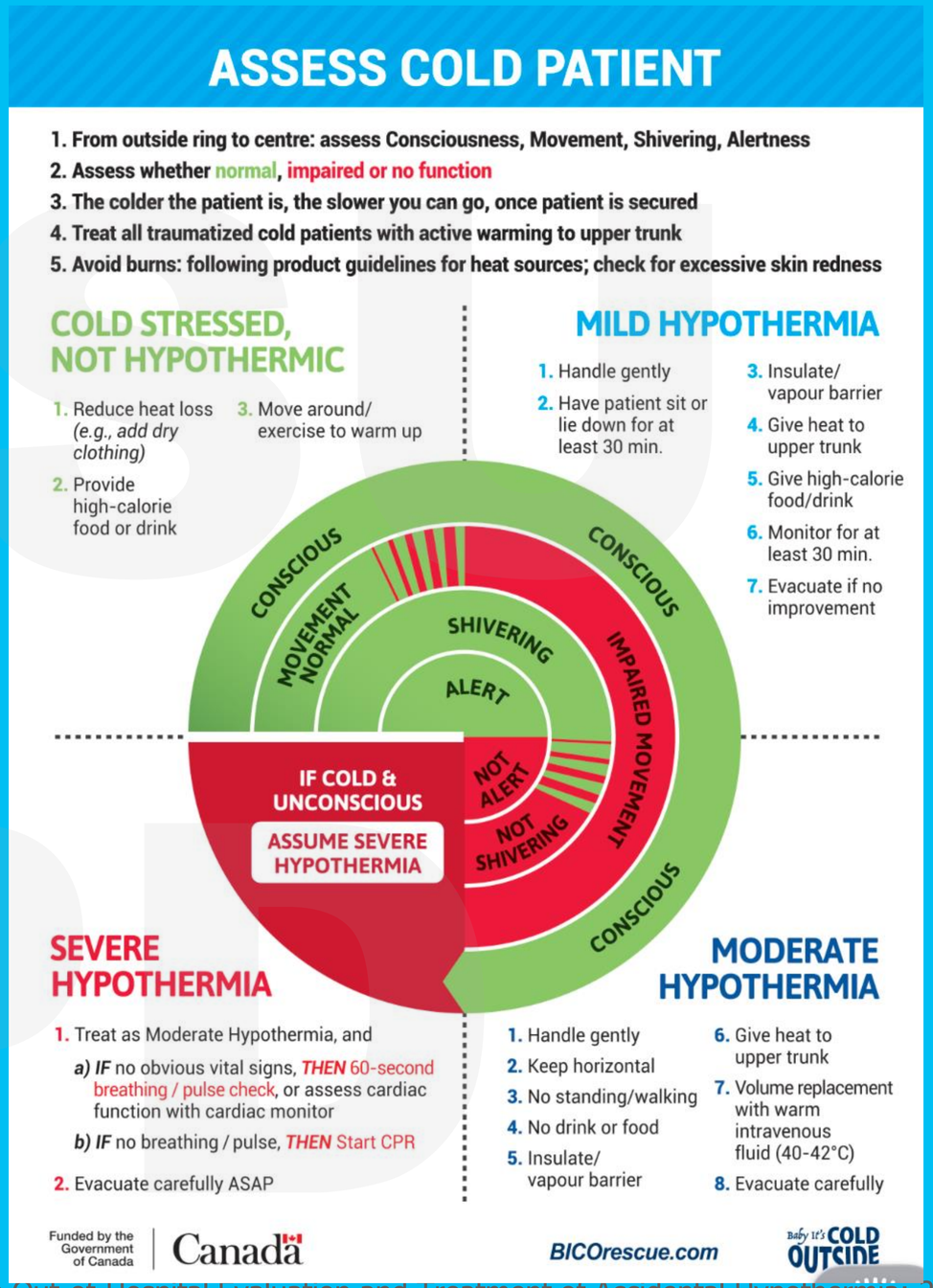
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CLASSIFICATION

- **Core temp not always feasible in the field, WMS recommends guiding treatment based on symptoms: LOC/alertness, presence/absence of shivering, CV stability based on BP and cardiac rhythm, and physical performance**

- **Mild Hypothermia: 35 - 32°C**
  - **Shivering present, alert**
- **Moderate Hypothermia: 32 - 28°C**
  - **Re-warming requires external heat**
  - **LOC decreases**
- **Severe Hypothermia: < 28°C**
  - **Most patients unconscious and not shivering**
  - **Risk of VF or asystole is high**



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ASSESS COLD PATIENT

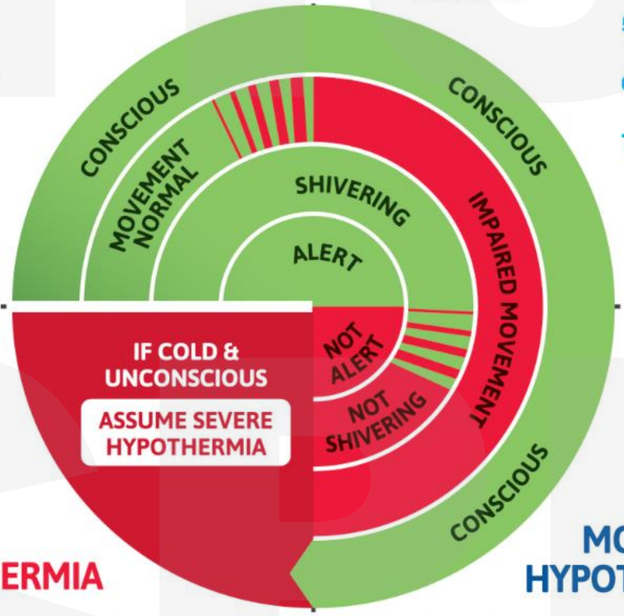
1. From outside ring to centre: assess Consciousness, Movement, Shivering, Alertness
2. Assess whether normal, impaired or no function
3. The colder the patient is, the slower you can go, once patient is secured
4. Treat all traumatized cold patients with active warming to upper trunk
5. Avoid burns: following product guidelines for heat sources; check for excessive skin redness

COLD STRESSED, NOT HYPOTHERMIC

1. Reduce heat loss *(e.g., add dry clothing)*
2. Provide high-calorie food or drink
3. Move around/ exercise to warm up

MILD HYPOTHERMIA

1. Handle gently
2. Have patient sit or lie down for at least 30 min.
3. Insulate/ vapour barrier
4. Give heat to upper trunk
5. Give high-calorie food/drink
6. Monitor for at least 30 min.
7. Evacuate if no improvement



SEVERE HYPOTHERMIA

1. Treat as Moderate Hypothermia, and
   - *a) IF* no obvious vital signs, *THEN* 60-second breathing / pulse check, or assess cardiac function with cardiac monitor
   - *b) IF* no breathing / pulse, *THEN* Start CPR
2. Evacuate carefully ASAP

MODERATE HYPOTHERMIA

1. Handle gently
2. Keep horizontal
3. No standing/walking
4. No drink or food
5. Insulate/ vapour barrier
6. Give heat to upper trunk
7. Volume replacement with warm intravenous fluid (40-42°C)
8. Evacuate carefully

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Baby it's COLD OUTSIDE

HYPOTHERMIA

FIELD TREATMENT

- **Avoid causing CV collapse during rescue**
- **Prevent further decrease in core temperature (afterdrop)**
- **Rewarm the patient in a safe manner**
- **If in cardiac arrest, initiate resuscitation**



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AFTER-DROP

- Continued core cooling after removal from a cold environment
- Periphery is cooler than core
  - Cooler peripheral blood moves to slightly warmer core and cools core
  - Warmer blood from the core loses heat as it circulates peripherally to extremities
- Avoid actions that increase peripheral blood flow: vertical/standing position, active/passive limb movement, warm water immersion
  - increase the volume of cold blood returning to the heart



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HYPOTHERMIA: FIELD TREATMENT

PREVENT HEAT LOSS

- **Use insulation and vapor barriers until the patient has reached a warm environment**
- **Remove wet clothes, only when the patient has been protected from the cold**
- **Insulate from the ground (eg, with sleeping pads) to protect from conductive heat loss**
- **Minimize heat loss from the head and neck by covering these areas as effectively as possible**
- **In windy conditions, a windproof layer, ideally a vapor barrier, provides substantial protection from convective heat loss**



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FIELD RE-WARMING

- **Only re-warm when protected from further heat loss**
- **Most patients with altered consciousness will require active rewarming**
- **Shivering can increase heat production 5-6x resting metabolic rate, but uses large amounts of energy**
  - **Shivering patients should be kept as warm as possible, given calorie replacement, and observed for a trial of standing with slow increase in intensity of exercise as tolerated**



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ACTIVE RE-WARMING

- **Active (exogenous) rewarming can supplement shivering in shivering patient, but is necessary in non-shivering patient to increase core temp since these patients cannot generate their own heat**
- **Active heating more effective in conjunction with insulation and vapor barrier to create an effective hypothermia enclosure system**



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RESUSCITATION

- **No cut-off temperature for resuscitation**
  - **Lowest known core temp from accidental hypothermia with neuro intact survival: 13.7°C**
- **Usual indicators of death (fixed, dilated pupils and apparent rigor mortis) are unreliable**
- **Do not attempt to resuscitate a patient with obvious fatal injuries or whose chest wall is too stiff for compressions**



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RESUSCITATION

- **Make every effort to move to a warm setting, where cardiac monitoring is available to guide resuscitation and to start rewarming**
- **Due to profound bradycardia, feel for carotid pulse for 1 min, then start CPR/rescue breaths if no pulse**
  - **If unsafe/not possible for immediate/continuous CPR: delayed or intermittent CPR should be performed**
  - **Recommended: at least 5 min of compressions every 5 minutes**



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