

Welcome...

Eric Johnson, MD

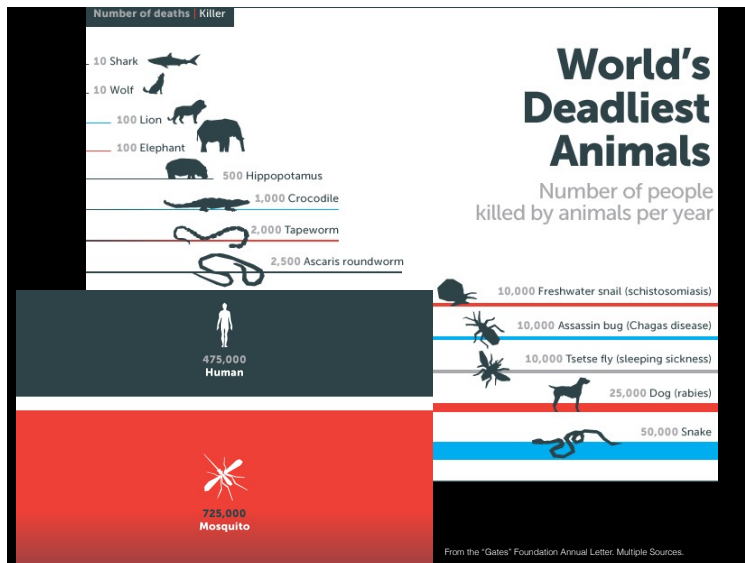
"Cold" Related Maladies

Aconcagua, 17k camp

A brief broad overview...

The World Health Organization (WHO) has identified 10 global health threats

- **Climate Change, Pollution, and Public Health.**
 - The WHO estimates that 90% of people in the world inhale polluted air daily, causing 7 million premature deaths yearly.
- **Prevention of Noncommunicable Diseases.**
 - 70% of deaths worldwide can be traced to noncommunicable diseases including diabetes, heart disease, and cancer. 15 million people are dying prematurely as a result – and over 85% are in low- and middle-income countries.
- **Preventing Global Pandemics**
- **Improving Health Equity, Particularly in Vulnerable Settings**
- **Combating Drug Resistance**
 - Many dangerous bacteria have evolved that are resistant to the drugs that have been developed to fight them, weakening our ability to treat infection and life threatening diseases.
- **Understanding and Monitoring High-Threat Pathogens...** Ebola, Covid, SARS, etc.
- **Advancing Primary Health Care For All Ages**
- **Supporting Vaccine Availability and Combatting Hesitancy**
- **Controlling Dengue and Other Mosquito-borne Diseases**
- **Tackling Communicable Diseases**
 - WHO and partners have worked tirelessly to end polio, HIV, tuberculosis and malaria. Efforts will intensify to end AIDS, TB, and malaria by 2030.



Ok, but in the Wilderness and related activities that can't be what really hurts or kills us ??

What's the real answer ? Is there one ?

What kills us out there! Wilderness Morbidity/Mortality
(Presented @ WMS Winter Meeting February 2023)

ARTHUR (TONY) ISLAS MD, MPH, CAQ-SM, FAWM, FAMSSM

Head Team Physician – UNR
Sports Medicine Fellowship, Director
Wilderness Medicine Fellowship, Director
Medical Advisor, Great Basin National Park
Professor – Dept. of Family Medicine – UNR
Certificate in Travel Medicine

What Hurts/Kills Us Out There

- A Literature Review of wilderness Injury/ mortality data was first done in 2007 which included 204 articles
- The literature was run again in 2009 and gained 72 more articles for a total of276 articles
- Search was run again in 2015 and 2017. (And prior to meeting).
- 11 different activities were identified

1. Hiking
2. In bound (downhill) skiing
3. Cross-country skiing
4. Snowboarding
5. Sledding
6. Snowmobile use
7. Mountaineering/Alpine climbing
8. Canyoneering
9. Swimming
10. Paddling Sports
11. Mountain biking

Arthur A Islas, "The pre-participation sports physical examination and wilderness athletes" (January 1, 2007). *ETD collection for Houston Academy of Medicine-Texas Medical Center*. Paper AAI1445481. <http://digitalcommons.library.tmc.edu/dissertations/AAI1445481>

What Hurts/Kills Us Out There

Morbidity

- Soft tissue – upper and lower ext (lacerations, sprains, strains, fractures)
- Illnesses – GI – nausea and vomiting

Mortality

- Falls
- Drowning
- CAD (35 and over)

What Hurts/Kills Us Out There

- Incidence numbers are hard to extrapolate but looking into the literature ...
- we could say that almost all studies show that **1 – 3 incidence/100,000 visits or 1-3 incidents per 1000 days.**
- Sport event numbers are higher and varied per sports event

NCAA Data:

- Football – games (13.8 injuries per 1000 A-Es) than in practices (4.0 injuries per 1000 A-Es)
- Basketball – The overall injury rate was 7.28 per 1000 athlete exposures, with competition rates twice those of practices

J Athl Train (2021) 56 (7): 681–687

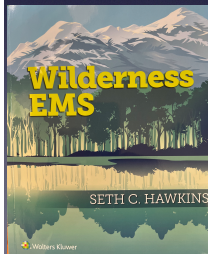
Resources:



Wilderness Medical Society Practice Guidelines for the Prevention and Treatment of Frostbite: 2019 Update

Scott E. McIntosh, MD, MPH; Luanne Freer, MD; Colin K. Grissom, MD; Paul S. Auerbach, MD, MS; George W. Rodway, PhD, APRN; Amalia Cochran, MD; Gordon G. Giesbrecht, MD; Marion McDevitt, DO, MPH; Christopher H. Imray, MD; Eric L. Johnson, MD; Pratima Pandey, MD; Jennifer Dow, MD; Peter H. Hackett.

Wilderness Environ Med. 2019 Dec;30(4S):S19-S32



Wilderness Medical Society Clinical Practice Guidelines or the Out-of-Hospital Evaluation and Treatment of Accidental Hypothermia: 2019 Update

Jennifer Dow, MD, MHA, et al.

WILDERNESS & ENVIRONMENTAL MEDICINE 2019; 30(4S): S47-S69

Other resources on individual slides



Objectives:

- To review WM morbidity/mortality
- Review Frostbite with emphasis on pre-hospital eval & Tx.
- Review Hypothermia with emphasis on Pre-Hospital Tx.
- Have fun...

No commercial disclosures with re: to this talk...



Why talk about Frostbite?



So this never happens again!!!!

Tissue heat loss > local tissue perfusion

Definition:

Frostbite is defined as the damage sustained by tissues while subjected to temperatures below their freezing point (typically -0.55°C , 31°F); in the broader sense it can include non-freezing cold injuries, where tissues do not freeze but are subject to a sustained and injurious cooling.



Trenchfoot



Prevention...is the key!



- Maintain peripheral perfusion.
- Exercise
- Protect from cold (insulate).
- Behavioral issues...

Epidemiology

- True incidence unknown...
- Military conflicts.
- Outdoor recreational activities.
- Males: ETOH and drugs



Risk Factors

- Outdoor cold activities
- Altitude.
- Duration of exposure.
- Dehydration.
- Previous cold injury.
- Over-exertion, fatigue, apathy.
- Immobility
- Altered mentation
- Poor nutrition.
- Contact with metal objects.
- Smoking.
- Home of origin
- Temperature and wind...WIND KILLS!



NWS Windchill Chart



Wind (mph)	Temperature (°F)															
	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84

Frostbite Times: 30 minutes (blue), 10 minutes (purple), 5 minutes (pink)

Wind Chill (°F) = $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$
 Where, T= Air Temperature (°F) V= Wind Speed (mph) Effective 11/01/01



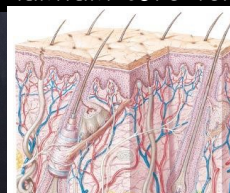
RISK FACTORS

- Impaired Local circulation:
- Nicotine & smoking
 - Drugs
 - Disease states which alter perfusion.
 - Splinted, injured extremities.
- Inadequacy of protective clothing:
- Tight fitting clothing
 - No head cap
 - Wet clothing
 - Gloves instead of mittens.
 - Poorly fitted footwear.
 - Tight crampons.

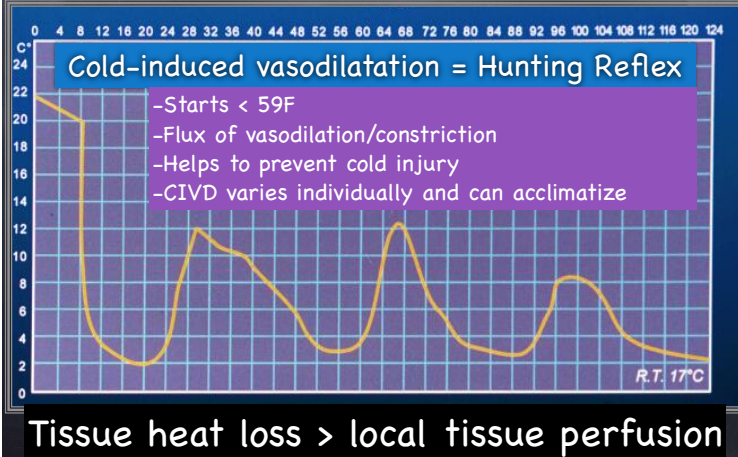
Anatomy/Physiology:

Hands, feet, nose, ears....

- AV anastomoses
- Capable of shunting and flow rates that vary 3ml/min-180ml/min
- Sympathetic innervation
- Maintain core temperature at the cost of periphery.



Physiology: CIVD



Pathophysiology

Pre-freeze phase

Tissue cooling with vasoconstriction and ischemia. No freezing

Freeze thaw phase

Ice crystals form intracellularly (during a more rapid-onset freezing injury) and/or extracellularly (during a slower freeze), causing protein and lipid derangement, cellular electrolyte shifts, cellular dehydration, cell membrane lysis and cell death.

Vascular stasis phase.

Vessels may fluctuate between constriction and dilation; blood may leak from vessels or coagulate within them.

Late ischemic changes

Progressive tissue ischemia and infarction from a cascade of events including: inflammation mediated by thromboxane A2, prostaglandin F2-alpha, bradykinins, and histamine; intermittent vasoconstriction of arterioles and venules; continued re-perfusion injury; showers of emboli coursing through the micro-vessels; and thrombus formation in larger vessels. **Destruction of the microcirculation is the main factor leading to cell death.**

Clinical Presentation

More frequent on extremities

Numbness followed by pain, then insensitivity

Clumsiness

Cold waxy appearance

Blisters, clear, yellow, bloody

May also affect eyes and tip of penis/nipples



Classification

Table 1. Four-Level Classification Schemes for Frostbite.^a

Classification Scheme	Classification Level			
	First Degree	Second Degree	Third Degree	Fourth Degree
Clinical scheme				
Depth of injury	Superficial, may include nonfrozen cold injury	Within the dermis	Full-thickness skin	Tissue beneath skin, including muscle tendon and bone
Initial findings	Reduced sensation, erythema, and burning after rewarming	Clear blistering with later sloughing of necrotic skin, pain with rewarming	Blue-gray skin discoloration; blisters that are clear, hemorrhagic, or both; pain with rewarming	Blue-gray skin discoloration, no pain with rewarming
Sequelae	None	Lasting cold sensitivity may develop	Full-thickness skin wounds, damage to growth plates in children	Full-thickness skin wounds, necrosis of underlying bone and deep tissue
	Grade 1	Grade 2	Grade 3	Grade 4
Cauchy scheme				
Extent of initial lesion	No lesion	Lesion on distal phalanx	Lesion on middle and proximal phalanx	Lesion on carpal or tarsal area
Bone scanning on day 2	Scanning unnecessary	Hypofixation of radiotracer	Absence of radiotracer uptake in digit	Absence of radiotracer uptake in carpal or tarsal area
Blisters on day 2	None	Clear blisters	Hemorrhagic blisters	Hemorrhagic blisters
Prognosis on day 2	No sequelae	Tissue amputation	Bone amputation of digit	Bone amputation of limb

^a The information is from Handford et al.⁴ and Cauchy et al.⁵

Sheridan SL, et al., Diagnosis and Treatment of Frostbite
n engl j med 386;23 nejm.org June 9, 2022

Cauchy Classification

A strong correlation was found between the extent of the lesion and the outcome of each finger or toe.

Anatomic area	Risk of Bone Amputation
Distal phalanx	1%
To Middle Phalanx	31%
Proximal Phalanx	67%
Metacarpal/metatarsal	98%
Carpal/tarsal	100%

Based on these clinical results and on the results of bone scans (previously validated), a new classification of frostbite severity at day 0 is proposed.

Table 2. Proposed classification scheme for severity of frostbite injuries

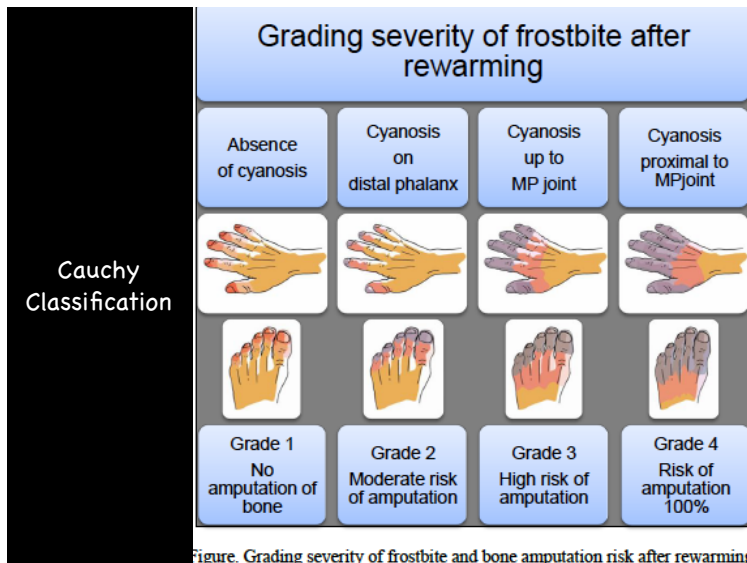
Frostbite injuries of the extremities	Grade 1 (Figure 1)	Grade 2 (Figure 2)	Grade 3 (Figure 3)	Grade 4 (Figure 4)
Extent of initial lesion at day 0 after rapid rewarming	Absence of initial lesion	Initial lesion on distal phalanx	Initial lesion on intermediary (and) proximal phalanx	Initial lesion on carpal/tarsal
Bone scanning at day 2	Useless	Hypofixation of radiotracer uptake area	Absence of radiotracer uptake area on the digit	Absence of radiotracer uptake area on the carpal/tarsal
Blisters at day 2	Absence of blisters	Clear blisters	Hemorrhagic blisters on the digit	Hemorrhagic blisters over carpal/tarsal
Prognosis at day 2	No amputation	Tissue amputation	Bone amputation of digit	Bone amputation of the limb
	No sequelae	Fingernail sequelae	Functional sequelae	Functional sequelae

Cauchy E, et al. Retrospective study of 70 cases of severe frostbite lesions: a proposed new classification scheme. Wilderness and Environmental Medicine, 12, 248-255 (2001)



Field Rescue Recommended:

- Superficial—no or minimal anticipated tissue loss, corresponding to first- and second-degree injury.
- Deep—anticipated tissue loss, corresponding to third- and fourth-degree injury.



Wilderness Medical Society Practice Guidelines for the Prevention and Treatment of Frostbite: 2019 Update

Strategies for 2 pre-hospital scenarios are presented:

**** Worst case scenario is Freeze-Thaw-Refreeze....mummifies tissue.**

Scenario 1: The frozen part has the potential for refreezing and is not actively thawed.

Scenario 2: The frozen part is thawed and kept warm without refreezing until evacuation is completed.



For both scenarios:

Treat hypothermia! (Moderate-Severe takes priority)

Hydration (oral or IV) to optimize volume status.
Vascular stasis should be minimized

LMW Dextran. Decreases blood viscosity (decreases RBC aggregation and microthrombi. Usually not available)

Ibuprofen. 12mg/kg/day (Field dose) (divided BID) if no pain for anti-prostaglandin effect, to Max 2400mg divided QID for pain.

Scenario 1: The frozen part has the potential for refreezing and is not actively thawed.

- Dressings (if able) - bulky, dry, clean with pads between digits.
- Ambulation and Protection:
 - Minimize trauma (pad and minimize trauma if able)
 - Use common sense (if necessary to ambulate for self extrication or evacuation, this takes priority)

Scenario 2: The frozen part is thawed and kept warm without refreezing until evacuation is completed.

- Rapid rewarming (warm water bath @ 98.6-102.2F)
- Pain control
- Debridement (Clear OK, hemorrhagic-NO)
- Allow vera
- Dressings
- Protection.
- O2 IF sats <88%, > 4000m
- -Elevate

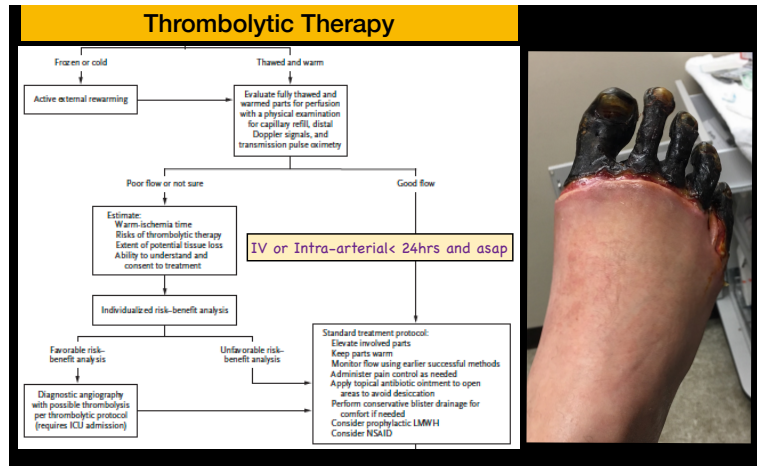
Table 2. Summary of field treatment of frostbite (over 2 hrs from definitive care)

1. Treat hypothermia or serious trauma
2. Remove jewelry or other extraneous material from the body part
3. Rapidly rewarm in water heated and maintained between 37-39°C (98.6-102.2°F) until area becomes soft and pliable to the touch (approximately 30 minutes). Allow spontaneous/passive thawing if rapid rewarming is not possible
4. Ibuprofen (12 mg/kg per day divided twice daily) if available
5. Pain medication (eg, opiate) as needed
6. Air dry (ie, do not rub at any point)
7. Protect from refreezing and direct trauma
8. Apply topical aloe vera cream or gel if available
9. Dry, bulky dressings
10. Elevate the affected body part if possible
11. Systemic hydration
12. Avoid ambulation on thawed lower extremity (unless only distal toes are affected)



Table 3. Summary of initial hospital management of frostbite

1. Treat hypothermia or serious trauma
2. Rapidly rewarm in water heated and maintained between 37-39°C (98.6-102.2°F) until area becomes soft and pliable to the touch (approximately 30 minutes)
3. Ibuprofen (12 mg/kg per day divided twice daily)
4. Pain medication (eg, opiate) as needed
5. Tetanus prophylaxis
6. Air dry (ie, do not rub at any point)
7. Debridement: selectively drain (eg, by needle aspiration) clear blisters and leave hemorrhagic blisters intact
8. Topical aloe vera every 6 hrs with dressing changes
9. Dry, bulky dressings
10. Elevate the affected body part if possible
11. Systemic hydration



Twoomey JA, Peltier GL, Zera RT. An open-label study to evaluate the safety and efficacy of tissue plasminogen activator in treatment of severe frostbite. *J Trauma* 2005;59:1350-4.

Reduction of the Incidence of Amputation in Frostbite Injury With Thrombolytic Therapy. Kevin J. Bruen, MD, James R. Ballard, BS, Stephen E. Morris, MD, Amalia Cochran, MD, Linda S. Edelman, MPH, BSN, Jeffrey R. Saffle, MD. *ARCH SURG/VOL 142, JUNE 2007*

Foot Ankle Spec, 2011 Sep 30. Efficacy of Intravenous Tissue Plasminogen Activator in Frostbite Patients and Presentation of a Treatment Protocol for Frostbite Patients. [Epub ahead of print]. Peltier GL, Delecrux E.

J Burn Care Res, 2015 Apr 24. Use of Intraarterial Thrombolytic Therapy for Acute Treatment of Frostbite in 62 Patients with Review of Thrombolytic Therapy in Frostbite. Gonzaga T, Jenaabadeh S, Anderson GP, Mohr MJ, Endorf FW, Ahrensolt DB.

Iloprost therapy: consider for deep frostbite to or proximal to the proximal interphalangeal joint, less than 72 hrs after injury, especially if angiography is not available or with contraindications to thrombolysis (Not approved in US).

PGI₂, a potent prostacyclin which vasodilates systemic and pulmonary circulation & Inhibits platelet aggregation.

Recommend that in the treatment of severe frostbite (stage 3 or above), after rapid rewarming, a combination of aspirin and prostacyclin should be used. The addition of rt-PA should be considered on a case-by-case basis, depending on the severity of injury (at least stage 4 frostbite), the presence of trauma (especially head trauma), any medical contraindications, and the amount of time passed since rewarming.

A controlled trial of a prostacyclin and rt-PA in the treatment of severe frostbite. *NEJM* 364:2 2011



Field use of both iloprost and IV tPA has been advocated to reduce delay in treatment for mountaineers who will invariably take >48 h for evacuation to a hospital. In these situations, iloprost may be the safer alternative.

Cochrane Library **Cochrane Database of Systematic Reviews**

Interventions for frostbite injuries (Review)

Lorentzen AK, Davis C, Penninga L. Interventions for frostbite injuries. *Cochrane Database of Systematic Reviews* 2020, Issue 12. Art. No.: CD012980. DOI:10.1002/14651858.CD012980.pub2.

There is a paucity of evidence regarding interventions for frostbite injuries. Very low-quality evidence from a single small trial **indicates that iloprost, and iloprost plus rtPA**, in combination with buflomedil may reduce the need for amputation in people with severe frostbite compared to buflomedil alone. However, buflomedil has been withdrawn from use.

HIGH QUALITY RANDOMIZED TRIALS ARE NEEDED TO ESTABLISH FIRM EVIDENCE FOR THE TREATMENT OF FROSTBITE INJURIES.





Hypothermia

Wilderness Medical Society Practice Guidelines for the Out-of-Hospital Evaluation and Treatment of Accidental Hypothermia: 2019 Update. Dow J, et al.....NOTE: New Guidelines out early 2024.

WEMJ Volume 30, Issue 4, Supplement, December 2019, Pages S47-S69

- $cT < 35^{\circ}$ or 95F
- Same Risk Factors as Frostbite.
- Cold and Wet....immersion most common (see drowning lecture)
- Not as common as Frostbite but takes priority over FB.

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

- Confounding Variables: Alcohol, Drugs, Hypoglycemia, Sepsis, Trauma, Medications...

Clinical Presentation	Approximate Core Temperature	Ability to rewarm without external methods	Classification
Cold Sensation Shivering	$>35^{\circ}\text{C}$ (95°F)	Good	Not Hypothermic
	$35^{\circ} - 32^{\circ}\text{C}$ ($95^{\circ} - 90^{\circ}\text{F}$)	Good	Mild
Altered Mental Status. $< 30^{\circ}\text{C}$ (86°F) Shivering stops Loss of consciousness	$32^{\circ} - 28^{\circ}\text{C}$ ($90^{\circ} - 82^{\circ}\text{F}$)	Limited	Moderate
Vitals Signs reduced. Severe risk of VF with rough handling	$< 28^{\circ}\text{C}$ (82°F)	Unable	Severe
Vitals Signs usually absent Spontaneous VF or Cardiac Arrest (asystole)	$< 24^{\circ}\text{C}$ (77°F)	Unable	Severe

Alaska Cold Injury Guidelines 2014

Symptom related to cT continuum....

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

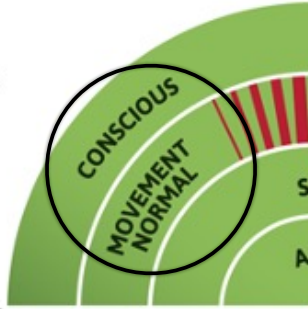
MODERATE HYPOTHERMIA

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 ($40 - 42^{\circ}\text{C}$)
8. Evacuate carefully

COLD STRESSED, NOT HYPOTHERMIC

>35C (95F)

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



- Conscious
- Normal Movement
- May be shivering
- Alert.

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



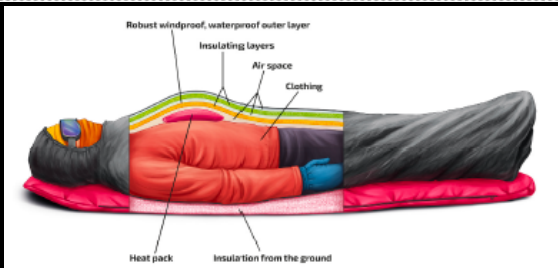
35-32C
95-90F

- Conscious
- Increasing Impaired Movement
- Shivering
- Alert

CARE FOR COLD PATIENT

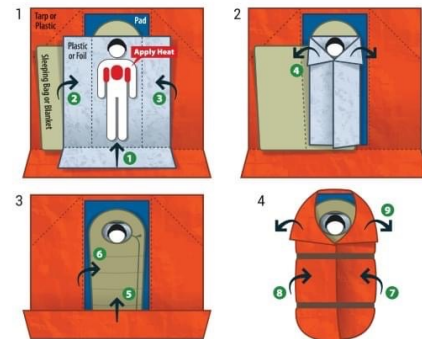
SUGGESTED SUPPLIES FOR SEARCH/RESPONSE TEAMS IN COLD ENVIRONMENTS:

- | | |
|---|--|
| 1 - Tarp or plastic sheet for vapour barrier outside sleeping bag | 1 - Plastic or foil sheet (2 x 3 m) for vapour barrier placed inside sleeping bag |
| 1 - Insulated ground pad | 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]) |
| 1 - Hooded sleeping bag (or equivalent) | |

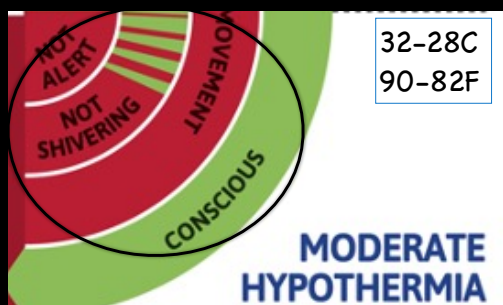


INSTRUCTIONS FOR HYPOTHERMIA WRAP "The Burrito"

1. Dry or damp clothing: *Leave clothing on*
IF Shelter / Transport is **less than 30 minutes** away, **THEN Wrap immediately**
2. Very wet clothing: *Remove clothing*
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



Copyright © 2016. Baly It's Cold Outside. All rights reserved. BICOrescue.com
Source: BICOrescue.com; Zahner, Gleditsch, Daniel et al. Wilderness Environ Med. 2014; 25:596-605.



32-28C
90-82F

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

- Still conscious but NOT Alert.
- In this phase, will lose the Shiver Response
- Impaired Movement

<28C
< 82F

IF COLD & UNCONSCIOUS
ASSUME SEVERE HYPOTHERMIA

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

Revised Swiss system for Pre-hospital

	Stage 1	Stage 2	Stage 3	Stage 4
Clinical findings ¹	"Alert" from AVPU	"Verbal" from AVPU	"Painful" or "Unconscious" from AVPU Vital signs present	"Unconscious" from AVPU AND No detectable vital signs ²
Risk of cardiac arrest ³	Low	Moderate	High	Hypothermic cardiac arrest
Oxygen according to usual clinical practice (goal: SpO ₂ > 94%) ⁴	+	+	+	+
Carbohydrates	Warm sweet tea, sweet bars	Glucose IV/IO ⁵	Glucose IV/IO ⁵	—
Active movement	+	— ⁶	—	—
Passive rewarming	+	+	+	+
Active rewarming	(+)	+	+	+
Cautious mobilisation/horizontal transport if possible	—	+	+	—
Defibrillation pads	—	+	+	+
Intubation	—	—	Consider	+
CPR	—	—	—	+
Defibrillation	—	—	—	+ ⁷
Drugs (CPR)	—	—	—	+ ⁸
Hospital with ECLS ⁹	—	—	+	+

Accidental Hypothermia: 2021 Update

Int. J. Environ. Res. Public Health 2022, 19, 501

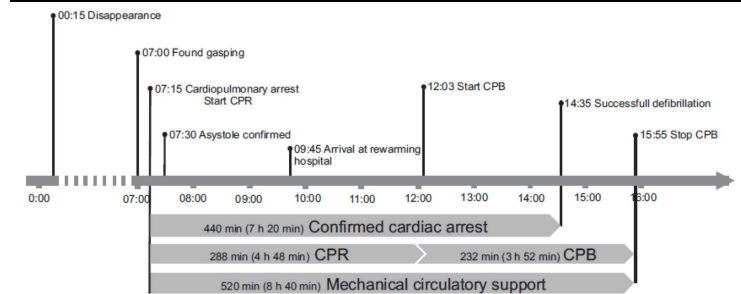


FIGURE 1. Resuscitation time line. CPR, Cardiopulmonary resuscitation; CPB, cardiopulmonary bypass.

