UPHS Post Cardiac Arrest Targeted Temperature Management (TTM) Clinical Practice Guideline

Purpose: A guideline to direct evidence-based care to post cardiac arrest patients who remain comatose after return of spontaneous circulation**.** This guideline should be used in conjunction with the Targeted Temperature Management (TTM) orderset in Penn Chart.

Position Statements

- All post cardiac arrest comatose patients, regardless of their initial rhythm (shockable vs non-shockable) and location of arrest (out-of-hospital or in-hospital cardiac arrest OHCA/IHCA) should be evaluated for active TTM. Active cooling should be considered and begin as soon as possible, and for up to 12 hours after ROSC.

- All patients should be first considered for a 33° C (range 32°-34 °C) goal temperature unless contraindicated.

- Patients should continue to receive aggressive post-cardiac arrest care, including 48 hours of post-rewarming normothermia and avoidance of neuro-prognostication for at least 72 hours after rewarming to 37 °C.

- OHCAs are often secondary to acute coronary syndrome and early coronary revascularization may improve survival. Prior to initiation of TTM and based on presenting cardiac rhythm, clinical teams are strongly encouraged to first consider the benefit of cardiac catheterization. Interventional cardiology should be consulted at the earliest appropriate time. If cardiac catheterization is indicated, TTM should not be delayed, and can be maintained during interventional cardiology procedures.

Research Summary

- Two early multicenter randomized controlled trials assessed patients with shockable rhythms after cardiac arrest and reported promising results in terms of survival and neurological outcomes at targeted temperatures between 32ºC and 34ºC. (1,2).

- However, more recent evidence from a large multicenter RCT (i.e., the Therapeutic Temperature Management Trial) suggested no difference in survival and neurological outcomes when TTM at 33°C was compared with TTM of 36ºC. Authors of this study listed several limitations that could have introduced bias. (3,4)

- In 2017, one center in Australia reported significant difficulty maintaining a targeted temperature of 36°C and a trend toward clinical worsening in patient outcomes after switching from TTM at 33°C to TTM at 36°C. (5) However, another center in Sweden reported no difference in outcomes after switching from TTM at 34°C to TTM at 36°C. (5)

Eligibility Criteria

Table 1: TTM Inclusion and Exclusion Criteria	
Inclusion Criteria	• Remains comatose immediately following out-of-hospital or in-hospital cardiac arrest with return of spontaneous circulation, regardless of initial cardiac rhythm
Exclusion Criteria	• GCS (motor) = 6 and patient following commands • Severely impaired pre-arrest cognitive status e.g. advanced dementia • Persistent non-perfusing cardiac rhythm or ongoing refractory shock despite interventions • Code status active for no resuscitation/intubation

Determining Temperature Goals

1. Target temperature of 33 °C (range 32°-34 °C) is recommended, and should be achieved within 4 hours of obtaining return of spontaneous circulation (ROSC), and maintained for at least 24 hours from time the target temperature is achieved.

2. Target temperature of 36 °C is recommended only if patient is at high risk for bleeding related to, but not limited to recent surgery, trauma, or other underlying medical conditions. Target temperature of 36 °C may be considered for patients with septic shock. Same conditions apply in that the temperature should be achieved within 4 hours of obtaining ROSC, and maintained for at least 24 hours from the time the target temperature is achieved.

3. Special Circumstances
    a. If patient has intracranial hemorrhage and cardiac arrest, the Neurology and Neurosurgery services should be consulted immediately and if available, consideration should be made for admission to the NeuroCritical Care Unit.
        - In some cases, if there are other reasons to use a colder body temperature, such as refractory intracranial hypertension, it would be reasonable to cool to 33 °C.
    b. If patient is pregnant, recommend consultation to OB/GYN service for guidance in determining target temperatures

4. Admission temperature at or below target
    a. Patients who are at the target temperature on admission to the hospital should be maintained using cooling measures described in this guideline.
    b. If below the target temperature on admission, patient can be maintained at the closest available targeted temperature 33 or 36 °C to avoid "rewarming" during acute insult.
    c. If **no current or anticipated** adverse events, "rewarm" gradually to the closest targeted temperature at a rate no faster than 0.33 °C per hour.

Initiating TTM

Pain and sedative medications are begun prior to inducing hypothermia. It is important to use the lowest effective dose of sedative and analgesic medications, so that subsequent neuro prognostication is not impeded. Refer to UPHS Pain, Agitation and Delirium Guidelines. See shivering section for further direction on the use of neuromuscular blocking agents (NMBA) during TTM.

1. Assess for pain initially, at least every 4 hours, and PRN using the behavioral pain scale (BPS).
    a. Provide IV fentanyl bolus dose of 12.5-25 mcg, repeat q 10 minutes x 3 as needed to achieve goal BPS <6 at initiation.
    b. Following initial management, provide IV fentanyl bolus dose of 12.5-25 mcg q hour as needed to maintain BPS<6.
    c. If 2 or more IV boluses needed per hour to maintain BPS <6, begin continuous fentanyl infusion at 12.5-25 mcg/hour
    d. Higher bolus doses of fentanyl may be needed based on patient medical/surgical history

2. Assess for agitation/sedation initially, at least every 4 hours, and PRN using the Richmond Agitation Sedation Scale (RASS).
    a. Post-cardiac arrest patients meeting criteria (GCS motor <6 and patient not following commands) for TTM, patients may already have a level of consciousness consistent with a RASS of -4 to -5, and therefore **not** require any sedatives. Consider sedatives only if patient has an underlying level of agitation that is not responding to pain medications.
    b. Patients may require sedatives for indications independent of TTM such as with agitation associated with ventilator asynchrony or severe ARDS.
        i. Continuous infusion sedation with Propofol (following assessment and treatment of any perceived pain) is recommended as first line to achieve an ordered RASS goal appropriate to the clinical scenario.
        ii. Intermittent IV PRN benzodiazepine bolus is second line, or alternative therapy if Propofol is not tolerated
        iii. If 2 or more hourly doses of IV benzodiazepine bolus doses are required, consider initiation of a continuous infusion to achieve an ordered RASS goal.
        iv. Benzodiazepines are not considered first-line because of delayed drug clearance and potential impact on neuroprognostication.
    c. Continuous infusions of both opioids and sedatives are needed if NMBAs are initiated for shivering management. See section on shivering prevention and treatment.

Hypothermia Induction Interventions

1. Use a continuous temperature monitoring device.
    a. A temperature monitoring urinary catheter can be used for both continuous urine output and temperature monitoring. If using a Bard Product, urine output is not necessary to obtain an accurate temperature via this catheter.
    b. Esophageal temperature probes can be used, but need to ensure appropriate positioning for accuracy. Refer to hospital guidelines for insertion of esophageal probes.
2. Initiate active internal or external cooling using a cooling device per hospital guidelines.
3. Target temperature should be achieved within 4 hours of initiation of TTM.
4. Depending on the starting temperature, consider infusing 4 °C normal saline solution during the initiation of TTM. Use normal saline for first two liters, then change to lactated ringers unless hyperkalemia or severe hepatic insufficiency exists.

   a. Patients with clinical conditions such as ARDS, significant pulmonary edema, or hemodialysis may tolerate or require less fluid.
5. If target temperature is not achieved within 4 hours
   a. Add ice packs to groin and axillae
   b. Consider additional 250- 500 ml bolus of 4°C intravenous fluid
6. If target overshoot and temp < 32 °C, the cooling device will actively warm patient in automatic mode, or consider infusing 250 ml bolus of warm 40 ° C intravenous normal saline or lactated ringers until temperature > 32 °C.

Hypothermia, electrolytes, and glucose management

1. Electrolyte repletion during both cooling and rewarming phases
   a. Hypothermia-induced diuresis is expected and should be treated aggressively with fluid and electrolyte repletion. Magnesium, phosphorus, and potassium should be monitored closely and maintained in the normal range due to extracellular shifts resulting in increased serum levels during rewarming. **See Table 2**
   b. If the patient has renal failure and requires CRRT, do <u>not</u> use the electrolyte recommendations in Table 2, rather use the CRRT electrolyte repletion order set for calcium, magnesium, and phosphate.
   c. If the patient has renal failure and not receiving CRRT, consult with provider for individualized patient orders

Table 2: Electrolyte Repletion for patients **with normal renal function**	
Potassium chloride	40 mEq IV every 6 hours prn serum potassium level 3.0-3.5 mmol/L 60 mEq IV every 6 hours prn serum potassium level 2.5-2.9 mmol/L 80 mEq IV every 6 hours prn serum potassium level ≤ 2.4 mmol/L
Magnesium sulfate	1 gm IV every 6 hours prn serum magnesium level ≤ 2 mg/dL <u>If maintaining a Mg level of 3-4 mg/dl for shivering prevention</u> See Shivering Pathway in Table 4. First Bolus 2 gm IV Mg Sulfate over 60 minutes x1 and then Mg Sulfate 4 gm IV q 6 hours prn serum Mg level < 3.0 mg/dL Patients with renal failure, (Serum Cr. >2 or CrCl <30 ml/min): Mg Sulfate 2 gm IV q 6 hours prn serum Mg level <3.0 mg/dL
Calcium chloride	1 gm IV every 6 hours prn serum ionized calcium level ≤ 0.9 mg/dL
Sodium phosphate	15 mmol IV every 6 hours prn serum phosphate 2.0-2.5 mg/dL 30 mmol IV every 6 hours prn serum phosphate ≤ 1.9 mg/dL

2. Hyperglycemia management
   a. Avoiding hyper- and hypoglycemia, and maintaining a goal glucose of 140-180 mg/dL is a reasonable goal during post-arrest resuscitation and TTM. This should be accomplished using ICU specific insulin protocols using IV dosing of insulin.

   b. Decreased insulin secretion and insulin sensitivity contributes to hyperglycemia in patients undergoing TTM. Patients should be managed with the Critical Insulin Infusion Protocol with vigilant monitoring of hypoglycemia during rewarming.

Shivering Prevention and Treatment

Hypothermia activates the sympathetic nervous system causing vasoconstriction and possible shivering. Shivering increases baseline metabolic activity and is associated with decreased brain oxygen availability, which can worsen hypoxic-ischemic brain injury. Thus, shivering should be aggressively managed after cardiac arrest. Shivering management can either be implemented prophylactically (i.e. with continuous neuromuscular blockade starting at the onset of TTM and continued throughout the TTM and rewarming period), or reactively (i.e. by continuous monitoring for shivering and implementation of a stepwise algorithm for shivering control when identified). (6-8)

1. Standard preventive measures that may be applied to patients for the duration of TTM period (including hypothermia and normothermia)
    a. Assess for shivering using the Bedside Shivering Assessment Scale (BSAS) every 30 minutes until patient at target temperature, then assess at least q 1 hour (Refer to Appendix for BSAS) (9).
    b. Provide surface counter warming by placing a warm blanket around the head, socks on hands and feet, and cover the body with a forced air warming device/blanket
    c. Acetaminophen – Do not administer to patients in fulminant hepatic failure
        i. 650mg liquid enterally q 4 hours for patients without hepatic impairment.
        ii. Use caution in patients with chronic liver disease or acute liver injury, decrease dosing in this patient population to 650mg enterally every 8 hours, not to exceed 2 grams per day
    d. Buspar
        i. 30 mg enterally every 8 hours
    e. Magnesium
        i. Consider maintaining a higher target serum level of 3.0 – 4.0 mg/dL
2. Neuromuscular blocking agent use
    a. During TTM a neuromuscular blocking agent (NMBA) can be used to either prevent or treat shivering.
    b. Patients may require NMBA independent of TTM for indications such as ventilator asynchrony, or severe ARDS.
    c. Administration of NMBA requires administration of analgesics and sedatives that may have prolonged durations during hypothermia.
    d. Alternatively, a step-wise approach to shivering treatment may minimize sedative, analgesic, or NMBA requirements.
    e. Choice of options 1 or 2 are dependent on the ordering provider, and should remain consistent throughout TTM management.

Use of Neuromuscular Blocking Agents during TTM

1. Option 1- Immediate continuous infusion of NMBA to prevent shivering **(See Table 3)**
    a. Ensure pain control and RASS goal of (-5) are achieved prior to initiating use of NMBA. If RASS is at (-5) without any sedative or analgesia, low dose continuous sedation and analgesic infusions are recommended to ensure adequate sedation and analgesia throughout the duration of the NMBA.
    b. A NMBA bolus dose, followed by a continuous infusion may be started at the initiation of TTM and maintained until patient rewarmed to 36.5 °C.
    c. If using a BIS monitor, titrate sedatives to a BIS goal of 40-60 once paralytics have been initiated.
    d. Titrate neuromuscular blockade to reach target BSAS = 0 and Train of Four (TOF) between 1-2 out of 4 twitches. Hypothermia may result in unreliable TOF monitoring.

Table 3- Recommended Initial Bolus and Starting Continuous Infusion Doses

NMBA bolus	**NMBA Continuous infusion**	**Analgesia Continuous Infusion**	**Sedative Continuous Infusion**
Cisatracurium 0.1 mg/kg IV or Vecuronium 0.1 mg/kg IV	Cisatracurium 1.0 mcg/kg/min or Vecuronium 0.4 mcg/kg/min	Fentanyl 12.5- 25 mcg/hr or Hydromorphone 0.2 mg/hr	Propofol 10-20 mcg/kg/min as hemodynamically tolerated or Lorazepam 0.5 mg/hr or Midazolam 0.5 mg/hr

2. Option 2- Shivering Prevention and Treatment Progressive Pathway**.** **(See Table 4)**
    a. This pathway uses an approach that applies a trial of multi-pronged shivering prevention and treatment measures before determining the need for continuous NMBA.
    b. Prevention and treatment of shivering is critical and must not be delayed due to this being a "step-wise progressive approach". Depending on the clinical scenario, a provider may progress through the steps as quickly as necessary.

	Table 4: Shivering Pathway- Multi-Pronged Treatment
Step 0 **If BSAS >1 proceed to Step 1**	Initiate standard nursing preventive measures at induction of TTM • Assess BSAS q 30 minutes until target temperature achieved, then q hour and PRN • Surface counter warming measures, socks to hands and feet, blanket around head acetaminophen- Do not administer to patients in fulminant hepatic failure • 650mg liquid via enterally q 4 hours for patients WITHOUT hepatic impairment. • 650 mg liquid via enterally every 8 hours not to exceed 2 grams per day for patients with chronic liver disease of acute liver injury buspirone • 30 mg enterally every 8 hours magnesium • Consider maintaining a target serum Mg level of 3.0-4.0 mg/dL [see Table 2 for details]
Step 1a **Step 1b** **If BSAS ≥ 1 proceed to Step 2**	Fentanyl • IV Fentanyl boluses 12.5-25 mcg every 5 minutes for 2 doses. **If after 15 minutes the patient continues to have BSAS ≥ 1, proceed to starting a continuous Fentanyl infusion at 25 mcg/hr, or increasing the infusion rate for patients already on a Fentanyl infusion. If BSAS ≥ 1 after another 20-30 minutes, proceed to Step 2** Meperidine: Meperidine is the preferred agent in patients WITHOUT renal failure Warning: Meperidine Should not be given at all in late term pregnancy or for prolonged use at any time. Concurrent use of Meperidine with SSRIs or SNRIs may cause serotonin syndrome. • IV Meperidine boluses 12.5 mg every 5 minutes for 2 doses: may administer 12.5 mg IV every 4-6 hours PRN. Maximum 100mg/24 hours. Contraindicated in renal failure, oliguria, and in patients on MAO inhibitors. **IF BSAS ≥ 1 within 30 minutes of bolus dose, go to Step 2**
Step 2	Propofol **OR** benzodiazepine (if no contraindications, propofol is considered first line) • Initiate continuous Propofol infusion (maximum 80 mcg/kg/min as tolerated), or up titrate in patients already on Propofol infusion **If BSAS ≥1 despite maximizing highest tolerated dose of continuous Propofol infusion add NMBA bolus in Step 3** • Bolus dose of midazolam or lorazepam **If BSAS ≥ 1 after 5 minutes of bolus, start a continuous infusion at the rate of the initial bolus dose and add the use of NMBA in Step 3**
Step 3	Cisatracurium **OR** Vecuronium NMBA bolus • Cisatracurium 0.1mg/kg IV bolus every 60 minutes for 2 doses • Vecuronium 0.1 mg/kg boluses every 60 minutes for 2 doses **Note:** As the patient becomes hypothermic, the duration of neuromuscular blocking agent becomes prolonged. Monitor BSAS every 1 hour to determine the need for additional doses while cooling to target temperature. **If BSAS ≥ 1 after 2 boluses, proceed to Step 4, a continuous NMBA infusion**
Step 4	Cisatracurium **OR** Vecuronium NMBA Continuous Infusion • Cisatricurium continuous infusion starting dose of 1 mcg/kg/min • Vecuronium continuous infusion starting at 0.4 mcg/kg/m Refer to Option 1, and Table 3 for guidelines on dosing and monitoring

Laboratories tests

Initially at the start of TTM	**Serial tests until patient rewarmed then as indicated thereafter**
• ABG with iCa+, Mg+ • CBC / PT / PTT/INR, Fibrinogen • Chem 7, plus iCa / Mg / Phos • Lactate/CPK-MB/CK/Troponin • Cortisol level (As Indicated) • Urinalysis • Blood Cultures, Urine Culture, and Sputum Culture (if appropriate) • Toxicology screen (if appropriate) • Amylase, Lipase • LFTs • Beta HCG on all women of child-bearing age • Co-oximetry (Central)	• Lactate q 6 hrs x 24 hours • Repeat CPK-MB/CK/Troponin q 6 hrs for the first 24 hours and then prn • Chem7 / iCa / Mg / Phos q 6 hours • ABG q6hr and PRN • CBC q12h • PT / PTT/INR daily
Note: Hypothermia can induce an in vivo coagulopathy which is not detectable by laboratory testing (as blood is warmed during testing)	

Initial Studies

1. ***CXR-*** Initially and then daily
2. **Head CT*:*** Used to rule out intracranial hemorrhage, or other cause for coma, as deemed medically necessary. Not necessary to initiate TTM but is recommended as soon as possible.
3. **Treat acute coronary syndrome:** Consult Cardiology for, hemodynamic instability, indeterminate ECG or suspected non-STEMI, malignant arrhythmia, or acute STEMI
4. **Echocardiogram:** Obtain routine echocardiogram within first 24 hours of TTM initiation to rule out regional wall motion abnormality and severe contractile dysfunction.
5. Consider earlier echocardiogram if requested by Cardiology consult, or in the case of ongoing hypotension with possible cardiac etiology, ongoing malignant arrhythmias, or indeterminate ECG

Ongoing Patient Monitoring

1. Cardiovascular
   - ***a.*** Hypothermia initially causes sinus tachycardia, then sinus bradycardia. At temperatures <30° C there is an increased risk for arrhythmias. At temperature <28 ° C there is an increased risk for ventricular fibrillation.
   - ***b.*** The severely hypothermic myocardium (<30 °C) is less responsive to defibrillation and medications. Therefore, it is extremely important to keep temperature >30 °C.
   - ***c.*** Obtain ECG after initial stabilization and repeat q 8 hours x 2 and prn to rule out acute coronary syndrome.
   - ***d.*** Vital signs q 1 hour

e. Insert arterial-line for continuous arterial blood pressure monitoring (essential prior to initiating hypothermia).

f. Insert central venous catheter, though don't delay initiation of hypothermia to perform.

2. Pulmonary
    a. Hypothermia causes a shift in the oxyhemoglobin curve to the left, which may result in decreased O_2 delivery. However, the metabolic rate is also lowered, decreasing O_2 consumption/CO_2 production, cardiac output and cerebral blood flow. Ventilator settings may need to be adjusted due to decreased CO_2 production.
    b. Titrate Fio2 down rapidly while maintaining oxygen saturation at goal (90-96%; see Fio2 weaning recommendations in entity ventilation liberation guidelines) as hyperoxia is associated with worse neurologic outcomes. In addition, adjust the minute ventilation to maintain a normal PaCo2, appropriate pH, using ABG's that are not temperature corrected.

3. Adrenal Insufficiency
    a. Acute adrenal insufficiency is a well-documented component of post-resuscitation syndrome. In patients with fluid and vasopressor refractory septic shock, treatment with "stress dose" corticosteroids significantly reduces mortality. Thus, in post-cardiac arrest patients with hemodynamic instability associated with vasodilation, diagnosis and treatment of acute adrenal insufficiency should be considered. (10)

4. Neurologic
    a. When available, continuous EEG monitoring should begin ASAP. EEG should be initiated within 6-12 hours of TTM initiation. Continue EEG monitoring through the TTM period until at least 24 hours after rewarming. Depending on the EEG findings, EEG monitoring may need to be continued for longer. If seizures or other malignant EEG features are identified, consult Neurology service or consider transfer to Neuro Intensive Care Unit.
    b. Neurological checks q 2 hrs; while paralyzed follow pupils and titrate paralysis per train of four (TO4) and shivering scores (BSAS).

5. Special considerations for anti-coagulation during TTM
    a. For patients cooling to 33 degrees, initial heparin dosing should be as follows
        i. VTE/Mechanical valves
            1. Initial bolus: 40 units/kg
            2. Initial infusion: 12 units/kg/hr
        ii. Acute Coronary Syndrome (Note: the P2Y12 inhibitor required is ticagrelor).
            1. Initial bolus: 30 units/kg
            2. Initial infusion: 8 units/kg/hr
    b. Dose of heparin titrations should follow the respective algorithms.
    c. Once rewarming begins, a patient's heparin requirement will increase, and more frequent aPTT monitoring may be required. For a patient with HIT, please consult Hematology or a Clinical Pharmacy Specialist.

Rewarming

1. Rewarming should begin at a minimum of 24 hours after target temperature reached
2. Rewarming is done gradually not to exceed more than 0.33 °C/hr. Goal rewarmed temperature is 37 °C. If patient is receiving continuous NMBA, discontinue when patient reaches 36.5 ° C.
3. Anticipate reduction in venous return (cardiac output) and blood pressure during rewarming due to venodilation.
4. Vitals signs q 1 hour
5. Prior to rewarming, discontinue all K+ containing fluids but always correct hypokalemia, and other electrolyte abnormalities, to the normal range.
6. Follow K+ closely q 6 hours and as needed. Obtain follow-up potassium within two hours of rewarming
7. Caution: check blood sugar prior to rewarming. Monitor for hypoglycemia during the rewarming phase every 1-2 hours. If on an insulin infusion prior to rewarming, continue to follow the insulin infusion guideline recommendations.

Normothermia post rewarming phase

1. Maintain active normothermia for a minimum of 48-72 hours post rewarming phase
    a. Keep cooling wraps on the patient for 48 hours after rewarming
    b. Monitor for shivering during normothermia period, and follow step-wise shivering treatment pathway outlined in Table 4, including Step 0 interventions.
    c. In patients requiring escalating doses of sedatives for management of shivering to maintain BSAS =0, consider adjusting the BSAS goal to $\leq$ 1 and tolerate mild shivering in order to minimize the amount of sedation required to achieve a BSAS goal.
2. Monitor skin breakdown closely during this time. If using the Arctic Sun, the pads should not be on for longer than 5 days.

Assessment of Neurological Prognostication

Assessing the capacity for meaningful neurologic recovery after cardiac arrest is difficult, and no single clinical test or examination finding is sufficiently accurate to determine neurologic prognosis. Premature neuroprognostication is strongly discouraged, since recent studies suggest that a significant fraction of post-cardiac arrest patients can be unresponsive for more than a week after rewarming and ultimately regain consciousness with good neurologic outcome.

1. In general, it is reasonable to wait at least 72 hours after arrest before starting the process of neuroprognostication.

2. Determination of death by neurologic criteria (i.e. brain death) in patients who have a clinical examination consistent with brain death should not be performed until at least 24 hours after rewarming (see UPHS guidelines for brain death determination for further details).

3. Assessing neurologic prognosis and brain death determination should always be performed in consultation with the Neurology Service.

4. The consulting Neurologist may opt to utilize a “multi-modal” approach, where serial clinical examinations are coupled with multiple types of clinical tests (e.g. electrophysiology, imaging, and laboratory tests). Concordant results across multiple tests sites help to confirm the degree of brain injury and the capacity for neurologic recovery.

5. Some tests that the consulting Neurologist may order to aid in neuroprognostication include

- ***a.*** Imaging studies: Head CT, brain MRI
- ***b.*** Electrophysiology: Cortical Somatosensory Evoked Potentials, EEG
- ***c.*** Serum Biomarkers: Neuron Specific Enolase

Appendix

Bedside Shivering Assessment Scale- BSAS (9)

The BSAS requires raters to observe the patient for 2 minutes; this includes visual inspection as well as palpating the neck, thorax, arms, and legs.

Score	Definition
0	**None:** no shivering noted on palpation of masseter (muscles of mastication), neck, or chest wall
1	**Mild**: shivering localized to neck and/or thorax only
2	**Moderate**: shivering involves gross movement of the upper extremities in addition to neck and thorax
3	**Severe:** shivering involves gross movements of the trunk and upper and lower extremities

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