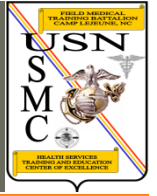


# ENVIRONMENTAL HEAT INJURIES





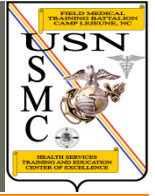
# OVERVIEW



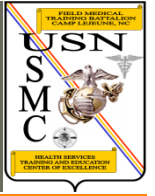
- Predisposing Factors
- Types of Heat Injuries
- Methods of Cooling the Body
- Preventive Measures
- Flag Warning System



# LEARNING OBJECTIVES

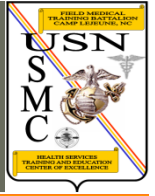


Please read your  
Terminal Learning Objectives  
and  
Enabling Learning Objectives

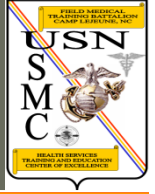




# BACKGROUND

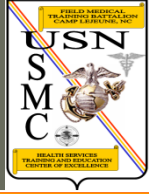


- High internal temperatures can produce stress on the body
- If not counterbalanced, these high body temperatures can produce injury or death
- Heat injuries can occur anywhere, but are more frequent in warm weather due to high temperatures, humidity and sunlight



# BODY TEMPERATURE REGULATION

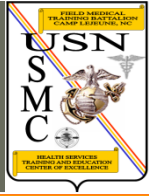
- Hypothalamus
  - Regulates the body's CORE temperature, not surface temperature
  - Can tell the body to either:
    - Conserve heat
    - Dissipate heat by increasing RR, cardiac output, vasodilation and perspiration
- Normal Range
  - 97.6°-99.6°F



# Predisposing Factors Associated with Heat Injuries



# PREDISPOSING FACTORS



- Chronic Conditions:
  - Fitness and Body Mass Index
    - Low levels of physical fitness reduce heat tolerance
  - Age
    - Thermoregulatory capacity and heat tolerance diminish with age



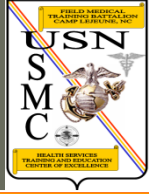
# PREDISPOSING FACTORS



- Chronic Conditions (cont):
  - Medical Conditions
    - Diabetes, thyroid disorders, renal disease increase the risk for heat intolerance and injury
    - Cardiovascular disease and circulatory problems are aggravated by heat exposure
  - Previous History of Heat Injury
    - May cause permanent damage to the hypothalamus



# PREDISPOSING FACTORS

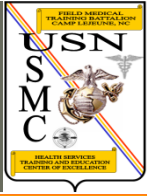


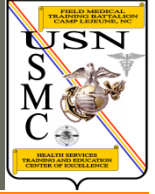
- Chronic Conditions (cont):
  - Skin Trauma
    - Hampers the heat regulatory mechanism
    - Sunburn, heat rash, windburn, dermatologic disease
  - Medications
    - Increase metabolic heat production
    - Suppress body cooling
    - Reduce cardiac reserve
    - Alter electrolyte and fluid balance

# PREDISPOSING FACTORS

- Transient Conditions
  - Poor acclimatization
  - Illnesses
    - Colds
    - Fever
    - Vomiting
    - Diarrhea



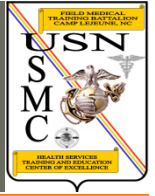




# TYPES OF HEAT INJURIES



# HEAT CRAMPS

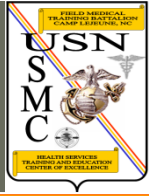


- Definition:
  - Short-term, painful muscle contractions
  - Frequently seen in the calf muscles and voluntary muscles of the abdomen and extremities





# HEAT CRAMPS

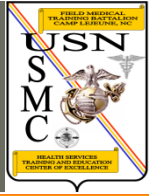


- Cause:
  - Prolonged physical activity in hot climates
  - Muscle fatigue
  - Body water loss
  - Sodium loss





# HEAT CRAMPS

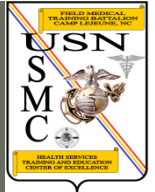


- Signs/Symptoms:
  - Muscle cramps and tenderness
  - Skin is usually moist, pale, warm
  - Normal or slightly elevated core temp





# HEAT CRAMPS



- Treatment:
  - Rest in cool environment
  - Prolonged stretching
  - Consume oral fluids and foods containing sodium
    - Electrolyte pouches, sports drinks, salty snacks



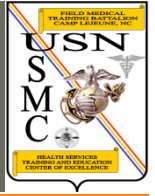
# HEAT EXHAUSTION

- Definition:
  - Most common heat related disorder
  - Systemic reaction to prolonged heat exposure





# HEAT EXHAUSTION



- Cause:
  - Results from cardiac output that is insufficient to support the increased circulatory load caused by
    - Competing blood flow
    - Reduced plasma volume
    - Sweat-induced depletion of salt and water



# HEAT EXHAUSTION



- Signs/Symptoms:
  - Frontal headache
  - Decreased urine output
  - Drowsiness
  - Nausea/Vomiting
  - Light-headedness
  - Fatigue



# HEAT EXHAUSTION



- Signs/Symptoms (cont):
  - Anxiety
  - Irritability
  - Decreased coordination
  - Orthostatic hypotension
  - Moist, pale, clammy skin
  - Rectal temp usually below 104°F



# HEAT EXHAUSTION

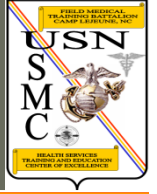


- Treatment:
  - Move to a cool location
  - Loosen or remove clothing
  - Assess vital signs
  - Oral rehydration preferred
  - Active cooling
  - Transport if patient is unconscious or does not recover rapidly





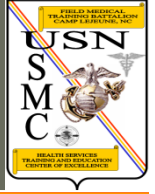
# HEAT STROKE



- Definition:
  - **A TRUE MEDICAL EMERGENCY**
  - Can cause irreversible brain damage and death



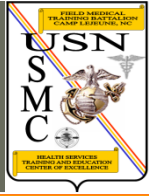
# HEAT STROKE



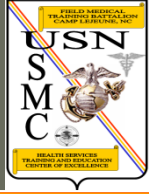
- Cause:
  - Impaired heat loss mechanisms
  - Total failure of the thermoregulatory mechanism causing excessive rise in body temperature



# HEAT STROKE



- Signs/Symptoms:
  - Elevated core temperature of 104° F or greater
  - Mental status changes
    - Confusion
    - Disorientation
    - Combativeness
    - Unconsciousness

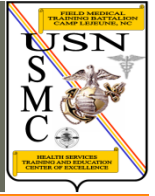


# HEAT STROKE

- Classic Heatstroke
  - Children, the elderly and sick patients
  - Dry, hot, red skin
- Exertional Heatstroke
  - Typically seen in men 15-45
    - Poor physical fitness
    - Lack of acclimatization
    - Involved in short-term, strenuous physical activity
    - Hot, humid environment
  - Sweat-soaked and pale skin at the time of collapse



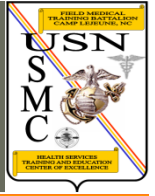
# HEAT STROKE



- Treatment
  - Primary goal is to reduce core temp
  - Remove patient from heat
  - Immediately begin cooling patient
    - Active cooling should stop when the rectal temp reaches 102.2°F
  - Maintain ABC's
  - Monitor core temp every 5-10 minutes

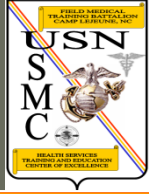


# HEAT STROKE



- Treatment (cont)
  - Oral fluids if conscious
  - Unconscious Gain IV Access
    - 500 ml, no more than 1-2 liters
    - Vigorous fluid therapy may develop pulmonary edema
  - TACEVAC ASAP





# METHODS OF COOLING THE BODY



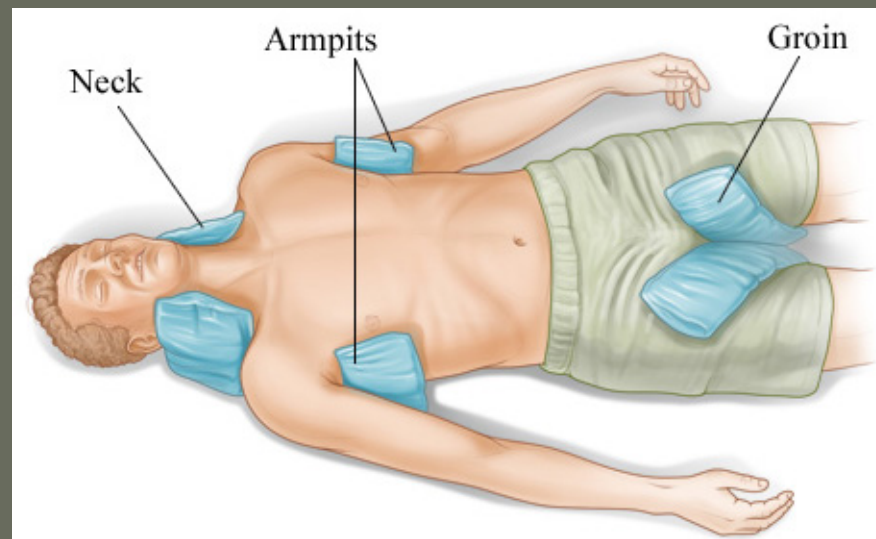
# MEHTODS OF BODY COOLING



- Immersion (Conduction):
  - Fastest method of cooling
  - Immerse patient in ice water
  - Not readily available in a field environment
  - Requires constant monitoring

# MEHTODS OF BODY COOLING

- Direct Cooling
  - Apply ice packs on head, trunks and extremities
  - Place ice water towel/sheets over casualty

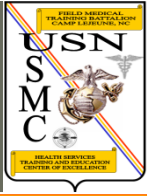


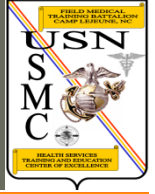


# MEHTODS OF BODY COOLING



- Room Temperature Water Misting
  - Remove clothing and wet the pt down
  - Fan the skin to cause evaporation and convective heat loss
  - Advantages
    - Fast method
    - Requires minimal monitoring
    - No cold or ice water necessary
    - Can treat multiple casualties at once

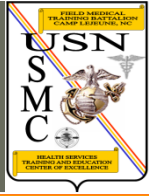




# Preventive Measures



# PREVENTIVE MEASURES

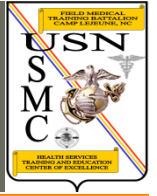


- Educate Personnel
  - Most important prevention measure
- Physical conditioning and health
  - Poor health and conditioning increases susceptibility





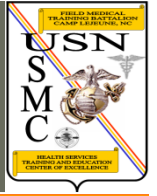
# PREVENTIVE MEASURES



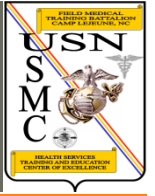
- Proper water intake
  - Drink liberal amounts of water (especially in hot weather)
  - Replace electrolytes by eating an adequate diet
- Proper acclimatization
  - 2 to 4 weeks (3 weeks optimal)
  - Gradual introduction to PT



# PREVENTIVE MEASURES



- Proper clothing
  - Wear least amount possible
  - Avoid skin exposure to sunlight
  - Clothing should be loose fitting
  - NO STARCH of field uniforms
- Work Schedules
  - Tailor work schedules around the climate and type of work





# Heat Condition Flag Warning System



# HEAT CONDITION FLAG WARNING SYSTEM



- Wet Bulb Globe Temperature (WBGT) index considers
  - Humidity
  - Air temperature
  - Radiant heat temperature





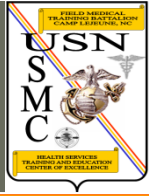
# HEAT CONDITION FLAG WARNING SYSTEM



- Color coded flag warning system:
  - White
  - Green
  - Yellow
  - Red
  - Black
- Flags should be displayed at all commands



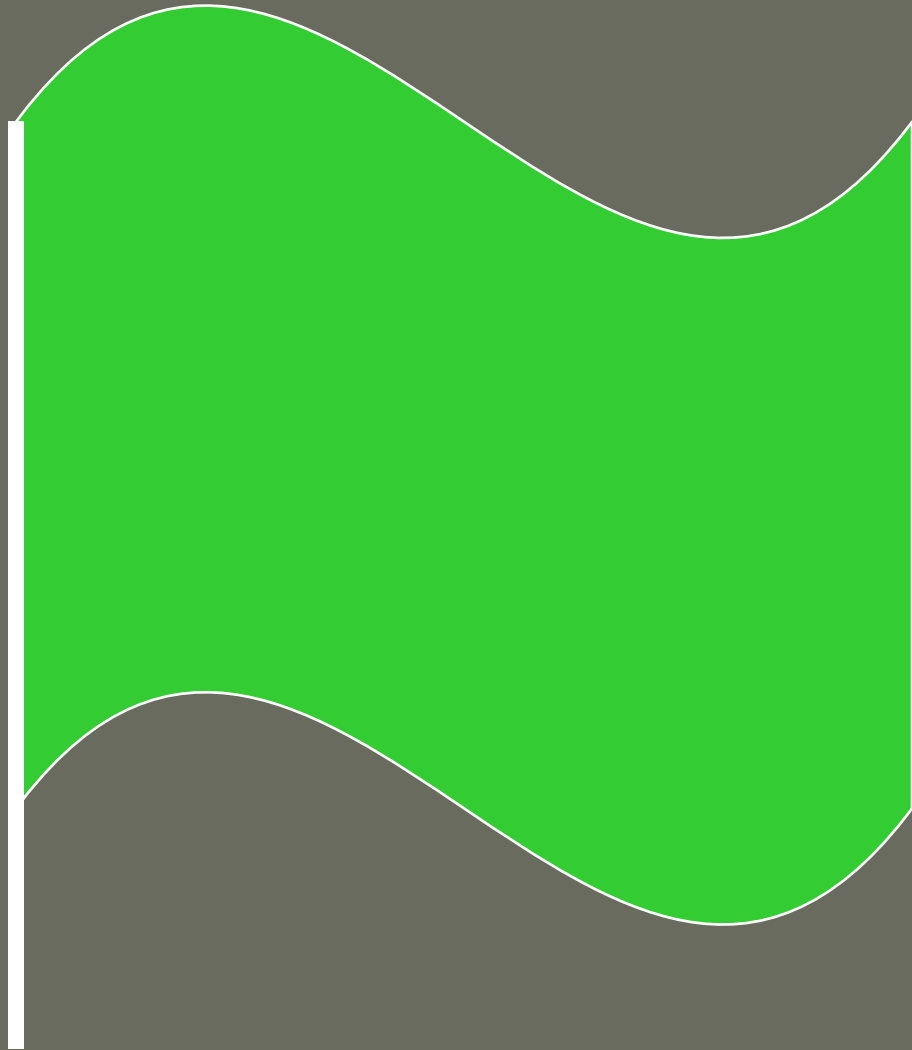
# FLAG WARNING SYSTEM



- White Flag:
  - WBGT 78 – 81.9° F
  - Caution must be taken



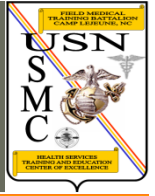
# FLAG WARNING SYSTEM



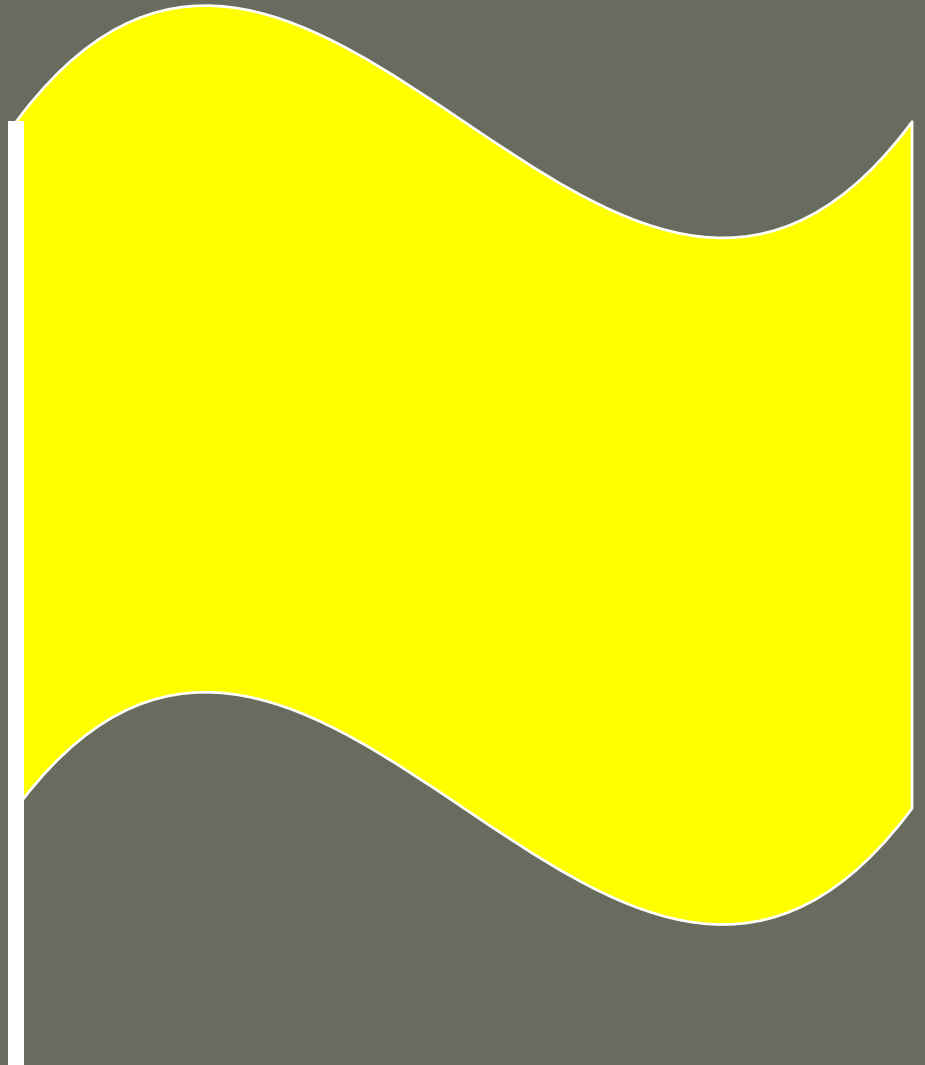
- Green Flag:
  - WBGT Index 82° - 84.9° F
  - Heavy exercise conducted with caution

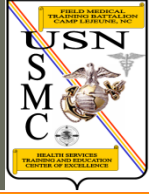


# FLAG WARNING SYSTEM

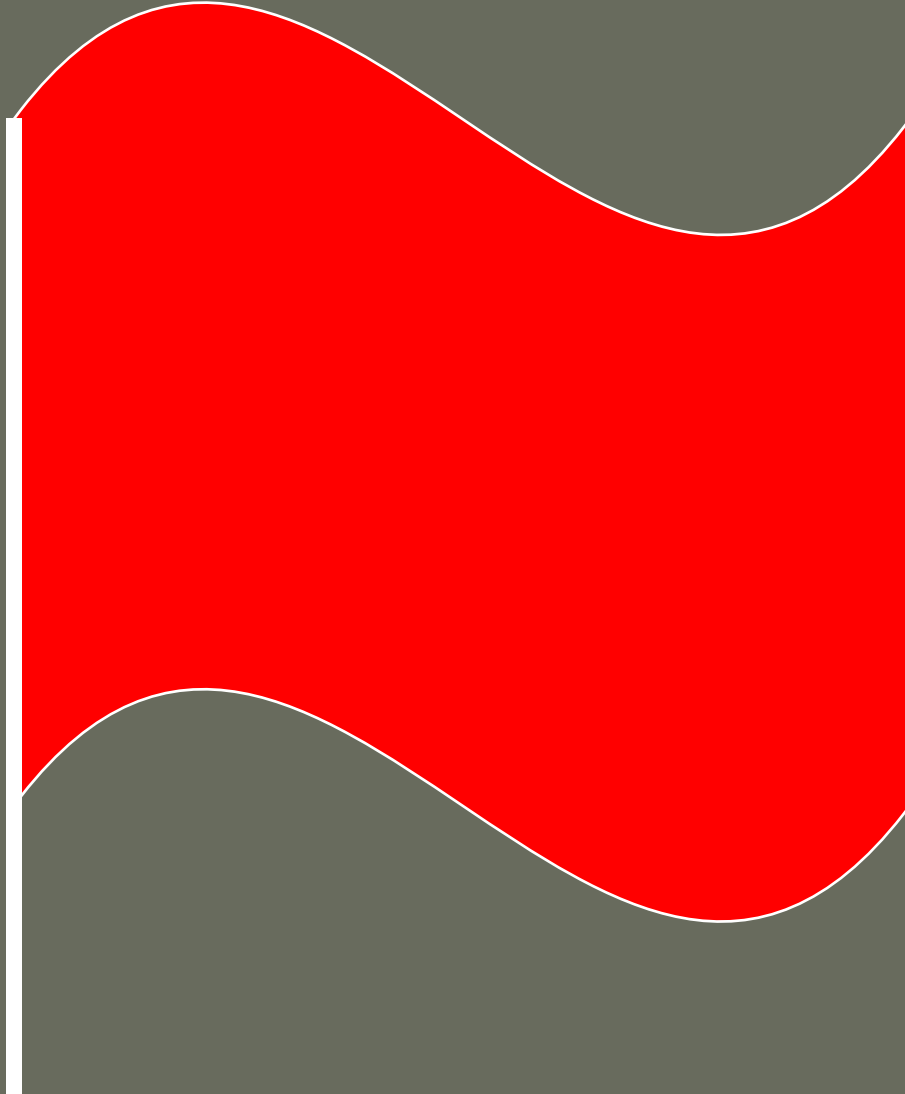


- Yellow Flag
  - WBGT Index 85°-87.9° F
  - Avoid strenuous exercise for unacclimatized troops
  - Avoid classes in sun





# FLAG WARNING SYSTEM



- Red Flag:
  - WBGT Index 88°-89.9° F
  - Suspend PT for unacclimatized troops
  - Limited activity for acclimated troops



# FLAG WARNING SYSTEM

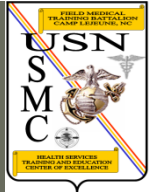


- Black Flag
  - WBGT Index 90°F and above
  - Suspend ALL physical activity for ALL Troops



Easy Work		Moderate Work		Hard Work			
<ul style="list-style-type: none"><li>Weapon Maintenance</li><li>Walking Hard Surface at 2.5 mph, &lt;30 lb Load</li><li>Marksmanship Training</li><li>Drill and Ceremony</li><li>Manual of Arms</li></ul>		<ul style="list-style-type: none"><li>Walking Loose Sand at 2.5 mph, No Load</li><li>Walking Hard Surface at 3.5 mph, &lt;40 lb Load</li><li>Calisthenics</li><li>Patrolling</li><li>Individual Movement Techniques, i.e., Low Crawl or High Crawl</li><li>Defensive Position Construction</li></ul>		<ul style="list-style-type: none"><li>Walking Hard Surface at 3.5 mph, ≥ 40 lb Load</li><li>Walking Loose Sand at 2.5 mph with Load</li><li>Field Assaults</li></ul>			
Easy Work		Moderate Work		Hard Work			
Heat Category	WBGT Index, F°	Work/Rest (min)	Water Intake (qt/hr)	Work/Rest (min)	Water Intake (qt/hr)	Work/Rest (min)	Water Intake (qt/hr)
1	78° - 81.9°	NL	½	NL	¾	40/20 min	¾
2 (GREEN)	82° - 84.9°	NL	½	50/10 min	¾	30/30 min	1
3 (YELLOW)	85° - 87.9°	NL	¾	40/20 min	¾	30/30 min	1
4 (RED)	88° - 89.9°	NL	¾	30/30 min	¾	20/40 min	1
5 (BLACK)	>90°	50/10 min	1	20/40 min	1	10/50 min	1
<ul style="list-style-type: none"><li>•The work/rest times and fluid replacement volumes will sustain performance and hydration for at least 4 hrs of work in the specified heat category. Fluid needs can vary based on individual differences (± ¼ qt/hr) and exposure to full sun or full shade (± ¼ qt/hr).</li><li>•NL = no limit to work time per hr.</li><li>•Rest = minimal physical activity (sitting or standing) accomplished in shade if possible.</li><li>•CAUTION: Hourly fluid intake should not exceed 1½ qts. Daily fluid intake should not exceed 12 qts.</li><li>•If wearing body armor, add 5°F to WBGT index in humid climates.</li><li>•If doing Easy Work and wearing NBC (MOPP 4) clothing, add 10°F to WBGT index.</li><li>•If doing Moderate or Hard Work and wearing NBC (MOPP 4) clothing, add 20°F to WBGT index.</li></ul>							
FMST 202				Environmental Heat Injuries			





# ENVIRONMENTAL HEAT INJURIES

