Coastal Carolina University
Athletic Training Department
Policy and Procedure Manual
Cold Stress

Revised/Reviewed 7/2011

INTRODUCTION:

Cold exposure can be uncomfortable, impair performance and even become life threatening. Conditions created by cold exposure include wind chill, frostbite, and hypothermia. Wind chill can make activity uncomfortable and can impair performance when muscle temperature declines. Frostbite is the freezing of superficial tissues, usually of the face, ears, fingers, and toes. Hypothermia, a significant drop in body temperature, occurs with rapid cooling, exhaustion and energy depletion. The resulting failure of the temperature-regulating mechanisms constitutes a medical emergency.

Hypothermia frequently occurs at temperatures above freezing. A wet and windy 30- to 50-degree exposure may be as serious as a subzero exposure. As the wind chill chart below indicates, wind speed interacts with ambient temperature to significantly increase body cooling. When the body and clothing are wet (whether from sweat, rain, or snow or immersion), the cooling is even more pronounced due to evaporation of the water held close to the skin by wet clothing.

Effects of Cold on the Body

Cold exposure affects many body systems. The combination of cold air and the deep breathing of exercise can trigger an asthma exacerbation (EIB). Cold air is not dangerous to lung tissue, but is can cause coughing, chest tightness and discomfort, such as a burning sensation in the throat and nasal passages.

Physiological factors, such as strength, power, endurance and aerobic capacity, are reduced by a drop in muscle temperature. Musculoskeletal injuries may increase when exercising vigorously in the cold, especially in the absence of adequate warm-up.

Recognition and Treatment

Early recognition of cold stress is important. Shivering, a means for the body to generate heat, serves as an early warning sign. Excessive shivering contributes to fatigue and makes performance of motor skills more difficult. Other signs include numbness and pain in fingers and toes or a burning sensation of the ears, nose or exposed flesh. As cold exposure continues, the core temperature drops. When the cold reaches the brain, a victim may exhibit sluggishness, poor judgment and may appear disoriented. Speech becomes slow and slurred, and movements become clumsy. The victim wants to lie down and rest. This is a medical emergency. Transport as soon as possible. First aid involves getting the victim warm and dry and, if possible, hydrated with a warm beverage.

Prevention

CLOTHING

Dress in layers and try to stay dry. Layers can be added or removed depending on temperature, activity, and wind chill. Begin with a wicking fabric next to the skin. Add lightweight or pile or wood layers for warmth and use a wind block garment to avoid wind chill. Because heat loss from the head and neck may be as much as 50 percent of total heat loss, the head should be covered during cold stress conditions. Hand covering should be worn as needed. Mittens are warmer than gloves.

Moisture, whether from perspiration or precipitation, significantly increases body heat loss. Keep dry by wearing a wicking fabric next to the body, hands and feet. Polypropylene or wool wick moisture away from the skin and retain insulating properties when wet. Cotton is a poor choice for winter wear since it holds moisture and loses insulating properties when wet.

ENERGY/HYDRATION

Maintain energy levels via use of meals, energy snacks and carbohydrate/electrolyte sports drinks. Negative energy balance increases the susceptibility to hypothermia. Stay hydrated, since dehydration affects the body's ability to regulate temperature and increases the risk of frostbite. Fluids are as important in the cold as in the heat. Avoid alcohol, caffeine, nicotine and other drugs that cause water loss, vasodilation or vasoconstriction of skin vessels.

FATIGUE/EXHAUSTION

Fatigue and exhaustion deplete energy reserves. Exertional fatigue and exhaustion increase the susceptibility to hypothermia, as does sleep loss.

WARM-UP

Warm-up thoroughly and keep warm throughout the practice or competition to prevent a drop in muscle or body temperature. Time the warm-up to lead almost immediately to competition. After competition, add clothing to avoid rapid cooling. Warm extremely cold air with a mask or scarf to prevent broncospasm.

Avoidance of cold injury is a matter of recognizing the potential for cold stress and dressing appropriately. While there is considerable variation in cold tolerance, repeated exposure increases tolerance. Adequate energy, hydration and warm-up will minimize problems. Considerations for canceling a practice or event should include specific environmental conditions, the experience and cold tolerance of the student-athletes, and the factors associated with cold stress.

NWS Windchill Chart

Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

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Courtesy of the National Weather Service