

# “Healthy Running”

## Running in Cold Weather

To paraphrase Bob Dylan, you don't need the weather report to know it's getting colder. In this month's "Healthy Running", I'll review how our systems react to cold conditions, discuss hypothermia and the risk factors for it, and the steps to take to run safely this coming winter season.

Our bodies maintain a steady internal or “core” temperature by balancing heat production and heat loss. We generate heat as a byproduct of our metabolism and from the work of our muscles during physical activity. We lose heat four ways: by radiation, when heat moves from our body to our surroundings without physical contact; by conduction, when heat moves to air or water in physical contact with our skin; by evaporation of sweat; and by convection, when air or water currents carry heat away. Running in winter months exposes us to cold, windy, and wet conditions that increase heat loss by these means. We can usually keep up with this loss through the heat generated from the muscular work of running. Our systems further reduce heat loss by decreasing blood flow to our skin and the areas farthest from the center of our body (called vasoconstriction). If needed, we further offset heat loss and generate more heat by the muscle activity of shivering. However, if these actions are not sufficient and we continue to lose more heat than we generate, our core temperature drops and we suffer hypothermia.

Medically, hypothermia is defined as a core body temperature below 35°C (95°F). Mild hypothermia, with core temperature 33°C to 37°C (91.4°F to 98.6°F) results in feeling cold, shivering, impairment of fine motor skills (clumsy hands), social withdrawal, impaired judgment, and apathy. Moderate hypothermia, with core temperature 29°C to 32°C (85.2°F to 89.6°F), results in slurred speech, sleepiness, loss of shivering, drop in blood pressure, and irregular heartbeat. Severe hypothermia, with core temperatures below 28°C (82.4°F), results in unconsciousness and life threatening irregular heart rhythm (ventricular fibrillation). Recognizing signs and symptoms is very important! You're not likely to have a rectal thermometer, the only accurate method of measuring core temperature.

By knowing how the body generates, retains, and loses heat, it is easy to understand the conditions that place runners at risk for hypothermia. Runners are at greatest risk for hypothermia in cold, windy, and/or wet conditions. Heat losses in raining weather can be considerable even in mild temperatures (more efficient convection and conduction than dry air). In the absence of rain or snow, clothing that becomes wet with sweat increases heat loss. Heat losses increase as wind speed increases (convection and evaporation). Remember that your running creates a “head wind” equal to your running speed. Thus, even on calm but cold days, there is always the potential for heat loss due to air movement around you.

Greater running intensity (track, fartlek, tempo, hills), will increase heat production, but the resulting wet gear can result in heat loss during the less intense “cool-down” or if there is a delay in getting into dry gear. Underdressing exposes more body surface area to the cold, and overdressing can result in excessive sweating, especially if wearing non-wicking non-technical materials. Due to their greater surface area, significant amounts of heat can be lost from the unprotected or wet heads, hands and feet.

Runners who are under the age of 12 years or over 60 years have a delayed response to the cold. They do not redirect blood away from the skin as quickly and they may not recognize feeling cold as promptly than others. Thin runners with less body fat and/or less muscle mass have less insulating capacity to preserve heat. Gender does not appear to play a specific role in predisposing to cold injury (other than related to differences in body size, body fat, and muscle mass). However, women with amenorrhea (cessation of periods) have difficulty maintaining core temperature compared to their counterparts with normal menses.

One's level of training and fitness are factors as well. Runners with greater fitness can maintain a greater exercise intensity, and thus greater heat production, for longer times. Less trained runners may slow down and take longer to complete the second half of a workout or race, generating less heat. The damp gear from the more intense earlier portion of the race leads to further heat loss. This is compounded by loss of effort due to fatigue, whether due to inadequate sleep, inadequate nutrition, etc.

Medical conditions can interfere with the body's temperature regulation. These include amenorrhea (as above), untreated hypothyroidism, diabetes, neuropathies, alcohol, and medications such as sleep medicines and anti-anxiety medication.

What should you do if you suspect a running partner has hypothermia? (Why do I word this question this way? The effects of hypothermia may prevent you from recognizing your own cold injury.) Move the runner to shelter, out of wind and rain and into warmth. Remove wet and damp clothing promptly, including gloves, caps, and socks. Dry off skin and help them into dry warm clothing. Encourage them to drink warm fluids. Note that dehydration does not increase the risk for hypothermia, but dehydration can result from sweat losses and moisture lost during breathing. Additionally, muscles use more glycogen when shivering. Therefore, carbohydrate containing fluids are a valuable aid. (Did anybody say hot chocolate?) Warm blankets may be necessary. However, if a runner displays the symptoms of moderate or severe hypothermia (as discussed above), or if she/he does not improve with these basic measures, keep them quiet and still (to prevent irregular heartbeat) and transport them to an emergency department for more aggressive warming measures.

There are other important cold-related conditions. Cold exposure is considered a factor in exercise-induced asthma, and those susceptible should use short acting rescue inhalers accordingly, including before the run. Another important consideration is heart disease. People with coronary artery disease should be familiar with the symptoms of angina (chest heaviness, pressure, tightness; shortness of breath or labored breathing) and recognize that cold conditions may provoke angina more easily. Every runner is different; discussion with the runner's PCP or cardiologist is prudent.

A brief mention of frostbite. Frostbite occurs when tissue freezes. It is most common on exposed areas of the ears, nose, cheeks, hands and feet that are not properly protected. The risk of frostbite is less than 5% if the air temperature is over 5°F (-15°C), but it increases if the wind chill temperature is under -18°F (-27°C). This occurs with exposure to 0°F with 15 mph winds, to 5°F with 30 mph winds, and to 10°F with 55 mph winds. For more details, this wind chill temperature index can be found at the US National Weather Service (<http://www.nws.noaa.gov/os/windchill/index.shtml>). Note that wet skin is more susceptible to frostbite. If feet, gloves, or ear coverings are wet, subtract 18°F (10°C) from the air temperature and use that when referring to the wind chill index table. Also, petroleum lubricants applied to these areas do not protect skin but efficiently conduct heat to the surrounding cold air and increase the risk for frostbite. The signs and symptoms of frostbite are numbness of the affected area,

followed by a “wooden” sensation. Skin becomes waxy white and may feel thick or firm to touch. It may take several days for the full extent of tissue damage to be known. The first aid for frostbite includes removing wet and restricting clothing and relocating the runner to warm conditions. Rewarming the injured area should only be started if one is absolutely certain that refreezing will not occur. The best course of action, therefore, is prompt medical attention and emergency department care.

Back to hypothermia. The most important way to manage hypothermia is to prevent it. Note that for practical purposes, we do not “acclimate” to cold weather and adjust our heat regulation as we can for hot weather running. Don’t forget the basics: prevent fatigue with adequate sleep and maintain adequate carbohydrate intake for muscle glycogen stores. If possible, run during the warmest hours of the day and when wind and rain are less. Winds can vary greatly over the time and course of your run. You can easily estimate wind speed with basic observations. Wind speed is at least 10 mph if you feel it in your face. It is about 20 mph if small tree branches are moving or if dust/snow is stirred and about 30 mph if large tree branches move. Author and coach Jack Daniels suggests planning your running route to run into the wind over the first half, thereby increasing heat production, and running the second half with the tail wind to minimize heat loss from sweat or the slowing effects of fatigue. Also, plan your route so that there are opportunities for warmth, shelter, and fluids if needed. Cold conditions may not be the best time for the first run on that trail that’s always been on your list. This is the time to be familiar your surroundings and resources and where you can seek assistance if needed.

Proper clothing is the most important preventive strategy. Remember to keep head, ears, and hands covered. If you warm up during your run, you can easily stow cap, ear band, and gloves in pockets. A balaclava is an option for some runners. Clothing should be in layers. The inner layer should be snug but not restricting and made of technical fabric that wicks moisture from the skin (typically referred to as compression gear). A middle layer can be a long sleeve technical shirt (as given out at races) or polyester fleece (wool is OK as well). It serves to provide insulation but should also take moisture away from the skin. An outer clothing layer can serve to protect from wind and rain but ideally should allow the escape of moisture. As the duration and intensity of your run or workout progresses, layers can be removed. For intense workouts, the outer layer can be reserved for the less vigorous warm-ups and cool-downs. If you anticipate that your running pace will slow as your workout/race progress, carry an outer layer with you at the start and put it on when your pace slows or you choose to walk. Additionally, based on your experience and training, consider running tights. And replace your summer socks with those made of materials that keep your feet warm and dry.

Preventing hypothermia and minimizing heat losses is the best way to run safely in the winter. If you are registered to run a half-marathon or marathon in cold conditions, take the time to read the weather and medical advisories sent out by the race director. Dress accordingly; our local running stores are well-stocked with all of the gear you will need for safe winter running. And when running in the cold, run with “a buddy” or a group. Others may see that cold stress is affecting you long before you recognize it.

Sources and citations:

“Prevention of Cold Injuries during Exercise”. American College of Sports Medicine Position Stand. *Medicine and Science in Sports and Exercise*, Vol 38: 2012-2029; Nov 2006.

“National Weather Service Windchill Chart”. Office of Climate, Water, and Weather Services, National Weather Service. <http://www.nws.noaa.gov/os/windchill/index.shtml> (accessed 11/20/14).

“Heat and Cold Illnesses during Distance Running”. American College of Sports Medicine Position Stand. *Medicine and Science in Sports and Exercise*, Vol 28: i-x; Dec 1996.

“Heat- and Cold-induced Injuries in Athletes: Evaluation and Management”. *Journal of the American Academy of Orthopedic Surgeons*, Vol 20: 744-754, Dec 2012.

“Subterranean Homesick Blues”. *Bringing It All Back Home*, Bob Dylan, Columbia Records, 1965.

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