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Cold Water Survival: Hypothermia

Michigan State University

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# COLD WATER SURVIVAL

## Hypothermia

### What It Is—What You Can Do

by Stephen Stewart and Suzanne Tainter

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When rescue vessels arrived less than two hours after the *Titanic* went down, almost 1500 people though floating with their heads out of water were already dead. The death certificates read drowning; but the more likely cause of death was hypothermia.

Hypothermia is not something exotic that happens only to victims of ship disasters. It endangers duck hunters, fishers, canoers, hikers, motorists stranded in blizzards—in short, it threatens anyone unprepared for cold weather or cold water. You may have heard it called exposure.

Hypothermia is a gradual lowering of the temperature of the body's core, especially the heart, lungs and brain. Unchecked, the eventual result is death. But there are many complications short of death. Most people are aware of the consequences of only a few degrees rise in body temperature—a fever. Fewer are aware that there is danger in a lowering of body temperature.

Hypothermia is "freezing to death," although death occurs long before the body reaches 32°F(0°C). And freezing temperatures are not required to produce it. Any exposure long enough to temperatures low enough to cause your body's heat loss to outstrip its heat production will cause hypothermia. It is one of the potentially severe hazards of outdoor activities.

Hypothermia is of two types depending upon the length of time over which the condition develops. Chronic or long-onset hypothermia develops with exposures usually greater than 12 hours. Most chronic hypothermia sufferers are hikers or mountain climbers who get wet through perspiration or precipitation and then must face temperatures between 32°F(0°C) and 50°F(10°C). In chronic hypothermia there is sufficient time for dangerous chemical changes to take place

in the blood and for fluid imbalances and blood pressure problems to develop. This makes professional treatment very important.

The other kind is acute sudden-onset hypothermia. Usually it is the result of sudden immersion in cold water. Victims are often hunters or fishers who fall overboard. Cold water can cool a body as much as 25 times faster than air. Thus hypothermia can develop rapidly in a water accident.

How quickly you would develop hypothermia depends on the temperature of the surrounding air or water and whether there is wind or a water current to constantly remove the air or water layer closest to the body. But your cooling rate also depends on your body build, what you are wearing, and what you do, your general health and whether you have been drinking alcohol or smoking.

In water 50°F(10°C), an average man wearing a shirt, pants, socks and running shoes staying still in a personal flotation device (PFD, life vest) may survive 2 1/2 to 3 hours. The skin in close contact with the water will very quickly take on the temperature of the water, but it takes 15 minutes for the brain and heart to begin to cool. Hypothermia can occur in air as warm as 75°F(24°C) and water as warm as 91°F(33°C).

Fat people cool more slowly than thin people. Women, although they have more

fat beneath the skin, being generally smaller than men also cool faster. Children, smaller than adults, cool faster than they do.

**Now that you know what hypothermia is, how do you recognize it?**

It is not always easy to recognize hypothermia, especially in yourself. The first thing the body does when it is cold is shut down blood vessels near the skin surface to conserve heat for the heart, lungs, and brain. This gives hypothermia victims a blue appearance. Another early symptom is violent uncontrollable shivering, as the body tries to generate more heat. As cooling continues, shivering gives way to muscle spasms, muscles become rigid and victims lose control of arms and legs. Thus hypothermia sufferers tend to be clumsy, lose coordination and manual dexterity. They often have trouble breathing.

Mental disorientation is another symptom. This may show up as an inability to make decisions, making the wrong decisions, forgetfulness, confusion or as personality changes. This mental disorientation is what makes it difficult to recognize hypothermia in yourself.

As the condition worsens, victims become semiconscious appearing drugged or drunk. Eventually they lose consciousness and may appear dead. Unless some form of heat is donated to the victims they will die.





## What should you do for hypothermia victims?

All hypothermia victims should be seen by a physician, but first aid can be very important for preventing the deepening of the hypothermia. This can mean the difference between death or survival.

In aiding a hypothermia sufferer it is important to distinguish between the two types of hypothermia. Chronic, long-onset hypothermia victims have developed the condition slowly and serious fluid and chemical changes have taken place. Sophisticated medical help is best. Wrap the trunk and head of the victim in a blanket to prevent further heat loss and transport to a medical facility as soon as possible. If you must rewarm the victim in the field, then use methods described below which allow you to keep the victim's feet slightly elevated, head lower than the rest of body. This helps maintain the blood flow to the brain.

First aid must be administered carefully to hypothermia sufferers. The aim is to minimize *afterdrop*. This is a further lowering of the body temperature as the cool blood from the extremities returns to the core once the victim begins to be warmed.

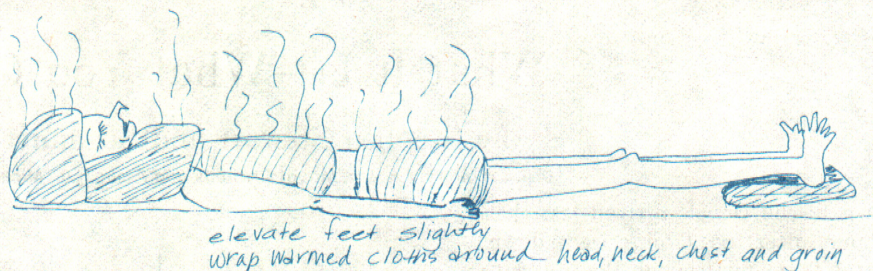
To minimize afterdrop all recommended rewarming methods add heat to the head and trunk to warm from the core outward. Furthermore, because of the loss of strength and weakened condition of the heart, it is important to handle patients as little and gently as possible. Jostling may cause cardiac arrest. During rescue, do not allow victims to exert themselves. Even helping remove their own clothing can stimulate blood flow and worsen afterdrop.

In any case of hypothermia, first get people out of the water, to warm shelter, and out of wet clothes. The next step is rewarming. The measures necessary depend upon the degree of hypothermia.

If the victims are conscious, talking clearly and sensibly, and shivering vigorously, then warm dry clothing and shelter, and hot sugary drinks will probably be sufficient to warm up the victims. But watch victims for signs that their condition is deteriorating.

If victims show signs of clouded consciousness like slurred speech, suffer muscle spasms, or, worse, are already unconscious, then aggressive rewarming is necessary. Heat must be donated to these victims. Once hypothermia has pro-

# COLD WATER



gressed beyond vigorous shivering merely wrapping victims in blankets will only keep them cold.

There are several time tested ways to supply additional heat. All make use of the high heat transfer areas of the body—the head, neck and groin where blood vessels pass near the body surface, and sides of the rib cage where little fat insulates the body.

**Heated Oxygen:** The most recommended method is to administer heated humidified oxygen at 108°F. However, this requires equipment which may not be readily available.

**Hot Packs:** This method allows flexibility to apply other measures which may be necessary like cardiopulmonary resuscitation. Lay the victims flat on their backs with feet slightly elevated. Then apply some form of hot pack to the head, neck, sides of chest and groin area leaving arms and legs free. One way is to use towels, sweatshirts or other cloth warmed with hot water (110°F, 43°C). Periodically rewarm the towels by adding hot water. Be careful not to burn the patient. Test the water temperature with your elbow. Hot water bottles, chemical hot packs, heating pads and other such devices could also be used.

**Warm Bath:** A fully conscious victim with no other major injuries, unlikely to require breathing assistance or cardiopulmonary resuscitation can be rewarmed in a bathtub. Place the victim's body with the arms and legs kept out of the water in a tub of 110°F water. You could also sit the victim in a shower stall with the warm spray directed at the trunk.

What do you do out in the wilds where you have no bathtub let alone humidified oxygen?

**Field Methods:** A time tested field method relies on body heat supplied by the rescuers. Strip the victim and wrap in a sleeping bag or blanket along with one or more rescuers, also naked to allow as much transfer of heat from the rescuers to the victim as possible. Be sure to use a sleeping bag or blanket to trap heat around the persons.

Mouth to mouth resuscitation is also a method that can be used in the field and in combination with the sleeping bag method. Even victims breathing on their own can be aided this way; just be sure to breathe with the victims not against them.

**What not to do:** There are some time honored folk remedies which may actually cause harm. Forget all those St. Bernards with the kegs of brandy around their necks. *Never* give alcohol to any hypothermia victim. It may relax the blood vessels in legs and arms allowing cool blood to return to the core.

## Hypothermia Prevention

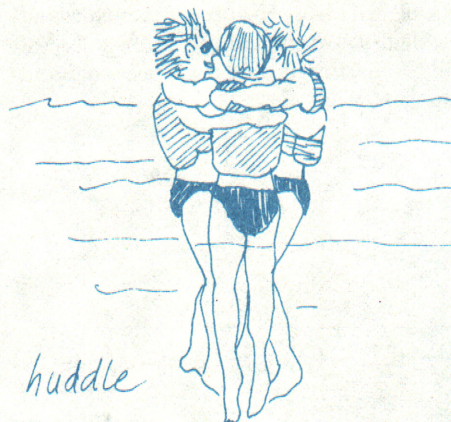
In hypothermia, as in most medical conditions, prevention is the best medicine. How can you protect yourself against it?

Weather and water temperature are beyond your control. You must be prepared to cope with natural conditions. What you wear and what you do will spell the difference between a safe outing, and a potentially life threatening one.



# R SURVIVAL

What should you do  
if an accident occurs?



Experienced outdoor enthusiasts know that layering is the key to staying dry, warm and comfortable. Rather than wearing one heavy jacket, wear pieces that can be put on or removed depending on weather and exercise. One of those layers should be wool. Unlike cotton or down, wool retains insulating ability even when wet. Always have a covering for your head. You can lose as much as 50 percent of your body heat through your head and neck area.

Proper nutrition, pacing and conditioning are also important to backpacking, hiking or other such outdoor activity.

For other hints on preparing yourself for such trips or blizzards or other situations where long-onset hypothermia can be a problem, contact your county extension office.

What can potential cold water immersion victims do to protect themselves from hypothermia? After all, we rarely intend to be forced out of a boat into cold water.

Again, there is special clothing you can wear. And most importantly, there are measures you can take to prevent accidents, and techniques to use if an accident occurs that will slow the onset of hypothermia.

Since water-accident victims rarely intended to enter the water, clothing donned before the trip is very important. Manufacturers of boating safety equipment make special "float coats," PFDs that are as handsome and inconspicuous as regular outdoor jackets. They look like ski jackets but have protective insulation and flotation

material in them. Some models even come with a panel that can be snapped over the groin area to turn it into a mini wet suit. One model has an inflatable pillow in the pocket which can be used as a raft to get as much of the body out of the water as possible.

These garments more than double survival time compared to regular PFDs, and are highly recommended for persons who spend a lot of time around cold water, for example duck hunters and Great Lakes boaters.

Another way to guard against hypothermia is to prevent behavior which contributes to water accidents. A thermos of hot chocolate will do more to keep you warm and your judgement sharp than a hip flask of something alcoholic. Know boating safety basics. Stay still; don't move about in a boat. Distribute loads evenly; heed the load limits on your craft. Slow down gradually; sudden deceleration can allow the sternwake to overtake and swamp the boat. Have as many PFDs as persons on board and wear your life vest.

The U.S. Coast Guard Auxiliary and the Michigan Department of Natural Resources offer free courses on boating basics—safety, navigation and rules of the road. Contact your nearest Coast Guard station or DNR office for the next course in your area. For more information contact the Sea Grant agent nearest you through your county extension office.

First, stay calm. If you struggle you may inhale water and you will lose the buoyancy of the air trapped in your clothing. If you are forced into the water try to enter as slowly as possible. Consciously control your breathing. The shock of the cold water tends to make you hyperventilate (breathe too often) which can make you pass out.

Try to get as much of your body out of the water as possible since water conducts heat away from your body many times faster than air. Even a capsized boat full of water usually floats.

If you must stay in the water, stay still curled up in the H.E.L.P. position (heat escape lessening posture). It is a fetal-like position. Pull your knees up, cross your ankles, hug your sides. This protects the high heat loss areas of the sides of the chest and the groin. This procedure assumes you have a PFD to keep your head out of the water.

If there is more than one person in the water, huddle together pressing chest areas together to block cold water flow. If there are children in the water also, huddle with them between adults if you can't get them out of the water onto a boat or other floating object.

If you have no PFD, you will have to tread water. Many people have learned a technique called drownproofing for keeping afloat for long periods with little energy expenditure. This works well in warm water but should not be used in cold water. Since it requires putting the head in the water, it speeds heat loss by as much as 82 percent over staying still in a PFD.

Should you swim for shore? This is a difficult decision. Distances over water are deceptive. Even strong swimmers are quickly overcome by hypothermia. Swimming speeds cooling rates. Hypothermia disrupts coordination and robs you of strength. Average swimmers make about 8/10ths of a mile before being overcome. Stay with the boat. It is easier for rescuers to spot you that way. Only swim for shore if it is less than a mile away, you are sure you can make it, you have flotation help, and there is absolutely no other chance of rescue.



# Cold Water Near-Drowning

The paradox of cold water is that just as it can steal away a life, it can also prolong the life of a person who otherwise would have drowned.

Recent research shows that persons who appear drowned may not be dead. Dr. Martin J. Nemiroff, Michigan Sea Grant, has determined that persons can survive submersion in water colder than 70°F (21°C) without brain damage longer than the four minutes previously believed to be the survival limit to avoid brain damage. Though victims pulled from the water appear dead and are not breathing, they can be revived with immediate resuscitation.

## Why can some cold water "drowning" victims survive?

Sudden face contact with cold water (below 70°F) sometimes touches off a primitive response called the "mammalian diving reflex." This complex series of body responses shuts off blood circulation to most parts of the body except the heart, lungs, and brain. Thus, what little oxygen remains in the blood gets transported to the brain where it is needed the most. Even though there may be very little oxygen in the blood, it can be enough since the cooled brain requires much less oxygen than normal.

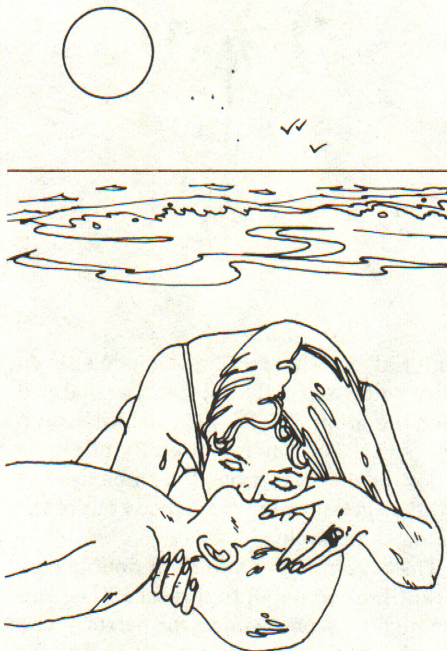
While we know little about the human diving reflex, scientists know that diving mammals like whales, porpoises, and seals depend on a similar mechanism to survive long periods underwater.

By itself the diving response won't protect everyone of course.

Survival depends on:

- How long the person is under water
- How cold the water is
- The age of the victim
- How well the rescuers do their jobs

Children and young people are the most frequent drowning victims. However, they are also good candidates for resuscitation since they often have a more pronounced "diving reflex." In research at the University of Michigan Hospitals, two-thirds of the cold water drowning victims successfully resuscitated were 3 1/2 years old and younger.



## CPR Spells the Difference Between Death and Survival

Immediate, competent cardiopulmonary resuscitation (CPR) is the key to reviving a cold water near-drowning victim, or for that matter a victim of a

heart attack, lightning strike or other accident involving heart and breathing stoppage.

CPR is a carefully choreographed system of administering mouth-to-mouth rescue breathing and external heart massage. A booklet describing CPR and other treatment in cold water emergencies is available from Michigan Sea Grant. Ask for *Cold Water Drowning: A New Lease on Life*.

Clearly, CPR is not something you want to be learning while you are trying to apply it. Call your local American Red Cross office for the next class offered in your area. Sign up; learn the technique so that if you are ever called upon to administer it you can do so promptly and confidently.

## References

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Michigan Sea Grant and U.S. Coast Guard. *Cold Water Drowning: A New Lease On Life*. 1978.

Stewart, Stephen R. *Hypothermia—What it is, what you can do*. 1978. Michigan Sea Grant Marine Advisory Service.

U.S. Coast Guard. *Hypothermia and Cold Water Survival*. 1978. Instructors Guide and other Coast Guard materials provided by Lt. Commander David Smith, Second District, St. Louis, MO.

A good source of water safety information is the U.S. Coast Guard. Contact the station nearest you or call the **Boating Safety Hotline** toll free: (800) 325-7376.

## What to do in a cold water emergency:

1. Clear the air passage and begin mouth-to-mouth rescue breathing and external heart massage (CPR) *immediately*. Do not worry about getting water out of the victim's lungs. The body will absorb it quickly.
2. Prevent the victim from losing more heat but **DO NOT** rewarm the victim.
3. Get the victim to the nearest medical facility quickly. CPR must be continued uninterrupted until the victim is under professional medical care.
4. **Do not give up.** Cold water victims look dead. Their skin is blue and cold to the touch. There is no detectable heart beat or breathing. Their eyes are fixed, and the pupils dilated (open). And there is no other sign of life. However, if the water was cold there is still a good chance of survival.

## How Cold is Cold Water?

Though pinning an exact temperature on "cold" is difficult, the cut off is about 70°F (21°C). This water feels cold to the skin. In many homes water out of the cold water faucet is about 68°F (20°C). Many waters in the Great Lakes region, particularly below the lake surface, are less than 70°F all year round.

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