High Altitude Health Care Information

The mountains are among the most beautiful places to visit and we hope to enjoy every bit of the visit. However, these mountains often rest at high altitude and can cause health problems for visitors like you and me – the causal day trip hikers, multi-days trip trekkers and peak climbers.

Here, we will discuss the health issues and common injuries that may occur at high altitude. We will also share some tips on how to prevent these injuries, as we all know, prevention is always better than cure.

The information shared here are compiled and reviewed by our Medical Advisor – ***Dr Shani Tan***

Health Issues At High Altitude

Altitudes over 3000m can pose health issues. Problems are related to:

1. High altitude (reduced amount of oxygen available to the human body)
2. Cold temperatures and dry air (high altitude places are often cold and dry)
3. Remote location – we usually have to travel a significant distance from “civilisation” to access these beautiful places.
4. Pre-existing medical problems may get worse

Our bodies will have to adapt to the reduced oxygen (a process called acclimatisation) and get used to cold dry air. We will experience new sensations and changes in our bodies.

Though generally not life threatening, these health issues can drastically alter the level of performance during a trek. It is vital and important to look after your body well and keep it in optimal conditions at altitude. If you have pre-existing medical conditions, visit your Family Doctor and Travel Clinic before the trip for specific advice.

Some of the most common effects of altitude exposure on the human body include:

Reduced physical performance

The human body cannot maintain the same physical performance at altitude as they can at sea level, regardless of sea level fitness. With acclimatisation this can improve. Individuals acclimate at different rates.

Psychological Effects

Altitude exposure may result in changes in senses e.g. taste and appetite, mood, and sometimes personality. These effects are directly related to altitude and are common at over 3000m. Some effects occur early and are temporary while others may persist after acclimatization or even for a period of time after descent.

High Altitude Heath Care Information

Dehydration

Dehydration is very common. Causes include perspiration/sweating, vomiting (due to altitude illness or gastro-enteritis), increased breathing (due to physical activity and altitude) and diminished thirst sensation. Dehydration decreases physical performance, increases symptoms of altitude illness, and may increase risk of developing cold injuries.

Sleep Disturbance

Altitude exposure will have significant effects on sleep. The most prominent effects are frequent periods of apnoea (a temporary pause in breathing) leading to fragmented sleep. Reports of “not being able to sleep” and “being awake half the night” are common and may also contribute to mood changes and daytime tiredness. Changes in time zone due to travel, not being used to sleeping in a sleeping bag or on a sleeping mat or tent may also contribute to poor sleep.

Swelling (Edema):

Edema is swelling caused by fluid retention - excess fluid trapped in the body's tissues. Swelling in the hands, arms, ankles, legs, feet and the face is common at high altitude. The swelling causes little discomfort and usually goes away in a few days. Unless the fluid retained causes a physical problem, such as difficult vision from puffiness around the eyes, or difficulty using fingers for fine manipulations, making an active attempt to get rid of the fluid is probably not necessary.

Cold Exposure

At higher altitudes, the air is "thinner" so you need to breathe more air to get the same amount of oxygen. Because the air is also drier and colder, you may lose more body heat through the lungs by panting and being active. Lower oxygen levels can also change your normal good judgment, such as knowing when to wear adequate protective clothing. Cold injuries like Trench Foot, Chilblains or the more serious frostbite and hypothermia can therefore occur quickly.

Nutrition

Poor nutrition can severely impact health and energy levels and contribute to illness or injury, decreased performance and poor morale. At high elevations dulled taste sensations (making food undesirable), nausea, or lack of energy can decrease the motivation to prepare or eat meals. Poor eating habits may also lead to constipation, aggravation of haemorrhoids, and undesired weight loss.

These are some ways that you can take care of your health at high altitude

Acclimatization

If you notice any early-warning symptoms (headache, nausea, sleeping problems, dizziness, general uneasiness), **do not ascend** to a higher altitude. Consider asking your GP about a medication called Acetazolamide (Diamox). It may be taken prophylactically or as treatment for Altitude Illness. Recommendations for Acetazolamide can be found **here.**

Hydration

Dehydration at high altitudes can be a serious problem, especially while you are acclimatising. Do not assume that you are OK if you are not thirsty. Drink water or tea regularly and aim for about 2-3 litres of liquids each day. Start hydrating adequately a few days prior to the start of the trek and throughout the trek. Practice the discipline of adequate hydration during your pre-trip physical training. Weight yourself before and after a training session to see how much sweat (fluid) you have lost. If you have been sweating a lot and think you have drunk enough fluid and are still lighter at the end of the session, then you haven't drunk enough. In the tropics it is not uncommon to sweat 1L per hour or more. In cooler temperatures the loss will of course be less.

Get adequate sleep & rest

It is sometimes difficult to sleep at high altitude, try to avoid lying flat on the bed or in a tent. Use your backpack as a backrest so that you rest your upper body slightly elevated.

Avoid Alcohol and sleeping agents (medication that cause drowsiness)

Avoid use of alcohol or sleeping agents. They both suppress breathing and result in lower blood oxygen level in the body.

Eat well

You will need those extra calories to keep warm and give you the energy for the long treks. Even if you do not have an appetite, do try to eat.

Keep warm / Stay dry

Extremes of temperature are not uncommon. The temperature can rise or fall in a very short space of time. Ensure that you have the essential layers of warm clothing to prevent the body from catching a chill. Trekking in the day can be hot and causes the body to perspire. Wear clothing that wicks perspiration away from the body and stays dry. Avoid materials such as cotton that does not wick and stays soggy. Examples of good materials are polypropylene, polyester and merino wool (which stays warm even when wet). Have a good layering system of several thin and medium layers instead of one thick layer so that you can adjust your clothing to stay comfortable, avoid excessive sweating and making all your clothes sweaty. When you stop to rest, and if your layer is super wet, change out to a dry layer. If your base layer is not wet, put on a layer to keep warm when in-active.

Keep the throat moist

Due to the dry and cold air, dry throat and cough is common at altitude. Keep the throat moist by drinking warm water (good to drink honey lemon water), suck on 1 or 2 lozenges, and breathe through the nose if possible (we recognise that some people are mouth breathers. Keep a small Thermos flask with hot water with you at bedtime such that warm water is within reach if you wake up with a dry throat in the middle of the night. Wear a lightweight neck gaiter or bandana if trekking along very dry and dusty trails – cover your nose and mouth and breathe through that if you find dry air and mouth breathing gives you a dry throat.

Booze up the immune system

Take multi-vitamins or Vitamin C, eat lots of fruits and vegetables if possible. Visit the Travel clinic in good time before the trip and get the recommended immunisations.

Pre-existing Medical Conditions

People with pre-existing medical conditions should speak with a doctor before travelling to high altitudes:

- Common conditions such as high blood pressure, asthma and certain lung diseases need a consultation with a doctor who is familiar with high altitude medicine. These conditions at the very least must be well controlled.
- Diabetics must be well controlled. Their condition may become more or less difficult to control depending on their situation and the trip conditions. Those with complications such as nerve damage or eye damage are at risk of further damage. Those with numb fingers and feet are at greater risk of frostbite and other complications.
- Certain inherited blood conditions may make high altitude travel more difficult.
- Pregnant women should seek advice from their obstetrician especially with regards to availability of adequate care in the event of premature labour. Most advise not travelling above 3000m.

Three important potential injuries

Altitude Sickness

Sun Damage

Cold Injuries

Altitude Sickness

As one ascends through the atmosphere, barometric pressure decreases (though the air still contains 21% oxygen) and thus every breath contains fewer and fewer molecules of oxygen. One must work harder to obtain oxygen, by breathing faster and deeper. The body also adapts (acclimatises) at the molecular level for example by making more red blood cells (to carry more oxygen).

Mountain medicine recognizes three altitude regions that reflect the lowered amount of oxygen in the atmosphere:

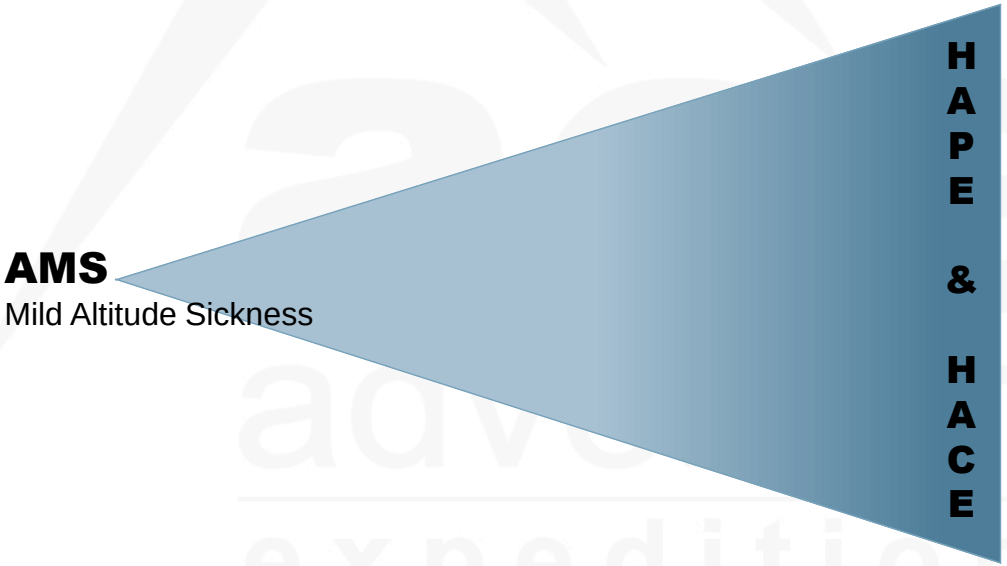
- High altitude = 1500–3500m
- Very high altitude = 3500–5500m
- Extreme altitude = above 5500m

Travel to each of these altitude regions can lead to medical problems, from the mild symptoms of acute mountain sickness (AMS) to the potentially fatal high altitude pulmonary edema (HAPE) and high altitude cerebral edema (HACE). The higher the altitude, the greater the risks.

Altitude Sickness

Let us understand the various symptoms of Altitude Sickness:

Altitude sickness is a spectrum ranging from mild (AMS) to life threatening (HAPE & HACE)



Altitude Sickness

Acute mountain sickness (AMS) is the most common response to altitude: it is a collection of signs that your body is becoming ill and has not adapted successfully to a higher altitude. AMS usually appears 24-48h after arriving at altitude. Mild AMS is common and in most instances, with sensible acclimatisation, will resolve.

However, for your own safety, **assume any illness at altitude is AMS**. The most common reasons that people fail to descend as soon as they should are bad assumptions. They assume that having AMS is a sign of weakness; that their level of fitness means they should not have AMS; or mistook their symptoms for flu or another illness. Assume AMS first: it happens to healthy strong people, and if it turns out you are indeed sick with something else, descending to a lower altitude will make it easier for your body to heal anyway.

In particular, if you have recently ascended, and you have a headache and any other symptom listed below, you have AMS.

<u>The symptoms of AMS vary for different people:</u>

Headache +

- Fatigue
- Loss of appetite / nausea / vomiting
- Dizziness / light headedness

If you have headache plus any of the other symptoms, you have AMS. Period. No further discussion.

Altitude Sickness

The next 4 symptoms or signs are **danger** signs!!!:

- Confusion / change of personality
- Unsteady walking (unable to walk a straight line – also known as ataxic gait)
- Rattling / crackly breathing, coughing up frothy sputum
- Extreme fatigue (e.g. unable to get out of sleeping bag or walk)

The last four signs in particular are signs that you are becoming quite ill. You should not wait for the onset of these symptoms before acknowledging you have AMS. They are fairly reliable indicators of the onset of **HACE** or **HAPE**. **HAPE and HACE if untreated will kill you.**

BUDDY SYSTEM
You and your party should keep an eye on each other for signs of AMS. If you suspect of someone suffering from AMS, look out for signs of it worsening. Very sick people can become confused and not realise how sick they are. Loss of appetite is a particularly good sign: anyone who has been walking or climbing at altitude for a day should be hungry for a good meal in the evening.

Altitude Sickness

HACE

High altitude cerebral edema (HACE) is the end-stage of AMS (conversely AMS can be thought of as the mild form of HACE). When you suffer “HACE”, your brain swells and stops working properly. HACE can kill within a few hours.

HACE symptoms include a number of signs of failing mental function: confusion, fatigue and unusual behaviour. But the most reliable one is **ataxic gait**, and you can test it by walking heel to toe along a straight line on the ground. Healthy people can pass this test easily; anyone who has difficulty balancing while they do it may be showing signs of HACE.

HACE is extremely serious, and *you may only have a few hours* to help someone with HACE. The most important treatment for this is *immediate descent*, but a person experiencing these symptoms will need significant help. They may need to be carried. Dexamethasone is one drug that can be used to relieve symptoms, but it is just a temporary bridge to give more time for descent. If your trekking party has oxygen, it can be given at 1-2L/min whilst waiting for evacuation and also during evacuation.

HAPE

High altitude pulmonary edema (HAPE) is another severe altitude illness. It sometimes occurs in conjunction with AMS or HACE, but sometimes not.

When you have HAPE, your lungs fill with fluid. Signs include extreme fatigue; breathlessness at rest, cough especially if it is wet (lots of frothy sputum) and has blood in it; rattling or gurgling breath; chest congestion; very fast heart rate; very fast breathing; and blue extremities. A fever is sometimes present. HAPE most commonly sets in at night.

Altitude Sickness

Preventive Measures for Altitude Sickness

These are things that you can do to improve your chances of not getting altitude illness

Pre-Trip

- ✓ Keep in good health
- ✓ Get fit, get adequate rest
- ✓ Eat a healthy diet
- ✓ Try not to catch coughs and cold

During Trip

- ✓ Ascend gradually: above 2500m – 3000m altitude; not more than 500m per day and having a rest day every 1000m
- ✓ “Climb high sleep low”
- ✓ Hydrate adequately
- ✓ Eat regular meals
- ✓ Avoid alcohol, smoking
- ✓ Do not take sleeping drugs
- ✓ Learn to recognise early signs and symptoms of altitude illness

Altitude Sickness

Golden Rules

That can help you to avoid getting into a severe confrontation with death!

Golden Rule #1
If you feel unwell at altitude, it is altitude illness unless proven otherwise!

Golden Rule #2
Never ascend with symptoms of AMS

Golden Rule #3
If you are getting worse (or have HACE or HAPE), go down at once!

Altitude Sickness

The Lake Louise Consensus on the Definition of Altitude Illness

2018 Lake Louise Criteria, HIGH ALTITUDE MEDICINE & BIOLOGY
Volume 19, Number 1, 2018
[a] Mary Ann Liebert, Inc.
DOI: 10.1089/ham.2017.0164

AMS

In the setting of a recent gain in altitude, the presence of headache and at least one of the following symptoms:

- gastrointestinal (anorexia, nausea or vomiting)
- fatigue or weakness
- dizziness or light-headedness
- difficulty sleeping

HACE

Can be considered "end stage" or severe AMS. In the setting of a recent gain in altitude, either:

- the presence of a change in mental status and/or ataxia in a person with AMS
- or, the presence of both mental status changes and ataxia in a person without AMS

HAPE

In the setting of a recent gain in altitude, the presence of the following:

Symptoms: at least two of:

- dyspnoea at rest
- cough
- weakness or decreased exercise performance
- chest tightness or congestion

Signs: at least two of:

- crackles or wheezing in at least one lung field
- central cyanosis
- tachypnoea
- tachycardia

High Altitude Heath Care Information

High Altitude Medical Conditions & Care Worksheet

AMS SCORE CARD			
Headache	None Mild Moderate Severe	0 1 2 3	
Gastro-Intestinal symptoms	None Poor appetite or nausea Moderate nausea & / vomitting Severe nausea & / vomitting	0 1 2 3	
Fatigue and weakness	Not tired or weak Mild fatigue or weakness Moderate fatigue or weakness Severe fatigue or weakness	0 1 2 3	
Dizziness / Lightheaded	Not dizzy Mild dizziness Moderate dizziness Severe dizziness / incapacitating	0 1 2 3	
TOTAL SCORE			

Total Score 3-5 = Mild AMS
Total Score > 5 = Severe AMS

If you have headache and score 3 -5, do NOT go higher

If you have headache, score 3-5 after a day of rest, DESCEND!

AMS PROPHYLAXIS WITH ACETAZOLAMIDE
Consult Travel Clinic for prescription
(You may need alternatives if you are allergic to sulphur drugs)
Typical dose: 125mg twice a day starting 24h before ascent
Stop when max altitude achieved and descent started
Side effects: passing lots of urine, tingling hands and feet

HYPOTHERMIA & FROSTBITE

Do remember to:
- Have layering system for clothes (avoid getting sweaty/damp)
- Change out of wet clothes
- Give warm sweet drink
- Warm gloves, socks, warm hat, proper fitting shoes
- Protect ears/nose/exposed bits from windchill

Signs of frostbite:
- Cold, white and hard extremity

What to do:
- Keep warm and remove tight / wet socks/gloves
- Rewarm in clean warm 38C water
- Do not burst blisters
- Gently pat dry and cover with dry dressing
- Give ibuprofen (if not allergic)
- Do not walk on injured foot
- Evacuate

HIGH ALTITUDE CEREBRAL EDEMA (HACE)

Main signs:	Test: Can the person
• severe headache • clumsy, stumbling, loss of balance • confused • drowsy, loss of consciousness	• Walk heel-toe in straight line? • Touch nose with finger with eyes closed? • Stand upright, feet together, eyes closed? • Do simple arithmetic (eg. 2+5 = 7?)

What to do:
- Do not leave the person alone - Get HELP!! They may not be able to walk!
- Descend immediately – NOW! Not 1h later or tomorrow
- Keep person warm
- Give oxygen if available
- Give Acetazolamide if available and no allergy
- Give Dexamethasone if available

Consequence if ignored
Confusion ----- Loss of consciousness --- Reduced breathing -- **DEATH**
It is possible for HACE and HAPE to happen at the same time

DESCEND DESCEND DESCEND

HIGH ALTITUDE PULMONARY EDEMA (HAPE)

Main signs:	Check:
• severe fatigue / weakness • wet cough, frothy sputum • trouble breathing • blue lips, tongue, fingers	• has the person ascended recently? • Does the person take a long time to get his breath back? • Is he breathless sitting still? (rate > 20?) • Gurgling / crackling sounds in chest?

What to do:
- Do not leave the person alone - Get HELP!! They may not be able to walk!
- Descend immediately – NOW! Not 1h later or tomorrow
- Keep person warm and sit upright
- Give oxygen if available
- Give Acetazolamide if available and no allergy
- Give Nifedipine if available and no allergy

Consequence if ignored
Reduced breathing --- **DEATH** (in as little as an hour!!)
It is possible for HACE and HAPE to happen at the same time

DESCEND DESCEND DESCEND

MEDICATIONS FOR HAPE & HACE
- Consult your Travel Clinic or Family doctor for prescription and doses of Dexamethansone and Nifedipine
- Purchase adequate and appropriate Travel Insurance

Prepared by
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Sun Damage

Skin and eyes (cornea) are at risk of sun's ultraviolet (UV) damage. At high altitude, the UV rays from the sun are more intense because the atmosphere is thinner. Even when it is cloudy, the risk of sunburn is extreme. The main reason for this is that in cool or cloudy conditions many people are unaware that they are still vulnerable to the burning effects of the sun's UV radiation, so fail to take precautionary sun protection measures.

There is also a risk of wind contributing to a burn, though the wind does not really burn you. The cooling effects of the wind decrease the perception of heat and burning. In other words, individuals are less likely to seek shade or to protect themselves against the sun, and are more likely to stay exposed to the burning effects of the sun's UV radiation for longer. Along with being cooling, the wind also has a drying effect on the skin, which may exacerbate the symptoms of sunburn. UV radiation is subdivided into UVA, which penetrates deeper and causes skin aging and UVB which causes sunburn and increased risk of skin cancer.

The human eye is more likely to be damaged by UV rays while skiing or climbing on the slopes in snow-covered areas compared to sitting on the beach. UV rays can cause conditions such as immediate conditions such as snow blindness, and long-term effects such as cataracts.

The safest way to enjoy the sun and protect yourself from sunburn is to use a combination of shade, clothing, sunscreen and proper sunglasses.

Sun Damage

Ways to protect yourself from the sun

- ✓ Sunscreen: minimum SPF 15, and Broad Spectrum (i.e. covers UVA and UVB).
  SPF greater than 50 are not very meaningful. What does SPF really mean?
  SPF 15 blocks 93% of UVB, SPF 30 blocks 97% and SPF 50 blocks about 98%.
- ✓ Make sure to apply 20-30min before sun exposure and re-apply every 2-3h.
  Earlier if sweating a lot and wiping your face!
- ✓ Ensure sunscreen is applied generously to all sun exposed skin.
  Don't forget ears and back of neck!
- ✓ Don't forget your lips – there is nothing worse than burnt cracked lips.
  Use a lip balm with SPF and moisturiser. Test it at home to make sure your lips are not allergic to it. Reapply regularly and after eating.
- ✓ Wear a hat, wide brimmed if possible, protect your scalp, especially those who are balding!
- ✓ Wear long sleeved SPF / UPF rated tops with fold up collars or hoods.
- ✓ Rest under shade or shelter if possible
- ✓ Protect your eyes! All must have 100% UV filter. Depending on the altitude and conditions, you may need higher rated sunglasses than those used in the city. Regular shades let in 18-43% sunlight. Category 3 8-18% and Cat 4 3-8%. If you intend to be walking on glaciers or snowfields, make sure you have Cat 3 as a minimum. Wrap around / side shields will protect your eyes better and are a must in snowy conditions. In windy and very cold conditions, a pair of ski goggles is better protection.

Cold Injuries

Exposure to cold can produce a variety of injuries that occur as a result of man's inability to adapt to cold. Therefore, trekking and climbing in cold climates face many risks.

Cold injuries are usually due to prolonged exposure to cold temperatures, although they can occur with brief exposure to extremely cold conditions. For heat regulation, our body uses its core (internal organs such as the brain and heart) and its shell (skin, muscles, and limbs). Cold injury to our body's core is called hypothermia, and cold injury to our body's shell is called frostbite. Hypothermia and frostbite commonly occur together, but they can occur separately.

Cold Injuries

What is Hypothermia?

Hypothermia is a decrease in core body temperature from exposure to a cold environment. By definition, if our core temperature is less than 35°C, we have Mild Hypothermia. We need to prevent even mild hypothermia because once a person's core temperature is 35°C or less, it is hard for them to help themselves and they may become confused and not be able to move properly and will be prone to falls and accidents. A severely hypothermic person may become unconscious and their heart may have very abnormal rhythm or stop altogether.

Hypothermia can even occur at non-freezing temperatures if exposure is prolonged. Our body's natural defences against the cold are quite limited. Initially, the blood vessels in our skin constrict to reduce heat loss and to keep blood flowing to the vital organs. Shivering (involuntary muscle contraction) and the increased release of hormones result in increased heat production. However, blood vessel constriction and hormone release are usually inadequate to maintain our body's temperature in cold environments. Individuals who drink alcohol, as well as those who suffer from fatigue, spinal cord injuries, or poor nutrition, are at greater risk for hypothermia.

Symptoms

Mild hypothermia

- Core temperature between normal and 35.5^{o}C
- Involuntary shivering
- Inability to do things requiring motor skills e.g. tie a knot, toss a ball, but can still walk and talk

Moderate hypothermia

- Core temperature between 35^{o}C and 33^{o}C
- Dazed state of mind
- Loss of general motor control e.g. untying boot laces
- Slurred speech
- Aggressive shivering

Severe hypothermia

- Core temperature between 33^{o}C and 30^{o}C
- Pale skin / Dilated pupils
- Waves of aggressive shivering followed by pauses.
- Flexibility and movement is reduced because of a lack of blood flow
- Person ceases movement and curls up in the foetal position to conserve heat
- Slow, intermittent, weak pulse
- Body goes into hibernation and person appears dead although they may actually still be alive

Cold Injuries

What is Frostbite?

Frostbite is a localized cold injury to a body part that may occur with or without hypothermia. It is most likely to happen in body parts farthest from the heart and those with large exposed areas. Body parts such as the feet and toes, the hands and fingers, ear, nose are areas that are at greatest risk. In some instances, severe frostbite may require amputation. When human tissue is exposed to near-freezing temperatures, the tissue temperature decreases. As the tissue temperature decreases, it goes through four phases of frostbite. In the first phase, the blood vessels constrict, causing inadequate blood flow and oxygen delivery to the tissues. In the second phase, the tissue temperature drops below sub-zero degree, and ice crystals form in the tissues. Unless the body part is re-warmed, frostbite will progress to the third and fourth phases. In the third phase, fluid leaks from the blood vessels into the damaged tissue. In the fourth phase, the blood vessels clot, resulting in irreversible loss of blood flow to the damaged tissue.

Frostbite injury

Cracked cuticles and mild frostnip

Frostbite symptoms typically start with a sensation of extreme coldness, followed by numbness, and then clumsiness. Superficial frostbite results in numbness and the development of clear, fluid-filled blisters. Deeper frostbite causes deeper blisters filled with purplish fluid (blood filled blisters). In all types of frostbite, the damaged tissue may swell and darken in colour after re-warming.

What is Frostnip?

Frostnip is a superficial cooling of tissues without cellular destruction. The initial stages of frostbite are sometimes called frostnip.

Cold Injuries

How To Prevent Cold Injuries

First, let's understand what causes cold injuries such as hypothermia and frostbite. Inadequate blood circulation when the ambient temperature is below freezing point leads to frostbite. This can be because the body is constricting circulation to extremities on its own to preserve core temperature and fight hypothermia. In this scenario, the same factors that can lead to hypothermia (extreme cold, inadequate clothing, wet clothes, wind chill) can contribute to frostbite. Poor circulation can also be caused by other factors such as tight clothing or boots, cramped positions, fatigue, certain medications, smoking, alcohol use, or diseases that affect the blood vessels, such as diabetes.

Modern clothing and equipment have decreased the risk for mountain climbers, but frostbite still occurs after accidents, as a result of poor planning, and in severe, unexpected weather. To prevent hypothermia and frostbite in cold conditions, be sure to have proper fitting boots and gloves and change out of wet garments promptly and drink plenty of fluids to avoid dehydration.

Pointers to note		
Use a layering system for your clothes. Several thin or medium weight layers are better than a single thick layer. More flexible and allows adjustment of layers depending on temperature. Refer to The Layering Concept on how to layer up adequately (next page).	**Plan** for extra / spare layers of clothing to change out of wet ones. This includes gloves and socks. Refer to The Layer Concept on how to layer up adequately.	
	Wear layered gloves; a single thick glove is not adequate except in the mildest conditions. Gloves: wear a thin liner and a thicker outer; making sure that the combination of two pairs of gloves does not constrict your finger circulation.	
Socks: wear a thin liner and a thicker outer, making sure that the combination of two pairs of gloves does not constrict your **toe circulation** or make your boots too tight. Be sure to test these out *before the trip.*	**Be aware** of your itinerary / altitude / weather and dress accordingly	**Wiggle** your toes and fingers regularly to improve circulation
	Stay hydrated, avoid alcoholic drinks, cigarette smoking or recreational drugs	
Trekking or climbing **boots / shoes** must have room for layers (see above point)	**Apply moisturiser** to fingers to avoid chapped skin	

The Layering Concept

The Layering Concept

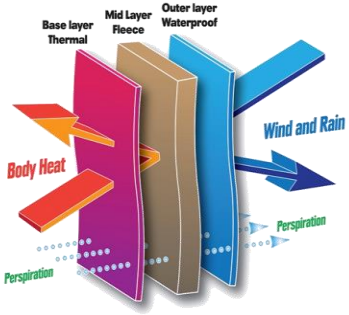
The 3 basic layers for weather extremes are **ESSENTIAL** to keep you comfortable, safe and protected.

The guiding principle of layering is that you are regularly adding and removing layers to keep your body temperature even. An example, you may start off on chilly morning hike wearing a base layer and a light fleece. As the body warms up, you stop to remove the fleece. At lunch break, on a breezy ridge, you immediately put the fleece back on, and possibly the outer shell to cut the wind. After lunch, it all comes off (except the base layer) as you start hiking. Afternoon thunderstorms roll in. You throw on your shell and open up the pit zips (underarm vents) and continue hiking.

ALWAYS make sure that your extra layers are conveniently located in your pack, so that you can always easily reach them.

① **First Layer - Moisture Management - Base / Inner / Skin Layer (Thermal)** – Worn directly against the skin, this layer's primary function is wick away moisture towards the outer 2 layers where it will eventually evaporate to keep the body dry. When the body or the base / inner / skin layer is wet, no amount of insulating layers or warm clothing piled on is able to keep the body warm or prevent hyperthermia. Keeping dry helps you maintain a cool body temperature in the summer and avoid hypothermia in the winter.

② **Second Layer – Insulation - Insulating / Middle Layer (Fleece / Down Jacket)** – This layer's function is to insulate heat to maximize warmth. It helps to retain heat by trapping air close to your body. It also helps facilitate the transfer of moisture wicked by the base layer on to the outer layer. For very cold and dry weather, especially those with temperature ranging below sub-zero, a down jacket is the best and sometimes wore over the base layer rather than a fleece or over the base layer and fleece.



③ **Third Layer - Weather Protection - Shell / Outer Layer (Hard shell Jacket)** – As the name suggests, this layer's function is to provide protection against the weather elements (wind and/or rain and snow) while also allowing the moisture received from the middle layer to be wicked away and ultimately evaporate.

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