

Travel at high altitude

Travel at high altitude is becoming increasingly accessible and popular. Travellers going on high altitude destinations, treks or expeditions should prepare carefully well in advance of travel, particularly if inexperienced in high altitude travel. Most trips to altitude can be enjoyed safely if adequate precautions are taken. Good medical insurance that covers medical evacuation and repatriation is strongly recommended for those travelling to an area of high altitude.

What are the risk areas?

High altitude is defined as an elevation above 1500m and can be subdivided into the following categories: high altitude 1500m–3500m, very high altitude 3500-5500m and extreme altitude >5500m. Altitude illness rarely occurs at altitudes lower than 2500m.

High altitude regions of the world include the Himalayas (Asia), Andes (South America), Rocky Mountains (North America), Alps (Europe) and the Caucasus (Europe/Asia).

High Altitude	Very High Altitude	Extreme Altitude
Between 2400-3500m	Between 3500-5500m	Over 5500m
Addis Ababa, Ethiopia - 2408m Cochabamba, Bolivia - 2550m Bogota, Colombia - 2640m Quito, Ecuador - 2850m Cuzco, Peru - 3399m	La Paz, Bolivia - 3640m Lhaza, Tibet -3656m Inca Trail, Peru - max ~4200m Mount Kinabalu, Malaysian Borneo - 4095m Everest Base Camp - 5380m Annapurna Circuit, Nepal – max ~5416	Mount Kilimanjaro, Tanzania - 5895m Aconcagua, Argentina - 6960m Mt Everest summit - 8850m

What risks are associated with high altitude?

There are risks associated with high altitude including exposure to ultraviolet (UV) radiation, cold and the risk of developing Altitude illness including acute mountain sickness (AMS), high altitude cerebral oedema (HACE) and high altitude pulmonary oedema (HAPE). Severe AMS, HACE and HAPE are life-threatening conditions that need urgent attention

What is Acute Mountain Sickness (AMS)?

Although the level of oxygen in the air remains constant, the level of absolute oxygen in the lungs and the blood decreases with climbing higher due to the lower air pressure at altitude compared to the air pressure at sea level.

Oxygen is important for the normal function of the body which adapts to lower oxygen levels by responding with faster and deeper breathing and producing more red blood cells in order to transfer

oxygen around. This response, called acclimatization takes approximately 3-5 days to develop; however it may vary between individuals and conditions.

Inadequate acclimatization may lead to altitude illness in any traveler going to 2,500 m or higher, and sometimes even at lower altitude. AMS is more common in those who do not take enough time to acclimatize properly or in those who arrive directly at areas of high altitude e.g. Cusco in Peru (3300m). The higher and faster the ascent, the more likely that AMS will occur. Anyone can suffer from AMS regardless of age, gender, level of fitness or training.

What is the risk of AMS for travellers?

Susceptibility and resistance to AMS are genetic traits. Risk of developing altitude illness depends on factors related to the trip and to the individual. Risk factors related to the trip include: the altitude, rate of ascent, and exertion. Risk factors relating to the individual include: previous history of altitude illness, normal residence below 900m, exertion on arrival to altitude and certain pre-existing cardiovascular conditions. Risk is not affected by training or physical fitness. Despite knowledge of these risk factors, an individual's susceptibility to altitude illness is not possible to be determined. Previous performance at altitude is probably the best predictor.

What are the signs and symptoms of AMS?

Symptoms of AMS usually occur during the first 36 hours at altitude and do not develop immediately upon arrival. The rate of onset and the altitude at which they occur may vary. Early, mild symptoms include: headache, dizziness, nausea/vomiting, loss of appetite, fatigue, flu-like symptoms, shortness of breath, lack of sleep and irregular breathing during sleep.

AMS can be diagnosed in adults by a self assessment using the Lake Louise Symptom Score (LLSS):

Symptoms	Severity	Points
Headache	- No headache	0
	- Mild headache	1
	- Moderate headache	2
	- Severe headache, incapacitating	3
Gastrointestinal	- No gastrointestinal symptoms	0
	- Poor appetite or mild nausea	1
	- Moderate nausea or vomiting	2
	- Severe nausea or vomiting, incapacitating	3
Fatigue and / or weakness	- Not tired or weak	0
	- Mild fatigue/weakness	1
	- Moderate fatigue/weakness	2
	- Severe fatigue weakness, incapacitating	3
Dizziness / lightheadedness	- No dizziness	0
	- Mild dizziness	1
	- Moderate dizziness	2
	- Severe dizziness, incapacitating	3
Difficulty of sleeping	- No sleep disturbance	0
	- Not sleeping as well as usual	1
	- Waking up many times, poor night's sleep	2
	- Unable to sleep	3

Anyone who has recently ascended to over 2500m and has a score of 3 or more should be considered to have AMS.

What are HACE and HAPE?

If AMS is ignored and ascent continues then there is a real risk that the condition will rapidly progress to either or both of the two serious forms of the illness: High Altitude Cerebral Oedema (HACE) and High Altitude Pulmonary Oedema (HAPE).

HACE is caused by fluid retention in the brain and symptoms may include: severe headache, drowsiness, confusion, unsteadiness, and vomiting.

HAPE is caused by fluid retention in the lungs and symptoms may include: shortness of breath even at rest, severe fatigue, tachycardia, bluish discolouration of the skin (cyanosis).

Both conditions can be rapidly fatal, therefore they are considered medical emergencies and require medical attention as soon as possible; descent must be carried out immediately since further exertion may cause deterioration. If descent is difficult, air evacuation by helicopter (if available) may be required.

Can travellers with pre-existing medical conditions travel to high altitude destinations?

If appropriate care is taken, most people can travel to high altitude destinations. However, travellers with the certain medical conditions are more likely to be affected by their condition at altitude and expert medical advice should be sought. Such conditions include diabetes, asthma, chronic obstructive pulmonary disease, epilepsy, heart conditions, lung conditions, pregnancy, sickle cell disease.

How can altitude illness be prevented?

General advice

- **Gradual ascent is the most important preventive measure.**
- Be aware of the signs and symptoms of AMS and recognize them early. Inform someone about your symptoms.
- Choose a trip involving gradual acclimatization.
- Avoid flying directly to areas of high altitude if possible.
- Take at least 2-3 days to acclimatize before going above 3000m.
- Do not climb more than 300m a day.
- Have a rest day every 600 – 900m of ascent or every 3 – 4 days.
- Maintain a good intake (not excessive) of fluids.
- Gentle exercise for the first 24 hrs.
- Eat a light but high calorie diet.
- Avoid alcohol.
- Descend if symptoms of AMS get worse at a given altitude or if symptoms are severe.
- Never leave an individual with altitude illness alone.
- Always trek with an experienced guide.

Medication

- **Preventative medications are not a substitute for gradual ascent.**
- Acetazolamide is the preferred drug. The recommended dose is 125mg twice daily to be commenced one to two days prior to reaching 3,500m and then continued for at least two days after reaching the highest altitude.

- A trial dose of acetazolamide for one or two days should be taken prior to travel to test for side effects such as increased urination, numbness, nausea, vomiting, headache and taste disturbance.
- For individuals ascending to and staying at the same altitude for several days, acetazolamide may be stopped after 2-3 days at target altitude. For those ascending to a high altitude and then descending to a lower level, acetazolamide should be ceased once descent has started.
- Acetazolamide is a diuretic therefore increased urine output is expected.
- Acetazolamide is contraindicated in those with severe allergy to sulfa-based drugs and in pregnant women particularly in the first trimester.
- Using acetazolamide does not rule out the need for gradual ascent and cannot prevent AMS. Dexamethasone is an effective alternative to acetazolamide for prevention of AMS.

What is the treatment of altitude illness?

- If early signs and symptoms of AMS are noticed, the traveller should stop and rest at that level.
- No further ascent.
- Analgesics for the treatment of headache e.g. ibuprofen or paracetamol.
- Anti-nausea medication e.g. promethazine.
- Maintenance a good fluid intake.
- Ascent can begin again with care after full recovery.
- If the symptoms of AMS do not improve over a day then descent of 500-1000m is necessary.
- If symptoms of HACE develop, immediate descend is recommended, oxygen via cylinder or pressure bag (if available), Acetazolamide and Dexamethasone may be administered. If unable to descend - prolonged use of a pressure bag may be needed.
- If symptoms of HAPE develop, immediate descend is recommended, oxygen via cylinder or pressure bag (if available), Acetazolamide and Nifedipine may be administered. If unable to descend - prolonged use of a pressure bag may be needed.

What other precautions should be taken when travelling to areas of high altitude?

Sun Protection

Exposure to UV radiation increases at altitude. Protection against UV light includes:

- The skin should be covered with clothes impermeable to ultraviolet light.
- A sunscreen should be applied protecting against UVA, UVB and UVC with a high sun protection factor (at least SPF15).
- Lips, ears and nose should be protected with a high protection sunblock.
- Wearing sunglasses which filter out UV light.
- A facemask or balaclava may be required to protect against cold and sun at very high and extreme altitude.

Cold Protection

Low temperatures combined with low oxygen levels increases the risk of frostbite at very high altitude. The risk is even greater in people who already have poor circulation e.g. Raynaud's disease. To help prevent injury from the cold:

- Wear correctly fitting clothes that are approved for cold climates; gloves, hats, socks, boots.
- Keep hands and feet dry, by changing wet socks and gloves promptly.

- Wear goggles.
- Wear a facemask or balaclava to protect against cold

Useful links

- Fit for Travel. At : <http://www.fitfortravel.nhs.uk/advice/general-travel-health-advice/altitude-and-travel.aspx>
- National Travel Health Network and Centre (Nathnac). At : <https://travelhealthpro.org.uk/factsheet/26/altitude-illness>
- Medex : Travel at high altitude. At : http://medex.org.uk/medex_book/about_book.php
- The International Climbing and Mountaineering Federation (UIAA): Mountain medicine advice and recommendations. At : <http://www.theuiaa.org/mountain-medicine/medical-advice/>
- Altitude.org. At : <http://www.altitude.org/home.php>