The following notes are provided by THE ALTITUDE CENTRE™

Healthy people may travel to altitudes up and above the height of Kilimanjaro (19,340ft) as long as they are properly acclimatized. Un-acclimatized individuals suffer from hypoxia, meaning lack of oxygen. Mild hypoxia is not normally a risk factor for altitude trekking. Moderate or severe hypoxia can lead to a condition called acute mountain sickness which needs to be identified and managed to ensure a safe and enjoyable trip.

**acclimatization**

The human body is an adaptive organism that has the ability to adjust to the changing environment around it, including changes in altitude. Charity Challenge trips provide adequate acclimatization time where the majority of healthy individuals will be able to function unhindered.

Sufficient acclimatization is imperative to avoid altitude illnesses. The speeds of the ascent, and the susceptibility of an individual, are the two main determining factors in developing an altitude illness. When going too high too fast, the body is unable to adapt sufficiently. When trekking as a group, the acclimatization process is always tailored to ensure the health of the individual who is slowest to acclimatize.

As you ascend you’ll notice an increase in pulse rate and breathing rate as your body works harder to get available oxygen to the muscles. Later you may notice an increased need to urinate as your body makes adjustments to the blood to help deliver more oxygen. A whole host of other adaptations will occur, to enable you to deal with the reduction in oxygen.

**acute mountain sickness (ams)**

The most common illness associated with travel and altitude, is termed acute mountain sickness (AMS). AMS develops in climbers ascending to high altitudes who are not sufficiently acclimatized. The condition usually develops within 6-12 hours of reaching a critical altitude, and peaks at approximately 24 hours. Although some incidences of AMS have been reported at as low as 3280ft, the condition is usually experienced at an altitude of approximately 9,842ft and above.

The incidence of AMS increases with altitude. When trekkers ascend rapidly to 8202ft, about 10% will suffer from AMS, and when ascending to 14763ft, the AMS incidence will exceed 60%. Therefore an individual climbing Mount Kilimanjaro (19340ft), should expect to develop at least some of the symptoms associated with AMS and therefore take precautions for both the prevention and treatment of such symptoms.

The common symptoms for ams are:

- Headache.
- Nausea (feeling sick).
- Vomiting (being sick).
- Fatigue (feeling tired).
- Poor appetite (not hungry).
- Dizziness.
- Sleep disturbance.
how to treat ams
During slow ascents to altitude, you acclimatize and minimise the effects of AMS. However, virtually all climbers will experience some of the symptoms of AMS when trekking at high altitude.

The occurrence of AMS does not necessarily spell the end of a climb; it does however mean that certain measures should be taken in order to prevent the development of AMS into more serious conditions. Such measures include;

- Sufficient fluid replacement
- The use of acetaminophen/Ibuprofen in order to combat headaches
- The cessation of any further ascent for at least 1 day (or until symptoms are reduced)
- The use of acetazolamide (Diamox)
- If symptoms persist, descend, descend, and descend until symptoms lesson.
- Administration of supplemental oxygen in severe cases

severe ams
If AMS is not properly treated and is allowed to develop, more serious conditions may arise. Two such conditions are high altitude pulmonary oedema (HAPE) and high altitude cerebral oedema (HACE), both of which can be life threatening.

high altitude pulmonary oedema (HAPE)
Approximately 2-3% of individuals travelling to altitudes above 8200f will develop HAPE, with this incidence increasing with both altitude and rate of ascent. HAPE is caused by the build up of fluid in the lungs due to vascular leaking, and results in the prevention of efficient gas exchange, which means increased hypoxia. HAPE can lead to coma and even death if left untreated. Symptoms of the condition usually occur within 24 to 72 hours of a critical altitude being reached (higher than 8200f).

Symptoms include;
- Rapid breathing and HR
- Chesty cough
- Bringing up frothy fluid and blood in saliva
- Extreme difficulty breathing
- Very weak and fatigued
- May have a fever
- Lips, tongue and nails become slightly blue in colour

Treatment of HAPE;
- Immediate descent
- The use of the drug Nifedipine
- The use of acetazolamide (Diamox)
- Administration of supplemental oxygen

Descent provides the quickest and most definitive recovery for the condition HAPE and it should therefore occur as soon as the symptoms of the illness have been spotted.

high altitude cerebral oedema (HACE)
HACE is caused by swelling of the brain due to fluid shifts, and can follow on from untreated AMS. Although the incidence of HACE is low (5% of individuals travelling above 8200f); the condition can develop very quickly with little or no other previous symptoms. Similarly to HAPE, if left untreated the condition can lead to fatality and again, incidence is increased with both increasing altitude and speed of ascent.
Symptoms include:

- Severe headache
- Severe weakness
- Impaired decision making/clumsy behaviour
- Loss of consciousness
- Confusion
- Irrational behaviour
- Drowsiness/vomiting

Treatment of HACE:

- Immediate descent
- Administration of supplemental oxygen
- The use of a high pressure bag (Gamow bag) if descent is impossible
- The use of acetazolamide (Diamox)
- The use of dexamethasone

If a climber develops either of the conditions HAPE or HACE a guide will remain with the individual at all times and not leave them on their own under any circumstance. **Descent is the best treatment for HACE and should always occur if at all possible.**

**General advice whilst at high altitude**

- Keep an eye on fellow trekkers, especially making sure they are well hydrated and protected from the sun.
- Be honest regarding how you’re feeling, do not lie about, or undersell any symptoms you may have
- Be prepared before you leave
- Remember that a slow even pace with a gradual ascent profile is the most important measure to prevent the onset of altitude illness
- If you have any existing health conditions prior to departure i.e. diabetes, asthma etc, ensure you see a doctor or specialist to find out the risks your condition may pose to high altitude travel, and ensure you’ve taken all precautions necessary

**Acetazolamide (trade name: Diamox)**

Charity Challenge itineraries are designed to acclimatize you to altitude without the need for Diamox. Diamox helps to speed up the process of acclimatization, and can also aid the sleep condition of periodic breathing. Subject to the essential approval from your doctor, it’s a personal decision as to whether to take the drug or not. **NOTE:** Acetazolamide is a sulfonamide medication, and persons allergic to sulfa medicines should not take it. We do recommend Diamox in the following cases:

- Treatment of persons with AMS
- Treatment of persons bothered by periodic breathing at night
- Prophylactically for persons on rapid forced ascents (such as flying into Lhasa, Tibet)
- Prophylactically for those persons who have repeatedly had AMS in the past

Although the drug works to reduce the effects of AMS, it does not mask the symptoms, and climbers should be aware that individuals can still suffer from AMS as well as the more serious conditions of HAPE and HACE while taking the drug. Whether or not one takes Diamox is obviously a matter of personal choice - travel to high altitudes is quite possible without it.

**How to take Diamox:**

If you decide to use the drug, we suggest 125mg (half of one tablet) is taken twice daily as a trial at sea level for two days several weeks before a visit to altitude. Assuming no unpleasant side effects are experienced, take the drug in the same dose for three days before staying at 11480f and thereafter for two or three days until you feel acclimatized, for about five days in all.
Like all drugs, Diamox may have unwanted side effects. Tingling of the fingers, face and feet is the most common, but this is not a reason to stop using the drug unless the symptoms are intolerable. Dizziness, vomiting, drowsiness, confusion, rashes and more serious allergic reactions have all been reported but are unusual. In exceptional cases, the drug has caused more serious problems with blood formation and / or the kidneys. Those who are allergic to sulphonamide antibiotics may also be allergic to Diamox. More commonly, the drug makes many people feel a little off colour, carbonated drinks can also taste strange when you’re taking Diamox.

**Further possible health problems at altitude**
- Blocked nasal passages and sore throat
- Sun burn
- Dehydration
- Heat stroke
- Hypothermia/hyperthermia
- Exhaustion
- Diarrhoea
- Constipation

A number of health issues, big and small, are possible to occur when travelling to high altitude, the most important thing is to be informed of the risks and prepare sufficiently to ensure a safe and enjoyable trip.

**Acknowledgments**
These notes were compiled by experts at The Altitude Centre. Further information, advice and acclimatization services are available at www.altitudecentre.com

**References**
- Kupper, T., Milledge, J., Et al. (2011). Work in Hypoxic Conditions-Consensus Statement of the Medical Commission of the Union Internationale des Associations d’Alpinisme (UIAA MedCom)
- Maggiorini, M., Melot, C., Pierre, S. Et al. (2001). High altitude pulmonary edema is initially caused by an increase in capillary pressure.