

How To Travel Safely at High Altitude

The world is loaded with beautiful mountain ranges. To visit these places, we often need to venture into high elevations we do not see on a normal basis. While the rewards of such travel are many, there are also important risks. Specifically, exposure to high altitude has the potential to cause various forms of illness ranging from mild symptoms to very severe problems capable of killing someone if they are not recognized and treated promptly.

Why We Get Sick at High Altitude

The reason people get sick at altitude is simple. There is less oxygen in the air as you gain elevation. This lack of oxygen leads to a series of physiologic changes that allow the body to adjust to the altitude but it also sets in motion maladaptive processes, which, depending on the particular person, can lead them to become ill.

Normal Changes in Your Body at High Altitude

There are several normal changes that occur in your body when you go to high altitude. It is important to be aware of these so you can tell the difference between what is normal and what is illness up there:

- **High Heart Rate:** with both exercise and at rest, your heart rate will be higher. This will return to normal levels after a few days at the same altitude.
- **Faster, Deeper Breathing:** you will take more and deeper breaths throughout the day and will sigh more often as well. It is expected that you will really huff and puff on the hills but when you take a break, your breathing will come back to normal within just a few minutes.
- **Increased Frequency of Urination:** Get ready, set, and head off to the toilet as many people have to urinate more often at altitude. It's part of your body's attempt to adapt and it goes away after a few days.
- **Poor Sleep:** Sleep can be very difficult at high altitude and, in some cases, people experience a pattern of irregular breathing where they stop breathing for periods of time throughout the night (sleep apnea). This all gets better with time and only certain medications are recommended for dealing with these problems.
- **Edema:** People can develop swelling of their hands, feet and around the eyes which goes away with descent.

What are the Risk Factors for Developing Illness at High Altitude

There is one main risk factor, which we can all control that will affect whether or not we get sick: **going too high, too fast**. It's simple: someone who goes to 15,000 feet in 3 days with no rest days is more likely to get altitude illness than someone who does the ascent in 6 days with 2 rest days. Other factors which predispose to high altitude illness over which we have less immediate control are living at an elevation below 2,500 feet and having had altitude illness in the past. Drinking alcohol and smoking cigarettes on the way up are not recommended but have never been proven to cause altitude illness. Sex and age do not affect susceptibility to altitude illness. Remember that being in good physical shape does NOT protect someone against high altitude illness. If they go too high, too fast, the great athlete (marathon runner, triathlete) is just as susceptible to getting ill as the average couch potato. In fact, sometimes, great athletes get into trouble because they have fewer problems with the physical work and, as a result, end up going too high, too fast without intending to do so.

The Main Forms of Acute Altitude Illness

Acute Mountain Sickness (AMS): This is the most common form of illness at high altitude. Symptoms of AMS generally start 6-10 hours after arrival at elevations above 8,500 ft. Someone is said to have AMS if they have a headache plus one of several other problems (dizzy, lightheaded, poor appetite, nausea, vomiting, fatigued). You can get headaches for a lot of reasons (dehydrated, exhausted for eg.) so in order to call it AMS, you must have a headache plus one of the other symptoms. As long as the person is not vomiting and the other symptoms are not very bad, the person is said to have **mild AMS**. If the person starts vomiting and the other symptoms get really really bad, the person is said to have **severe AMS**.

High Altitude Cerebral Edema (HACE): If the AMS symptoms continue to worsen or the person ascends in the face of AMS symptoms, they can develop HACE, or swelling of the brain. This is not nearly as common as AMS but can have very bad consequences if it's not recognized. HACE almost always occurs in people who earlier had AMS symptoms (i.e., it rarely occurs out of the blue). The hallmark of HACE is that the person becomes clumsy. If you ask them to walk on a straight line, heel-to-toe, they can't do it. People with HACE often have changes in their mental status (they become withdrawn, they behave oddly or act confused or "just not themselves"). If not recognized and treated, they can become very sleepy and even go into a coma. If it is not treated at this point, the person can actually die.

High Altitude Pulmonary Edema (HAPE): HAPE is a fluid build-up in the lungs that makes it hard to breathe and get enough oxygen. It sometimes occurs in people with AMS or HACE but can occur all on its own. It can be seen at altitudes as low as 8,000 feet but is more common higher up and can occur anywhere from 1-4 days after one arrives at high altitude. The first thing you will notice is that the person has trouble breathing with exertion or exercise performance declines. Eventually, patients with HAPE develop problems breathing at rest. Patients with severe HAPE are usually very fatigued – simple activities wipe them out. People with HAPE often have a dry cough but this isn't very helpful as many normal people have a dry cough in the high, dry mountain air. If the HAPE worsens, the person may cough up pink frothy looking material. They can also develop blue lips and fingertips. If it is not treated, HAPE can also be fatal.

Prevention

Non-Pharmacologic Measures:

- GO SLOWLY!!!: Once you get above 10,000 feet you should not increase your sleeping elevation by more than 1000-1500 ft per night. Every 3,000 feet or every few days take a rest day and sleep at the same elevation. You can hike as high as you want on the rest day, just come down and sleep at the same altitude.
THIS IS THE BEST THING YOU CAN DO TO PREVENT ALTITUDE ILLNESS
- Never ascend further with symptoms of altitude illness. Only if your symptoms resolve, can you go higher.
- Try to avoid any opiate pain relievers and excessive alcohol, particularly before bedtime.
- Avoid overexertion: lighten your pack, hire a porter, take plenty of rest breaks.

Pharmacologic Measures: If you go at an appropriately slow pace, most people can do their trip without prophylactic medications. Medication is recommended when either (a) the person has had altitude illness before and is going back to or above the same elevation, (b) the person will be traveling to over 10-11,000 feet in one day (eg. Flying into Lhasa, Tibet or La Paz, Bolivia) or (c) a fast ascent is required (eg. mountain rescue)

- AMS and HACE: the main medication used is Acetazolamide (Diamox). The dose is either 125 mg twice a day. It actually helps your body get used to the altitude. Caution should be used if you are allergic to sulfa drugs as there is a small chance of an allergic reaction. It will make you urinate more for a few days and can cause numbness or tingling of your lips, toes and fingers which goes away when you stop the medication. People with a sulfa allergy or who don't tolerate the medication can take Dexamethasone (a steroid) at a dose of 4 mg every 12 hours or 2 mg every 6 hours). These medications are started when you begin your ascent and stopped when you start to come down or once you have been at your peak elevation for 3 or more days.
- HAPE: if someone has had HAPE in the past, it is recommended that they take Nifedipine (long acting version) 30 mg twice a day. Tadalafil is an acceptable alternative.

Treatment:

The key principle is that descent to lower elevations makes all high altitude problems better. How much to descend will vary based on the person and the severity of illness. In general, descend until symptoms resolve.

- Mild AMS: - Stop ascending (do not need to descend)
 - Aspirin, acetaminophen, ibuprofen (but NO opiates) for the headache
 - Acetazolamide 250 mg twice a day (alternative: Dexamethasone 4 mg every 6 hours)
 - If symptoms improve, it's okay to ascend. If they get worse or don't go away --> descend!
- Severe AMS or HACE: - Descend, Descend, Descend!!!
 - If descent not possible, supplemental oxygen or a portable hyperbaric chamber
 - Severe AMS: Dexamethasone 4 mg every 6 hr
 - HACE: Dexamethasone 8 mg once then 4 mg every 6 hours
 - May reascend **only if symptom free off any medications** but generally recommend against further ascent this trip
- HAPE: - Descend, Descend, Descend!!!
 - If descent not possible: supplemental oxygen or a portable hyperbaric chamber
 - Nifedipine 30 mg of the long acting version twice a day
 - May reascend **only if symptom free with normal oxygen levels off medications** but generally recommend against further ascent this trip

If you have any questions: feel free to email me at: aluks@uw.edu