



## **Altitude Sickness Guidelines**

### **Introduction**

At high altitudes, typically elevations of over 8,000 feet, altitude sickness may manifest. Generally speaking, the higher the altitude, the more severe the symptoms expressed. There are three main types of altitude sickness, each briefly described below, Acute Mountain Sickness (AMS), High Altitude Pulmonary Edema (HAPE) and High-Altitude Cerebral Edema (HACE). The latter two can be life threatening, but typically are not experienced except when working at extremely high altitudes without proper acclimation

### **What is High Altitude?**

Altitude is defined on the following scale:

- High (8,000 - 12,000 feet [2,438 - 3,658 meters])
- Very High (12,000 - 18,000 feet [3,658 - 5,487 meters])
- Extremely High (18,000+ feet [5,500+ meters])

### **Why does Altitude sickness occur?**

The concentration of oxygen at sea level, where the barometric pressure averages 760mm mercury, is about 21%. With an increase in altitude, barometric pressure decreases so there are less oxygen molecules taken up per breath. For example, at 12,000 feet the barometric pressure is about 483mmHg, resulting in about 40% fewer oxygen molecules per breath. To compensate, the breathing rate has to increase. High altitude (lower air pressure) causes fluid to leak from the capillaries which can cause fluid build-up in both the lungs and the brain, which can lead to serious, even life-threatening illnesses or death.

## **Acclimation**

The major cause of altitude illnesses is going too high too fast. Given time, your body can adapt to the decrease in oxygen molecules at a specific altitude. This can take several days. Below are a few basic guidelines for proper acclimation.

- Walk up rather than flying or driving to high altitude. Start below 10,000 feet.
- If you can't walk up, do not over-exert yourself or move higher for the first 24 hours.
- For work above 10,000 feet, increase your altitude by 1,000 feet or less per day.
- For every 3,000 feet of elevation gained at high altitudes, take a rest day.
- When possible, climb high, but sleep low.
- If symptoms of moderate altitude illness appear, do not go higher (and perhaps go lower until symptoms) decrease. Always go down, if the symptoms increase.
- Different people will acclimatize at different rates, so before going higher, be sure all are properly acclimatized.
- Stay hydrated. Acclimatization is often accompanied by fluid loss, so drink at least 3-4 quarts of water per day. (Urine output should be copious and clear).
- Do not over exert when you first get up to altitude.
- Avoid tobacco, alcohol and depressant drugs including, barbiturates, tranquilizers, and sleeping pills. These decrease the respiratory drive during sleep resulting in a worsening of the symptoms.
- Eat a high carbohydrate diet (more than 70% of your calories) while at altitude.

## **Types of Altitude Sickness**

**Acute Mountain Sickness (AMS)** is common at high altitudes and is thought to be a mild form of HACE (see below). The occurrence is dependent not only on altitude, but on rate of ascent and individual susceptibility. There are three levels of AMS, mild, moderate and severe. Seventy-five percent of people will have mild symptoms at elevations over 10,000 feet.

**Mild AMS** will affect many people during acclimatization, with headache, dizziness, fatigue, shortness of breath, decreased appetite, nausea, disturbed sleep and general malaise appearing twelve to twenty-four hours after arrival at altitude. These symptoms generally tend to be worse at night and will decrease in severity in about three days. Mild AMS does not interfere with normal activity and as long as symptoms are mild (nuisance level), ascent can continue at a moderate rate. An analgesic can be taken for headache. When hiking, it is essential to communicate any symptoms of illness immediately to others on your trip. While there are drugs that can help, if they are not available, descent is the only option.

**Moderate AMS** includes severe headache not relieved by medication; nausea and vomiting; increasing weakness and fatigue; shortness of breath and loss of coordination. Normal activity is difficult. At this stage of AMS, only advanced medications or descent can reverse the problem. The person should remain at lower altitude until symptoms have subsided (up to 3 days). At this point, the person has become acclimatized to that altitude and can begin ascending again.

**Severe AMS** presents as an increase in the severity of the moderate AMS symptoms, such as shortness of breath at rest, inability to walk, decreased mental status, and fluid buildup in the lungs. Severe AMS requires immediate descent to lower altitude.

**High Altitude Pulmonary Edema (HAPE)** is caused by fluid buildup in the lungs, which prevents effective oxygen exchange. As the condition worsens, the decrease in oxygen in the bloodstream leads to cyanosis, impaired cerebral function, and death. Symptoms include shortness of breath while at rest, "tightness in the chest," extreme fatigue, a feeling of impending suffocation at night, weakness, and a persistent productive cough bringing up white, watery, or frothy fluid. Confusion and irrational behavior are signs that insufficient oxygen is reaching the brain. Immediate descent (2,000-4,000 feet lower) is a necessary life-saving measure after which anyone suffering from HAPE must be evacuated to a medical facility for proper follow-up treatment.

**High Altitude Cerebral Edema (HACE)** is the result of swelling of brain tissue due to fluid leakage in the brain cavity. Symptoms can include headache, loss of coordination, weakness, and decreasing levels of consciousness including, disorientation, loss of memory, hallucinations, psychotic behavior, and coma. HACE generally occurs after a week or more at high altitude. If not treated quickly, it can lead to death. As with HAPE, immediate descent followed by evacuation to a medical facility for evaluation and treatment is necessary.

Contact UNLV Risk Management & Safety (702-895-4226) if you have questions, or are planning to conduct field research and instructional activities at high altitudes.