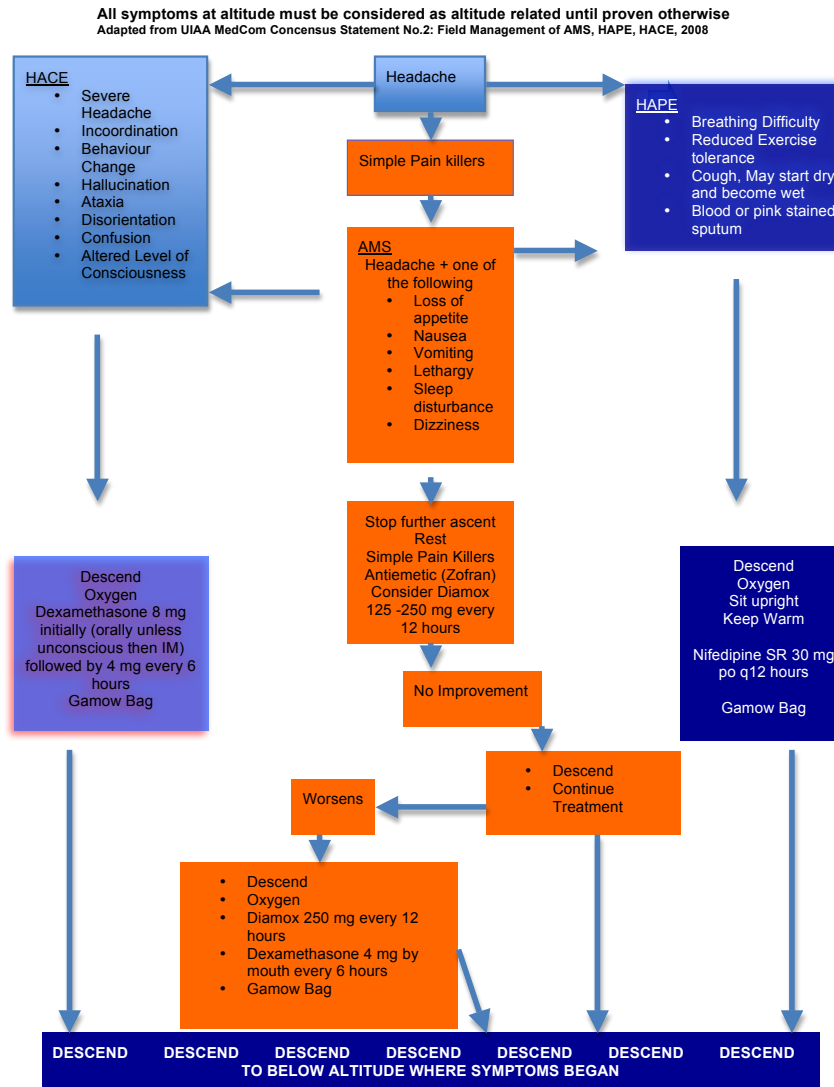


Risk Category	Description
Low	<ul style="list-style-type: none"> <li>Individuals with no prior history of altitude illness and ascending to &lt; 2800 m;</li> <li>Individuals taking &gt; 2 days to arrive at 2500-3000 m with subsequent increases in sleeping elevation &lt; 500 m/day and an extra day for acclimatization every 1000 m</li> </ul>
Moderate	<ul style="list-style-type: none"> <li>Individuals with prior history of AMS and ascending to 2500-2800 m in 1 day</li> <li>No history of AMS and ascending to &gt; 2800 m in 1 day</li> <li>All individuals ascending &gt; 500 m/day (increase in sleeping elevation) at altitudes above 3000 m but with an extra day for acclimatization every 1000 m</li> </ul>
High	<ul style="list-style-type: none"> <li>History of AMS and ascending to &gt; 2800 m in 1 day</li> <li>All individuals with a prior history of HAPE or HACE</li> <li>All individuals ascending to &gt; 3500 m in 1 day</li> <li>All individuals ascending &gt; 500 m/day (increase in sleeping elevation) above &gt; 3000 m without extra days for acclimatization</li> <li>Very rapid ascents (eg. &lt; 7 day ascents of Mt. Kilimanjaro)</li> </ul>

- Notes:**
- AMS: Acute mountain sickness; HACE: High altitude cerebral edema; HAPE: High altitude pulmonary edema
  - Altitudes listed in the table refer to the altitude at which the person sleeps
  - Ascent is assumed to start from elevations < 1200 m
  - The risk categories described above pertain to unacclimatized individuals

- References:**
- 1) UIAA Consensus statement of UIAA Medical Commission Vol 2; Emergency Field Management of Acute Mountain Sickness, High Altitude Pulmonary Edema, High Altitude Cerebral Edema; Kupper et al, June 2009
  - 2) Wilderness Medical Society Consensus Guidelines for the Prevention and Treatment of Acute Altitude Illness; Luks et al; Wilderness and Environmental Medicine, V 21;2, 146-155, June 2010
  - 3) Altitude Illness: AMS, HACE, HAPE, Jim Duff 3/2007 [http://www.treksafe.com.au/medical/documents/altitudeillnessfordoctors\\_000.pdf](http://www.treksafe.com.au/medical/documents/altitudeillnessfordoctors_000.pdf)
  - 4) Alaska Mountaineering School; Backcountry Medical Direction Protocols; Hackett, Taysom; 1/2010
  - 5) Travel at High Altitude, MEDEX, 2008; [www.medex.org.uk](http://www.medex.org.uk) ( This is an excellent resource for guides and clients)

Day	Alt	AMS Score										Notes			
		Morning					Evening								
		H	G	F	D	S	T	H	G	F	D		S	T	
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
Headache, Guts, Fatigue, Dizziness, Sleeping, TOTAL												Score 0=Fine to 3=Worst			



## Guidelines for Field Treatment of Altitude Illness (AI), AMS, HACE, HAPE



### High altitude: Issues to consider while guiding

- Acute Mountain Sickness (AMS) is very common and is more of a nuisance than a serious threat. It may be impossible to completely prevent all AMS. The guide's goal is not to necessarily prevent all AMS, but to recognize the more serious signs and symptoms of severe AMS, HAPE and HACE that might lead to end of trip/travel for the client, evacuation, or death.
- Altitude Illness occurs at elevations greater than 2000-2500m (6500-8000 feet).
- At higher elevations, the risk of developing symptoms and signs of AI increase.
- Rapid ascent in poorly acclimatized individuals greatly increases the risk of AI
- The ability to acclimatize is varied. Some individuals acclimatize fast, others more slowly.
- Incidence of AMS varies with altitude and rate of ascent; 20% in Colorado, 80% on Kilimanjaro
- AMS does not occur after 3 days at an altitude, but HAPE can
- HAPE more common than HACE; affects 1-2% of people sleeping over 4000 m; can occur rapidly and can be fatal.
- Prevention of AI is paramount
- Pre-trip planning and prior history of altitude illness and coexisting medical history are required for proper management

Dispensing medications without a medical license is illegal. Contact your medical director or advisor to assist in decision making when faced with the decision to assist a client in use of their own medication. Utilizing clients' personal medication is the preferred method of medication use. In a medical emergency, utilize all the resources you have including electronic communication with your medical advisor/director. Do what you have been trained to do and stay within your boundaries.

This document was created by Alan Oram, D.O., Medical Advisor to the American Mountain Guides Association in conjunction with Peter Hackett, M.D. Any errors or omissions should be brought to the attention of Alan Oram, D.O., [aoram1755@gmail.com](mailto:aoram1755@gmail.com).

AMS Scorecard			Total
Headache	None		0
	Mild		1
	Moderate		2
	Severe / incapacitating		3
Guts / Stomach	Good appetite		0
	Poor appetite, nausea		1
	Moderate nausea or vomiting		2
	Severe / incapacitating		3
Fatigue / Weakness	Not tired or weak		0
	Mild fatigue / weakness		1
	Moderate		2
	Severe / incapacitating		3
Dizziness / Light-headedness	None		0
	Mild		1
	Moderate		2
	Severe / incapacitating		3
Difficulty sleeping	As well as usual		0
	Not as well as usual		1
	Woke many times, poor night		2
	Could not sleep at all		3

<b>AMS</b>	<b>Common Symptoms</b>	<b>Treatment</b>
<ul style="list-style-type: none"> <li>Occurs 4-24 hours after arrival at a new altitude</li> <li>View as a continuum</li> <li>May progress to HACE</li> <li>Lake Louise score useful for progress and severity</li> <li>DO NOT OVERHYDRATE in hopes of preventing AMS</li> <li>Prevention</li> <li>Gradual ascent</li> <li>Sleeping altitude more important than altitude reached during waking hours</li> <li>Acetazolamide: 125 mg twice daily (lower doses being studied) 24hours prior to ascent and continue for 48 hours at given altitude.</li> <li>Dexamethasone: 2 mg every 6 hours or 4 mg every 12 hours</li> <li>Limit dex for urgent need to ascend such as military or SAR, do not use for more than 5-6 days</li> <li>Do NOT use dex and diamox together for prevention</li> </ul>	<ul style="list-style-type: none"> <li>Exactly like a hangover</li> <li>Headache</li> <li>Poor sleep</li> <li>Loss of appetite</li> <li>Listlessness</li> <li>Peripheral edema</li> <li>Nausea/Vomiting</li> <li>Shortness of Breath/Mild</li> <li>Dizziness</li> </ul> <p><i>AMS Score</i></p> <p>2-4 Mild 5-15 Moderate to severe</p> <ul style="list-style-type: none"> <li>If severe symptoms, consider HACE (See below) No neurologic signs in AMS</li> <li>Vital signs may be normal</li> <li>SpO2 not useful, can be normal or low in AMS; but a high SpO2 is unusual in AMS</li> </ul>	<ul style="list-style-type: none"> <li>Mild to moderate</li> <li>Stop ascent, acclimatize</li> <li>Adequate hydration (avoid over-hydration)</li> <li>Limit work</li> <li>Avoid alcohol</li> <li>Symptomatic Treatment</li> <li>Mild analgesics</li> <li>For nausea and vomiting, Zofran (ondansetron) 4mg ODT or orally every 6-8 hours as needed</li> <li>Ibuprofen 600 mg three times daily with food may assist with symptoms and prevention. Consider Acetazolamide – 125 – 250 mg twice daily for 24-48 hours for treatment and to speed acclimatization.</li> <li>If symptoms not improved or worse, DESCEND 500-1000 meters or until symptoms resolve</li> </ul>

### **Diamox (Acetazolamide)**

*Class:* Carbonic anhydrase inhibitor

*Mechanism:* Speeds natural process of acclimatization by promoting bicarbonate diuresis and thus regulating pH, which stimulates breathing, especially at night.

*Contraindications:* Sulfa allergy (relative contraindication) If true anaphylaxis to sulfa, DO NOT USE DIAMOX.

*Indication for use*

- Prophylaxis for AMS: 125 mg twice daily starting 24 hours prior to ascent and continue until at max altitude. Stop after 2 days at highest altitude. Stop once descent is initiated
- Treatment of AMS: 250 mg twice daily

*Side effects:* Tingling in extremities, tiredness, changes taste of carbonated beverages

### **Oxygen**

If oxygen is available, initiate its use immediately if HAPE or HACE is present. Oxygen combined with descent is ideal. If the patient has mild symptoms that resolve with small amount of oxygen, consider 24 hours of watchful waiting, if symptoms return with ascent, halt immediately and descend. Further ascent is not safe. Headache due to altitude will usually improve with 10-15 minutes oxygen breathing.

Start at 1-2 liters/minute via nasal cannula for mild to moderate symptoms. Cylinders will not last for more than 4-6 hours at this rate. Better to use low flow to conserve supply than to run out.

For severe symptoms, use mask and high flow rate up to 10-15 liters/minute, and reduce as patient improves. Descent is mandatory

Utilize pulse oximetry to assist in decision-making. No need to maintain high SpO2, but keep at

least at normal for that altitude or a bit higher. 85-90% SpO2 usually adequate.

<b>HACE</b>	<b>Signs/Symptoms</b>	<b>Treatment</b>
<ul style="list-style-type: none"> <li>A continuum: As AMS or HAPE worsens, HACE develops</li> <li>HACE HAS NEUROLOGIC findings</li> <li>May develop rapidly without s/s of AMS</li> <li>if HAPE present, esp at extreme altitude</li> <li>May occur with HAPE</li> <li>Typically develops over days</li> </ul>	<ul style="list-style-type: none"> <li>+/- headache</li> <li>Loss of coordination (ataxia)</li> <li>Declining level of consciousness</li> <li>Behavior change</li> <li>Drowsiness</li> <li>Disorientation</li> <li>Confusion</li> <li>Nausea/vomiting</li> <li>Uncooperative</li> <li>Acting drunk</li> <li>Vital signs may be fairly normal</li> <li>If SpO2 very low, HAPE is present</li> </ul>	<ul style="list-style-type: none"> <li>This is a medical emergency</li> <li>DESCENT is critical</li> <li>DO NOT DESCEND ALONE</li> <li>Give dexamethasone as below</li> <li>If terrain and condition prevent descent,</li> <li>Oxygen</li> <li>Gamow Bag if available</li> <li>Dexamethasone 8mg orally or IM followed by 4 mg orally or IM every 6 hours until descent and symptoms resolve</li> <li>If mild and symptoms resolve with above measures, they may remain at a given elevation in the absence of ongoing symptoms while off of dexamethasone. Reattempt ascent if symptoms have resolved while off of dex for 48 hours</li> </ul>

### **Dexamethasone**

*Class:* Glucocorticoid steroid (Potent)

*Mechanism:* Anti-inflammatory; Decreases cerebral edema; stabilizes membranes

*Contraindications/side effects:* Few; can elevate blood sugar, gastric ulcers, agitation, psychosis, peripheral edema. Use will be short term and likelihood of untoward side effects rare

*Indications for use:* AMS/HACE/High altitude headache

- Prevention**
  - 2 mg every 6 hours or 4 mg every 12 hours
- Treatment**
  - Very effective for treatment of severe AMS with or with out HACE
  - 4-8 mg po (oral) first dose, then 4 mg every 6 hours if stuck at altitude or severe illness. For headache, 4-8 mg one time.
  - If parenteral (injectable) form available and patient unable to take by mouth, give 8 mg IM once then 4 mg every 6 hours for 24 hours if stuck at elevation or symptoms persist

If HAPE present, would recommend use of Dex as well as there is probably some element of HACE/AMS present as well

### **Ibuprofen**

*Class:* NSAID (non-steroidal anti-inflammatory)

*Indication for use:* Prevention of AMS: Two studies evaluated its use with some benefit.

*Dose:* 600 mg three times daily starting 24 hours prior to ascent, may stop after 48 hours at highest elevation

*Contraindications;* Allergies to NSAIDs and aspirin, gastric ulcers, gastritis; may cause gastrointestinal bleeding. Do not use if also taking dexamethasone or any other steroid medications.

*Side Effects:* Can cause serious gastrinintestinal bleeding. Be very cautious when using. Do not hand it out as if it were candy!!!!

### **Zofran (ondansetron)**

*Class:* Antiemetic (antinausea) serotonin antagonist

*Indications:* Nausea and vomiting

*Dose:* 4mg Oral Disintegrating Tablet (ODT) every 6 hours as needed for nausea and vomiting. Can give 8mg if need be in short period of time. Oral form is also available – same dose.

*Contraindications:* Liver disease. Side effects; Headache, fever, diarrhea (rare). Severe side effects unlikely with oral administration

<b>HAPE</b>	<b>Signs/Symptoms</b>	<b>Treatment</b>
<ul style="list-style-type: none"> <li>Non Cardiac Pulmonary Edema</li> <li>Screen for clients with prior history</li> <li>Prophylaxis is only for those with prior history of HAPE</li> <li>Symptoms of AMS in only 50%</li> <li>May develop rapidly or gradually</li> <li>Usually occurs during or after 2nd night at new altitude</li> <li>Unusual to occur after 4-5 days at a given altitude</li> <li>Consider re-ascent when symptoms have resolved and client can maintain stable oxygenation at rest and with mild exercise while off of oxygen</li> <li>If you suspect both HAPE and HACE, treat with dex and other appropriate measures – descent, oxygen, hyperbarics, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Early: fatigue and breathlessness with exercise, reduced physical performance</li> <li>Dry cough (early)</li> <li>Late: severe breathlessness with exercise, progressing to breathlessness at rest.</li> <li>Hemoptysis (blood tinged pink sputum)</li> <li>Wet cough (late)</li> <li>Fast respiratory rate at rest(&gt;20)</li> <li>Fast heart rate (&gt;100)</li> <li>Crackles in lungs</li> <li>Altered level of consciousness as hypoxia becomes worse</li> <li>Vital signs: elevated resp rate and heart rate, temp to 101</li> <li>Pulse oximetry</li> <li>usually at least 10 points lower than others</li> <li>drops with mild exertion</li> <li>range from 40-80% depending on altitude and severity</li> </ul>	<ul style="list-style-type: none"> <li>Graded ascent</li> <li>Time for acclimatization</li> <li>Recognition of prior events</li> <li>Nifedipine: 20-30 mg of SR (suspended release) twice daily</li> <li>Acetazolamide;</li> <li>Hastens acclimatization</li> <li>Treatment</li> <li>Descent: Not always necessary. Generally 500-1000 meter descent or until symptoms resolve</li> <li>Limit exertion</li> <li>Supplemental oxygen to keep SpO2 &gt;85-90%</li> <li>Gamow bag; Use if descent not possible or is delayed, can put oxygen in bag</li> <li>Nifedipine SR 30 mg twice daily. Use as emergent treatment if descent not likely</li> <li>Phosphodiesterase inhibitors; Viagra, cialis, levitra, for prevention and are probably useful for treatment. Do not use with Nifedipine – one or the other but not both.</li> <li>Consider dexamethasone in usual dose, especially if neuro signs or descent delayed.</li> </ul>

### **VIAGRA, CIALIS, LEVITRA**

*Class:* PHOSPHODIESTERASE INHIBITORS; decreased pulmonary artery pressure

*Indications for use:* Prevention and treatment of HAPE

*Dose:* Viagra 25-50 mg every 8h hours for prevention and treatment (different dose than for ED)

Cialis 10 mg once to twice a day for prevention and treatment

Levitra 10 mg per day for prevention and treatment

*Contraindications:* Do not use if patient is taking nitrates for coronary disease; Do not combine with nifedipine for HAPE – the combination can drastically reduce blood pressure.

### **Procardia (Nifedipine)**

*Class:* Antihypertensive

*Mechanism:* calcium channel blocker, decreases pulmonary artery hypertension and helps treat and prevent HAPE

*Contraindications:* Low blood pressure; inability to monitor blood pressure; avoid if drinking grapefruit juice

*HAPE treatment/prevention:* 30 mg sustained release (SR) every 12 hours or 20 mg SR every 8 hours. This will be short term medication and is rescue only

Use with caution. DO NOT USE WITH VIAGRA OR SIMILAR AGENTS

Do not use variety that is given sublingually as this can decrease the patients blood pressure precipitously and lead to fainting