

## ***THE AWARENESS OF ACUTE MOUNTAIN SICKNESS IN TREKKERS AND CLIMBERS VISITING THE NEPAL HIMALAYA***

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### **Introduction**

Mountains and high plateaus cover approximately 20% of the earth's surface and are being increasingly visited by travellers. The Nepal Himalaya are one such venue, once restricted to an elite group of trekkers and climbers, but now frequented by a variety of people from all over the planet. Many will fall prey to altitude illnesses that are often preventable if certain precautions are taken. The disease is felt worldwide, affecting 2/3 of travellers to Mt. Rainier, 1/2 of those in the Khumbu region of Nepal, and up to 1/4 of those visiting Colorado ski resorts. Acute Mountain Sickness (AMS)<sup>1</sup>, High Altitude Pulmonary Edema (HAPE), and High Altitude Cerebral Edema (HACE) are three potential sequelae of improper acclimatization. Much research has been done on these entities in the recent past and many risk factors have been quantified and expressed. However, in order to practice risk-reducing behaviors, an inherent knowledge of these dangers and a willingness to act within reason to help prevent problems is required. The aim of this study is threefold. First, to quantify how many trekkers and climbers in our sample had simply heard of AMS. Second, to assess as quantitatively as possible the depth of their knowledge. Third, to study differences in the above two objectives in terms of country of origin, gender, and age. As a result, we hope to more accurately target our education efforts at the Himalayan Rescue Association and to increase both public awareness of these dangers and primary preventive behavior. In addition, such work can ideally help reduce morbidity, mortality, and dangerous rescue missions in the mountains. As travel becomes easier and more popular, travel medicine health care providers must be aware of common attitudes and behaviors expressed by our patients in order to accurately pinpoint our services. This type of study has not been completed in the Nepal Himalaya up to this point.

### **Methods**

From mid September through October 1998, 148 trekkers and climbers were asked to complete a questionnaire designed to test their knowledge regarding altitude illness. The study is a random sample of subjects questioned at the Himalayan Rescue Association, the Himalayan Explorers Club, and the Office of Immigration in Thamel, Kathmandu, Nepal. Subjects were approached by the authors, asked to complete the questionnaire, and had the results explained and any other questions answered. The questionnaire is comprised of 15 multiple choice questions in English, designed to assess three tiers of knowledge, from a basic understanding of altitude illness to more complex physiological phenomena that occur at such heights. The 15 questions are divided into three groups of 5 questions, randomly assorted and arbitrarily named 1, 2, and 3, with level one questions testing basic knowledge of AMS. To achieve a basic understanding of altitude illness, i.e. the subject has enough knowledge to avoid AMS and practice appropriate behavior should he or she become sick, the subject is required to answer all 5 level one questions properly. Levels 2 and 3 are passed with four correct responses. The questions are detailed below, with

asterixes indicating the correct answer.

**Level one questions:**

- 1) *Have you heard of AMS (Acute Mountain Sickness)?*
  - \*yes*
  - no*
- 2) *What is the most important symptom of AMS?*
  - \*headache*
  - nausea*
  - fatigue*
  - insomnia*
- 3) *What is the most important risk factor of AMS?*
  - \*rate of ascent*
  - rate of descent*
  - the altitude of your home*
  - cigarette smoking*
- 4) *The most important treatment of AMS is...*
  - keep going higher*
  - go to sleep and tell your friends not to disturb you*
  - diamox*
  - \*going down (descent)*
- 5) *The most important treatment for someone beginning to develop more severe altitude illness is:*
  - oxygen*
  - Gamow bag*
  - \*descent*
  - love and kisses*
  - faster ascent*

**Level 2 questions:**

- 1) *What is a Gamow bag?*
  - a suitcase*
  - \*treatment for severe forms of AMS*
  - a very useful device to prevent the "bends" in deep sea diving*
  - a device used to transport medical equipment into the mountains*
- 2) *In general, most Nepalis and porters do not suffer from AMS*
  - true*
  - \*false*
- 3) *Signs of altitude illness in your companions include:*
  - \*loss of appetite, fatigue, and withdrawn behavior*
  - excessive talking and increased activity*
  - overt sexual behavior*
  - fever and diarrhea*
- 4) *Severe AMS is characterized by:*

*happy thoughts and a drug like high*  
*\*imbalance, poor coordination, and confusion*  
*excessive gas and burping*  
*blurred vision*

5) *A good test for HACE (High Altitude Cerebral Edema) is:*

*check the pupils*  
*\*ask person to walk in a straight line heel to toe and see if he/she walks like a drunk*  
*ask the person who he/she was in a past life*

### **Level 3 questions:**

1) *At high altitude, heart rate and breathing rate:*

*HR increases and BR decreases*  
*\*HR increases and BR increases*  
*HR decreases and BR increases*  
*HR decreases and BR decreases*

2) *With adequate fluid intake, urine:*

*\*colour will be white and rate of urination will increase*  
*colour will be variable and rate of urination will be unchanged*  
*colour will be yellow*  
*colour will be white and rate of urination will decrease*

3) *Acetazolamide (Diamox) helps to decrease the incidence of:*

*AMS*  
*insomnia at altitude*  
*neither*  
*\*both*

4) *HACE (High Altitude Cerebral Edema) and HAPE (High Altitude Pulmonary Edema) are related to:*

*drinking bad water*  
*not cleaning deep wounds*  
*\*water collection in the brain and lungs*  
*none of the above*

5) *What is the finger test or pulse oximeter?*

*\*device used to measure the amount of oxygen in the bloodstream*  
*device used to measure breathing rate*  
*device designed to help you itch your back*  
*device used to measure bone strength*

These three levels were compared to age (in decade), gender, and geographic area of residence (continent). Contingency tables are used for the statistical evaluation of results. There are a total of 7 people who refused to complete the questionnaire or did so in a manner that made it unusable for statistics. 9 subjects are not included in the continent cohort because they are not from the Americas, Europe, or Australia/NZ and did not comprise groups large enough for contingency tables or did not reveal their country of origin. All 141 subjects are included in gender cohorts. 4 subjects are not included in the age cohort because they did not reveal their age.

## Results

No statistical differences are found in most of the cohorts, i.e. there is no difference in age, gender, and geographic area of residence with respect to degree of knowledge save for gender when crossed with level 3 knowledge where females exhibited statistically favorable results ( $p=0.025$ ). 51% of subjects answered level one correctly, with again no statistical difference amongst the cohorts. 138 respondents reported that they had at least heard of AMS. The table below shows the number of subjects that passed/failed according to level and cohort. You can also see that the number of subjects answering levels 2 and 3 perfectly are included.

**Table 1 Results of questionnaire analysis**

	Level 1 questions passed with 5/5 questions correct	Level 2 questions passed with 4/5 questions correct	Level 2 questions passed with 5/5 questions correct	Level 3 questions passed with 4/5 questions correct	Level 3 questions passed with 5/5 questions correct	Heard of AMS?#
Continent: (132 cases used)						
Americas	8/9	13/4	10/7	3/14	0/17	17/0
Europe	23/30	42/11	19/34	10/43	1/52	50/2 (131 cases)
Aust/N.Z.	35/27	42/20	23/39	22/40	5/57	62/0
p value	0.358	0.360	0.211	0.089	0.178	0.213
Gender: (141 cases used)						
Male	40/33	50/18	25/43	12/56	3/65	66/1
Female	32/36	54/19	30/43	25/48	3/70	72/1 (140 cases)
p value	0.358	0.952	0.598	0.025	0.929	0.951
Decade: (137 cases used)						
2	39/35	55/19	30/44	19/55	2/72	72/1
3	22/25	35/12	17/30	11/36	2/45	46/1 (136 cases)
4	9/7	10/6	6/10	5/11	2/14	16/0
p value	0.743	0.602	0.885	0.823	0.221	0.825

# Heard of AMS is calculated by dividing those who have heard of the disease by those who have not, and then calculating any statistical differences in this percentage by cohort.

## **Discussion**

This study demonstrates the need for better education of climbers and trekkers before they enter the Himalaya, at least in Nepal. Despite an awareness of AMS by the vast majority of respondents, almost half of those sampled did not have adequate knowledge to prevent the disease, recognize the symptoms, or take appropriate steps once sick, at least according to our arbitrarily defined criteria. Since there does not appear to be a weighted distribution of knowledge, again at least according to our criteria, the education of this group must necessarily be directed towards all regardless of home, gender, or age. According to the statistics, women have responded better to the questions dealing with more complex physiological phenomena, but still do not show an acceptable level of basic understanding. This statistically significant result may also be a function of probability since several comparisons are made with this data and probability dictates that there is a chance that one comparison will be positive if several are made. Peter Hackett's study in 1976 found an equal incidence of AMS in males and females, a greater incidence of HAPE in males, and a negative correlation of AMS development with age<sup>2</sup>. Much of this was attributed to behavioral differences at altitude in terms of aggression and precaution.

Since the HRA is the primary education center for those venturing into the mountains of Nepal, more forceful steps must be taken to ensure adequate preparation of trekkers and climbers at this institution. This group must understand common symptoms of AMS such as headache, GI upset, dizziness, fatigue, and sleep disturbance and must be taught proper responses to such symptoms. We have found that the questionnaire was widely accepted and could possibly be an entertaining method to ensure basic understanding and stimulate more detailed and personalized interaction. Altitude sickness is very serious because of the sequelae that may develop and the remoteness of the typical patient when symptoms strike. Much work has been done to understand the science behind the disease, but we also must remember that primary prevention is key when attempting to lessen the incidence and prevalence of this problem. In addition, one must remember that like any disease associated with adventure travel, primary education is a challenge in itself, and must overcome obstacles such as an international setting, language barriers, and possible hubris.

The risk factors associated with AMS are more clearly defined now, and the pathophysiology, while still being debated, is also more clear. Our patients (or potential patients) must be educated as much as possible regarding these developments, at least to the degree that will aid them practically. Ease of travel, especially when compared to earlier eras, has opened this terrain to the novice and has necessitated a great need for education and prevention. These trails and routes have traditionally been the outpost of a select group of experienced trekkers and climbers, but such days are gone.

The questionnaire format is attractive as a quick and efficient method of gathering data in this population. In addition, it has value as a stimulus to both provoke thought and increase discussion of altitude illness and other dangers. This is an attractive way to teach travellers before they become patients. The questionnaire,

however, has several limitations. First, degree of medical training was not assessed. Secondly, the levels of knowledge are arbitrated by the author and these may be subject to debate. Third, the questionnaire was given only in English and although all subjects spoke English, for many it was not their native language. Fourth, many who came of their own volition to the HRA and the HEC may comprise a group in and of themselves more willing to educate themselves about the terrain and potential dangers. Should this cohort exist, however, it is unlikely that these subjects have less knowledge than the group as a whole which would thereby signify a possible greater need for education of the general trekking and climbing public and the more efficient and directed education. Fifth, more subjects would be preferable. Sixth, it is difficult to carry these conclusions over to different mountain ranges because the Nepal Himalaya can be vastly different than say, for example, the Rockies or the Alps. The Himalaya comprise the highest mountain range in the world, and is the only area where novice trekkers can fly to altitudes of 3-4000 m and continue to trek upwards for days or weeks. The altitudes able to be reached by such adventures with relative ease make this range unique.

Travel Medicine is a recent response to increased international travel, especially by those with preexisting medical conditions. While research into the science behind the disease continues and theories regarding renal, pulmonary, and hormonal maladjustment continue to be tested, we must realise that primary prevention of this disease is possible in practically the entire population. The most effective way to promote this attitude is through education, especially targeted education based on an understanding of the general knowledge base of this specialised population. Using a format that is entertaining, quick, and educational is an ideal way to accomplish our goals. In addition, a format that stimulates further discussion and questions will help we as teachers target the needs of the individual.

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1. Ann Intern Med 1993 Apr 15; 118(8):587-92
2. Lancet Nov 27 1976 Hackett, Rennie and Levine