ORIGINAL RESEARCH

Mountain Sickness Knowledge Among Foreign Travelers in Cuzco, Peru

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Objective.—Cuzco, Peru, is host to a dangerous mix of high altitude and rapid access from low elevation, which results in a high prevalence of acute mountain sickness (AMS). Thus, it is important that travelers entering Cuzco understand the basics of AMS. To this end, we assessed travelers' awareness of AMS, especially the resources used to obtain this knowledge. With this information we make recommendations with regard to better avenues for distribution of AMS information.

Methods.—One hundred foreign travelers, representing an international population, completed a 45-item written questionnaire that was subsequently analyzed.

Results.—Over half of the respondents (51%) rated their knowledge of AMS as “low” or “none.” Furthermore, very few respondents knew about acetazolamide (Diamox) as prophylaxis for (9%) or treatment of AMS (5%). People who consulted physicians for AMS information were more likely to know about the utility of acetazolamide than those who depended on a guidebook ($P = .0266$) but were less likely to correctly identify the symptomatology of AMS ($P = .047$). While AMS knowledge was poor, the majority of travelers (90%) indicated compliance with recommended pretravel vaccinations.

Conclusions.—This survey adds to the body of knowledge that indicates a lack of AMS knowledge among travelers. In addition, this survey identifies 2 potential avenues for improved dispersal of information: 1) guidebooks for countries of concern and 2) national health agency Web sites linked to information on pretravel vaccinations. Recommendations are made to utilize these commonly accessed resources to increase AMS information distribution to the general populous.

Key words: altitude sickness, health survey, Peru, travel, acute mountain sickness, AMS

Introduction

Acute mountain sickness (AMS) results from an increase in elevation without adequate time for acclimation. It is diagnosed when the cardinal sign of headache is accompanied by at least one other symptom of either gastrointestinal disturbance (including anorexia), dizziness, fatigue, or sleep disturbance.¹ Every year the prevalence of AMS is rising among millions of travelers to high-

altitude destinations.² This increase is due to multiple factors, including increased accessibility to elevations over 2500 m, especially from departure sites that are at or near sea level. Frequent destinations with this specific concern include Cuzco, Peru (3000 m, 11 000 feet), La Paz, Bolivia (3444 m; 11 300 feet), and Lhasa, Tibet (3749 m; 12 500 feet).

In most situations AMS is a preventable illness. Unfortunately, slow ascent and proper acclimation, 2 essentials of AMS prevention, are not possible when one arrives at a high-altitude destination directly from sea level.³ As a result, travelers are placed into a potentially dangerous environment. It is therefore important that travelers to these destinations have a basic knowledge of AMS and its symptoms. Simply distributing information on symptoms, prevention, and treatment of AMS

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has been hypothesized by investigations in Nepal⁴ to decrease the related mortality. In addition, knowledge of acetazolamide (Diamox) as a proven prophylactic and treatment for AMS can increase the safety and quality of the high-altitude experience.^{5–7}

Cuzco, Peru, is host to a particularly dangerous mix of high altitude, rapid access from low elevation, and inexperienced travelers. The potentially serious consequences of such a combination can be reduced significantly simply by educating travelers. Thus, we feel that it is important that all travelers entering Cuzco understand the basics of AMS. To this end, this investigation assessed travelers' knowledge of AMS symptomatology, prevention, and treatment, especially the resources used to gain this awareness. Through this assessment, we hope to find better avenues of education so that travelers may enjoy high-altitude destinations more safely and comfortably.

Methods

A questionnaire was developed to assess each respondent's background information, travel history, and AMS knowledge (see Appendix, available at www.wemjournal.org). Background information included questions about gender, nationality, education level, and work experience. The travel history included questions regarding previous travel to Peru and other countries, number of trips at high altitude, vaccination compliance, travel preparation, and perception of travel itinerary flexibility in the face of illness. The AMS knowledge that was assessed included resources used for AMS information, knowledge of prophylaxis and treatment options, and knowledge regarding safe travel at high altitude.

The questionnaire was distributed in the "Plaza de Armas" of Cuzco (a central location that is frequented by foreign travelers) from June 21, 2004, to July 23, 2004. Subjects who appeared to be foreign travelers were identified and approached to complete the questionnaire. Non-English speakers and Peruvian citizens were excluded from the study. There was not an attempt to limit one country's predominance. All persons agreeing to participate were informed that upon completion of the study they would receive an informative brochure provided by the Centers for Disease Control and Prevention (CDC) that included information about AMS. The subjects were then provided with pens and asked to return the questionnaires when completed. A total of 109 subjects were approached, and 100 completed the survey.

Results were analyzed using Excel software (Microsoft, Redmond, WA) upon our return to the United States. Results were analyzed based on the percentage

of people responding appropriately to the question compared to the total number of participants. Comparisons were calculated using 2-sided Student's *t* tests or Yates' χ^2 significance test to obtain a *P* value. Analysis of variance testing was conducted to check for confounding factors. A *P* value of less than .05 was considered to be significant.

The questionnaire and survey procedure was approved by the University of Southern California (USC) Institutional Review Board.

Results

The survey was offered to 109 volunteers, and 100 subjects completed the survey (92%). Of the 9 that did not participate, 7 did not speak English and 2 did not wish to participate. The surveyed population was 55% (55/100) female and 45% (45/100) male, and represented 17 countries of citizenship. Of the respondents, 84% (84/100) of the people correctly identified Cuzco's high elevation within 10% accuracy (3000–3600 m). The majority of respondents (58%, 58/100) were able to name 2 or fewer of the symptoms of AMS, and less than half (41%, 41/100) could name headache as the primary symptom. People were aware of their lack of knowledge, as 51% (51/100) of respondents rated their knowledge of AMS as "low" or "none."

In spite of its utility, only 9% (9/100) of respondents knew that acetazolamide could prevent symptoms of AMS, and only 5% (5/100) of respondents knew that it could relieve symptoms of AMS.

Of all respondents, 85% (85/100) knew to accompany a person with AMS at all times, and 66% knew that it is unsafe to climb to a higher elevation with symptoms of AMS. In addition, 71% knew to descend if they were experiencing worsening symptoms of AMS and could not walk heel to toe in a straight line.

There was a high degree of compliance regarding pretravel health care, with 90% (90/100) of respondents indicating receipt of recommended vaccinations prior to traveling. Of these respondents, 91% (82/90) obtained the pretravel vaccine information from a physician or through their national health agency. In addition, 92% (83/90) of people receiving pretravel vaccinations obtained the injections at a doctor's office, clinic, or hospital, indicating potential contact with a physician.

Many resources were used by the respondents to gain information about AMS, but the most frequently used resources were guidebooks (52%) and doctors (24%). The most popular guidebook used as an AMS resource was the *Lonely Planet* series of books (Lonely Planet Publications, Oakland, CA), with 38% (38/100) of all

respondents and 73% (38/52) of all guidebook users choosing this brand.

People that reported using a guidebook without consulting a physician were less aware of acetazolamide (3%, 1/36) than were those who also consulted a physician (25%, 6/24) ($P = .0266$). On the other hand, travelers using only the guidebook were able to name more symptoms of AMS than were those who consulted a physician ($P = .047$).

Unfortunately, while 85% of respondents visited a clinic, hospital, or personal physician for pretravel vaccinations, only 24% of people surveyed received AMS information from a physician or health care professional. Overall, 59% of all respondents used a doctor, a guidebook, or both for their AMS knowledge.

Discussion

This study adds to the body of knowledge that continues to reveal a lack of AMS knowledge among travelers. In Cuzco, Peru, there was a general lack of AMS awareness, prophylaxis, and treatment. Such limited AMS knowledge can negatively affect the lay traveler's experience, especially since acetazolamide is widely available over the counter in Peru and is useful in AMS prevention when arriving in Cuzco via airplane from sea level.⁵⁻⁷

Two similar studies have clearly shown that lay travelers lack knowledge of AMS: "Although the literature has clearly delineated the dangers that extreme altitudes confer, few laypersons may have benefited from this information."⁸ Along with this understanding is the realization that the medical community has failed to distribute AMS information effectively. It is clear that in addition to obtaining more information on AMS, our duty must also include development of effective distribution methods to deliver the acquired information to the general populous.

This investigation obtained information about travelers' habits in an effort to identify possible avenues for effective information distribution. One possible limitation of this investigation is that respondents may have relied on knowledge gained during their current stay in Peru to complete the survey rather than relying solely upon information they had acquired prior to arrival in Cuzco. To avoid this complication, the survey clearly indicated in bold lettering that questions should be answered only with information obtained before arriving in Peru. However, this complication may not have been completely avoided, and the respondents' levels of AMS knowledge may be overestimated. The impact of this limitation seems to be minimal, as most respondents suffered from a general lack of knowledge.

There were a few key findings that are worth reiterating before we discuss recommendations for the future: 1) the majority of travelers depended on guidebooks, physicians, or both for AMS knowledge, 2) most (90%) travelers obtained the recommended pretravel vaccinations, 3) most (91%) of those vaccinated obtained the region-specific vaccine information from a physician or the CDC or their national health agencies, and 4) physicians and guidebooks differed in the AMS education they provided to travelers.

These data lead us to recommend 2 strategies for improving the distribution of information to the general populous: 1) improved guidebook information and 2) a nationwide program linking AMS knowledge to the CDC vaccination information.

We encourage the writers of guidebooks, especially those provided by Lonely Planet, to acknowledge their influence on travelers and to provide complete and accurate AMS information sections for books on countries where this condition is a concern. Stephan Bezruchka clearly details all important aspects of altitude sickness in his guidebook, *Trekking in Nepal: A Traveler's Guide*.¹⁰ The 5-page section on AMS in this text should be used as an example of a well-written, appropriate, and easily understood reference for the general populous. By dedicating a section to detailing AMS symptoms, prevention, and treatment, and by communicating in clear language, authors of guidebooks would provide benefit to the 52% of travelers who depend on this resource.

Other potential resources for travelers are pretravel health Web sites maintained by the CDC and other national health agencies. As a mode of information distribution, these agencies generally provide up-to-date Web site information that is country or region specific in terms of vaccine and travel recommendations. In the United States, the CDC Web site is often used by both laypersons and physicians to determine which vaccines are necessary given the patient's itinerary. In our study the vast majority of respondents indicated compliance with pretravel vaccinations, while they simultaneously admitted ignorance to AMS awareness. With 82% of all people surveyed obtaining vaccine information from a physician, the national health agency's Web site, or both, this is likely to be an effective avenue for information distribution.

Incorporating AMS information into the profiles of countries in which high-altitude travel is possible would not be difficult. On the CDC Web site there is already an "Other Disease Risks" category that can be updated to include more information than the current statement: "If you visit the Andes Mountains, ascend gradually to allow time for your body to adjust to the high altitude,

which can cause insomnia, headaches, nausea, and altitude sickness.”¹¹ This Web site can also be cited within the guidebooks as a source of up-to-date information.

Finally, we encourage the authors of both travel guidebooks and health agency Web sites to include information on clinics or travel centers around the world that specialize in high-altitude medicine. While awareness of AMS symptoms and prevention will improve the travel experience, travelers should also be aware of available resources in case of severe AMS. As current medical knowledge permits adequate diagnosis and treatment of AMS and its sequelae, high-altitude travel should no longer take lives.

With the above recommendations travelers can leave their home countries with an adequate base of information on AMS from the CDC or from their physicians and should also find in their guidebook a traveling resource. If the Wilderness Medicine community accepts these recommendations and encourages the authors of guidebooks and the CDC to provide more complete and accurate information, travelers to high-altitude regions will have safer adventures.

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