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Correspondence

Incidence of acute mountain sickness and healthcare related behaviors among travelers to Cusco, Peru



ARTICLE INFO

Dear Editor,

Prior to the onset of the COVID-19 pandemic, South America led the market growth trend within the Americas, with an increase in international arrivals from 11.6 million in 1995 to 36.7 million in 2017 [1]. Popular destinations include locations at high altitude in the Andes, such as the city of Cusco in Peru, which had a fivefold increase in its number of visitors over the last fifteen years [1,2]. Importantly, a survey in 2002 suggested that half of the visitors to Cusco become ill during their stay, being acute mountain sickness (AMS) among the most common conditions [3]. Moreover, it has been noted that proper pre-travel counseling is often missed by healthcare providers, and travelers frequently show poor adherence to the preventive measures for AMS [3,4].

With the purpose to determine the incidence of AMS and its associated healthcare behaviors, we conducted a cross-sectional study during the peak of tourism season in year 2017. Foreign travelers in the departures area of the Alejandro Velasco Astete International Airport in the city of Cusco in Peru were invited to participate. Subjects 18 years of age and older who stayed in Cusco for less than a month and were able to read and understand English or Spanish were asked to answer a self-administered anonymous questionnaire. Data on demographics, travel characteristics, AMS symptoms, and the use of healthcare services before and during travel were collected. A score of ≥ 3 according to the 2018 Lake Louise Score (LLS) was used to define AMS. The study was reviewed by the Institutional Review Board of the University of Texas Medical Branch and authorized by the Peruvian Ministry of Health and the Alejandro Velasco Astete International Airport authority.

A total of 1729 subjects were invited to participate and 1481 accepted. After excluding incomplete questionnaires, 1274 (76%) individuals were included in the analysis. The mean age was 35.8 years (standard deviation, ± 14.1) and most subjects were female (58%). Half of the subjects were from the United States (47%) and most visited Cusco for tourism (92%). The median length of stay was 4 days (IQR 3–7). Less than half visited a healthcare professional before traveling (46%), but 57% reported having travel health insurance. Thirty-seven percent of participants met the definition of AMS during the first two days of their stay in Cusco and 38% of them had a LLS >5 indicating moderate-to-severe AMS. Younger age (Adjusted Odds ratio (AOR): 1.01 (95% Confidence Interval (95% CI): 1.01–1.03), $p < 0.01$), female sex (AOR: 1.61 (95% CI: 1.26–2.06), $p < 0.01$), and not visiting a city over 2500 m before Cusco (AOR: 2.41 (95%CI: 1.80–3.21), $p < 0.01$) were

independently associated with AMS in the binary logistic regression analysis. One in five ill travelers reported that AMS affected their travel plans, 10% had to stay in bed, and 6% missed a tour. Most travelers with AMS drank coca leaf tea to treat the symptoms (69%), but only 24% took acetazolamide. Only 19% consulted a physician for treatment. In contrast, 28% accepted treatment recommendations from travel companions, 18% from tour guides, 12% from the internet and 11% from hotel personnel. Table 1 shows the variables associated with pre-travel and in-travel medical consultation among participants with AMS.

Most of the participants in this survey were young educated adults coming to Cusco for tourism, from developed countries, and staying for less than a week. Our results showed that AMS is a common condition, with more than one-third of the travelers reporting compatible symptoms. Younger age, female sex, and lack of recent exposure to high altitude were associated with increased likelihood of AMS. In addition, pre-travel and in-travel medical consultations were associated with recommended behaviors (i.e. bringing a medication kit) and treatment choices (i.e. taking acetazolamide). A decrease in AMS incidence (37%) compared to previous reports among travelers to Cusco (49%) was evident [4]. The exclusion of sleep disturbances from the 2018 LLS made it more specific and likely accounted for decreased incidence in our study. Interestingly, traveling to South America has been identified as an independent predictor for severe AMS, presumably due to the rapid ascent rates to several major cities at high altitude in the region and the lack of prior exposure to high altitudes [5].

We believe that destination specific pre-travel medical advice is of paramount importance to prevent AMS. Evidence suggests that subjects who obtain pre-travel consultations are more knowledgeable about the treatment of AMS, plan their ascent more carefully, and are less likely to experience AMS symptoms. In our study, only 24% of participants who met criteria for AMS took acetazolamide, however, those who had a pre-travel medical consultation were four times more likely to do it (Table 1). Likewise, most travelers consumed coca leaf tea for AMS treatment, but those who visited a physician before or during their travel were less likely to use it. Coca leaf tea consumption is popular among tourists despite very scarce scientific evidence supporting its efficacy.

Region-specific pre-travel health advice on AMS and its potential complications should aid to improve preparation before travel and management during travel. Additional research should focus on healthcare behaviors at destination to increase understanding on factors affecting motivation and adherence to recommendations.

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Table 1
Variables associated with pre-travel and in-travel medical consultation among subjects with AMS.

Characteristic		Pre-travel consultation		OR (95% CI)	p	In-travel consultation		OR (95% CI)	p
		Yes (%)	No (%)			Yes (%)	No (%)		
Took acetazolamide	Yes	72 (37.9)	30 (12.3)	4.35 (2.68–7.04)	<0.01	46 (58.2)	55 (16.3)	7.14 (4.19–12.17)	<0.01
	No	118 (62.1)	214 (87.7)						
Brought a medication kit	Yes	116 (60.1)	91 (35)	2.79 (1.90–4.11)	<0.01	60 (75.9)	141 (40.8)	4.59 (2.62–8.02)	<0.01
	No	77 (39.9)	169 (65)						
Had travel health insurance	Yes	134 (67.3)	121 (45.3)	2.48 (1.69–3.64)	<0.01	52 (65)	184 (53)	1.64 (0.99–2.72)	0.052
	No	65 (32.7)	146 (54.7)						
Drank coca leaf tea	Yes	122 (64.2)	178 (73)	0.66 (0.44–1.00)	0.051	42 (53.2)	249 (73.9)	0.40 (0.24–0.66)	<0.01
	No	68 (35.8)	66 (27)						
Took caffeine/ASA	Yes	10 (5.3)	35 (14.3)	0.33 (0.16–0.68)	0.002	2 (2.5)	40 (11.9)	0.19 (0.04–0.81)	0.013
	No	180 (94.7)	209 (85.7)						

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Authorship contribution statement

Roberto Pineda-Reyes: Participated in the data analysis, drafting and proofing the manuscript, and approving its last version. **Rana Lahham, Sophia Quinones, and Spencer Glenn:** Participated in data collecting, data analysis, writing and approving the final version of the manuscript. **Maria Luisa Morales and Karen Mozo:** participated in the conceptualization, data collection, and approving the final version of the manuscript. **Miguel M. Cabada:** Participated in the conceptualization, methodology, data analysis, writing and approving the final version of the manuscript.

Declaration of competing interest

The authors declare that they have no conflicts of interest.

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