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REVIEWS

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Extreme travel medicine

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A – Study Design, **B** – Data Collection, **C** – Statistical Analysis, **D** – Data Interpretation, **E** – Manuscript Preparation, **F** – Literature Search, **G** – Funds Collection

Summary Extreme travel may be defined as participating in high-risk sports activities in a remote destination. These destinations may either be in developing countries or in the wilderness of a developed country as well. Extreme sports encompass a variety of activities. For travellers journeying to the mountains, it could be backcountry snow skiing or mountaineering; for those travelling to the seaside, it may be scuba diving, open-water sailing or white water rafting; but other extreme activities, such as sky diving, hang gliding, spelunking, abseiling or bungee jumping, have also been popular among international travellers.

The goal of an extreme medicine specialist is not just to provide their patients with advice on how to deal with the possible health problems that may occur during travel, but also to discuss all the potential risk factors they may encounter.

Extreme travellers must remember that even the best insurance coverage and the highest quality equipment cannot be a substitute for wisdom and caution. Rescue insurance coverage offers a false sense of security, yet, in the case of an emergency, it will not save a traveller's life. For those unfamiliar with extreme sports, the best advice is not to engage in any activities which are beyond their skills and abilities.

Key words: health, travel medicine, preventive medicine.

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Background

Extreme travel may be defined as participating in high-risk sports activities in a remote destination. These destinations may either be in developing countries or in the wilderness of a developed country as well. Extreme sports encompass a variety of activities. For travellers journeying to the mountains, it could be backcountry snow skiing or mountaineering; for those travelling to the seaside, it may be scuba diving, open-water sailing or white water rafting; but other extreme activities, such as sky diving, hang gliding, spelunking, abseiling or bungee jumping, have also been popular among international travellers. Extreme travellers may encounter a wide range of medical problems during their trip – these problems are normally dealt with by both travel and expedition medicine specialists. The activities which are normally excluded from travel insurance policies are the best reference as to which activities may be defined as extreme sports. If travellers are going to engage in any form of extreme activities, they are normally required to purchase additional insurance that would cover the cost of treatment of any injuries they may suffer, as well as the cost of medical evacuation (normally excluded from accident insurance). These commonly include [1]:

- professional sporting events, amateur contact sporting events,
- amateur athletic activities practiced for purposes other than recreation or leisure,
- mountaineering with the use of professional equipment (ropes) or at more than 4,500 m above sea level,
- aviation (except as a passenger on a commercial flight),
- hang gliding, sky diving, parachuting or bungee jumping,
- skiing and snowboarding, except for the purpose of recreation (no insurance coverage in case of backcountry skiing/snowboarding or skiing/snowboarding against the advice of the local ski instructors of local authorities),
- animal or motor vehicle racing,
- spelunking,
- scuba diving,
- jet skiing,
- any other sporting activity associated with an increased risk of injury.

Travelers willing to engage in the abovementioned high-risk activities during their travel need to be aware of the coverage exclusions and are strongly recommended to purchase additional insurance, which is usually paid extra [2]. The doctors providing pre-travel advice to extreme travellers need to have all the necessary knowledge on currently available prophylactic measures, as well as potential risk factors – both environmental and activity-related [3]. The demographic profile of the traveller is important as well. A study involving American tourists indicated that the average age of extreme travellers was lower than the average age of the US international travellers as a whole (32 vs 44) [4, 5]. Although a majority of extreme travellers were found to be in their 30s, there were also significant numbers of older travellers. Mortality among extreme travellers was principally associated with cardiovascular diseases (among the older travellers) and sports-related trauma (in younger travellers) [6]. Prolonged physically or emotionally stressful travel may unmask or aggravate a cardiovascular disease, and therefore it is particularly important that older travellers undergo a comprehensive medical examination before going abroad [7]. Myocardial infarctions typically occur within the first two days of travel [8]. Travelers over the age of 50 who are at an increased cardiovascular risk (e.g. obesity, arterial hypertension, hypercholesterolemia) should have an electrocardiogram performed before travel. Women are recommended to have a gynaecological consultation, and all travellers are recommended to see their dentist in order to rule out any dental problems before they go abroad. It is also very important to prepare a travel health kit containing all the necessary medications for the treatment of chronic diseases [9, 10].

Activity-related risk factors

The goal of an extreme medicine specialist is not just to provide their patients with advice on how to deal with the possible health problems that may occur during travel, but also to discuss all the potential risk factors they may encounter. The two principle risk factors include long-term travel and journeying to remote destinations with harsh climate and poor sanitation. Other common risk factors include:

- engaging in activities associated with a high risk of injuries,
- increased drowning risk (unfamiliar or poorly charted waters, currents),
- crime or political instability,
- using local transport (overcrowding, bad roads, lack of traffic regulations).

The highest single risk for extreme travellers is trauma; the injuries can result from the activity itself or travelling by local public transport. In developing countries, most injuries seen in travellers result from traffic accidents [11]. The risk of a motor vehicle collision is 6-fold higher when travellers are driving themselves, with an additional 2.5-fold higher risk if they need to drive on the opposite side of the road than in their home country [12, 13]. Travelers should avoid travelling at night and must never drive under the influence of alcohol or without their seatbelts fastened [2, 11].

Types of extreme activities

Travelers are generally keen on engaging in different sporting activities practiced on land, in the air, on or in water. In recent years, extreme sports have also been gaining in popularity among tourists. In many cases, however, extreme travellers fail to prepare well for their expedition: they have no additional insurance covering for extreme sports trauma or a good travel health kit, they do not hire experienced guides or instructors and sometimes even fail to plan the itinerary of their journey carefully.

Table 1. Selected types of extreme activities, risks and preventive measures

Extreme activity	Risk	Preventive measures
Backcountry skiing	avalanche	avalanche knowledge, avalanche transceiver, CO_2 scrubber
Scuba diving snorkelling	decompression sickness drowning	decompression in a hyperbaric chamber or in-water (if a hyperbaric chamber is unavailable)
Spelunking	trauma drowning	experienced guides, avoiding the activity during rain, avoiding bat guano, rabies vaccination
Mountaineering	acute mountains sickness trauma	experienced guides, supervised expedition with medical support, avoiding rapid ascents, acclimatisation
Rock climbing	trauma	local guides, experience of rock climbing
Sky diving, bungee jumping	trauma	experienced and certified operators
White water rafting	drowning	experienced and certified operators

Backcountry skiing

The lack of ski patrols, trail maintenance or avalanche prevention increases the risk of trauma and the time to medical care. The risk of avalanche is particularly high during the winter, and it can never be fully eliminated, even if the traveller has all the necessary experience and is well prepared. Approximately 90% of avalanches occur on slopes of between 30° and 50°, usually after a heavy snowfall, i.e. when the conditions for skiing seem to be perfect. Skiers are advised to travel in groups and to equip themselves with an avalanche transceiver, a shovel and a CO_2 scrubber; in the case of emergency, this equipment could save their life [14]. A study by Radwin et al. [15] demonstrated that in most avalanche victims, CO_2 necrosis occurs much faster than hypoxia or hypothermia, which means that CO_2 scrubbers offer the highest chance of survival for those trapped by an avalanche.

Scuba diving, snorkelling

A vast number of tour operators globally have diving trips or diving holidays on offer. In countries with a developed tourist economy (e.g. Belize, Australia, Thailand), it is necessary to hire a certified local instructor for anybody willing to go on a diving excursion. In developing countries, however, the law may not be as strict. The two greatest risks for divers include drowning and decompression sickness. The Diver's Alert Network is an organisation that offers substantial support in case of emergency. The organisation can provide comprehensive diving insurance, they can find the nearest functional hyperbaric chamber, and they can assist with hyperbaric treatment. Scuba diving far away from functional hyperbaric chambers requires alternative strategies for dealing with decompression sickness. One such strategy includes in-water recompression, i.e. re-descending until symptoms subside and then slowly re-ascending with doubling one's decompression time. This strategy, however, requires considerable experience, sufficient air supply, good weather conditions and a flexible timetable [1].

Spelunking (caving)

Remote cave exploration has been increasing in popularity among travellers. In principal, the major health risks include trauma and drowning (flash flood). In developing countries, evacuation may not be an option, as the medical capabilities are limited. For their own safety, cave explorers are advised to inform local authorities of their plans and itineraries and, ideally, organise medical and evacuation support on their own. Spelunking is also associated with certain infectious risks, e.g. rabies resulting from exposure to infected bats (bats account for 17% of all rabies cases in animals in the US) [16]. Rabies can be transmitted through direct contact with an infected bat, but it can also spread indirectly, i.e. through exposure to the animal's saliva. There have also been reports of aerosol transmission of the rabies virus – this is possible with very large colonies of bats living in poorly ventilated caves with high humidity and temperatures [17].

Mountaineering and climbing

Experience and good guides are essential for anyone willing to engage in mountaineering or climbing. The two major risks associated with high-altitude endeavours include traumas (e.g. falls, avalanches, crevasses) and altitude sickness. There are, however, some other risks involved as well, e.g. conditions associated with prolonged exposure to low temperatures (frostbite, hypothermia, chilblains or trench foot) or the effects of increased solar radiation (sunburn or snow blindness) [18]. Altitude sickness is a group of general symptoms resulting from

exposure to high-altitude conditions that can be classified into three major conditions: acute mountain sickness (AMS), high altitude pulmonary edema (HAPE) and high altitude cerebral edema (HACE). Although AMS is not life-threatening itself, it may lead to more severe conditions, such as HAPE and HACE, which are illnesses may pose a direct threat to the lives of mountain climbers if left untreated. Altitude sickness is caused by decreased partial pressure of oxygen, which leads to functional disorders of the central nervous system, as well as the circulatory and respiratory systems. The progression rate of the illness and the severity of symptoms will primarily depend on the elevation itself, but also on a number of other factors, such as the age and psychophysical condition of a climber, intake of fluids and medicines, as well as time of exposure and the rate of ascent [19]. 10–20% of people who have climbed to 1,800–2,400 m in less than 24 hours develop symptoms of AMS. A majority of climbers who ascended to a height of 3,400–4,300 m suffer mild symptoms of AMS, 50% experience moderate symptoms, while 12–18% may develop a severe form of AMS. A rapid ascent to an altitude of over 5,300 m produces serious pathological symptoms in nearly all climbers. Therefore, AMS may be suspected in any acclimatised individuals who have ascended above 1,800 m within less than 24 hours and have stayed at this altitude for at least several hours [18]. Interestingly, symptoms of AMS may occur in those who have climbed from a low to high altitude within a short period of time, as well as those who, being at a high altitude, have climbed even higher. Thus, the cause of AMS is not the high altitude itself, but rather making a quick ascent within a short period of time [20]. Altitude sickness is best prevented by gradual acclimatisation and slow ascent. If, nevertheless, symptoms of altitude sickness do occur, climbers are recommended to stop the ascent or to descend to a lower altitude as quickly as possible. Supplemental oxygen therapy and the administration of AMS-preventing drugs are also advised in such cases. When rapid descent is not possible, a portable hyperbaric chamber (e.g. Gamow bag – a pressure bag where a patient may be placed to simulate descent) should be used instead if it is available [19]. Extreme travellers must remember that even the best insurance coverage and the highest quality equipment cannot be a substitute for wisdom and caution. Rescue insurance coverage offers a false sense of security, yet, in the case of an emergency, it will not save a traveller's life. For those unfamiliar with extreme sports, the best advice is not to engage in any activities which are beyond their skills and abilities.

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