

## CONCEPTS

# From Matterhorn to Mt Everest: Empowering Rescuers and Improving Medical Care in Nepal

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This article describes a private initiative in which professional Swiss rescuers, based at the foot of the Matterhorn, trained Nepalese colleagues in advanced high altitude helicopter rescue and medical care techniques. What started as a limited program focused on mountain safety has rapidly developed into a comprehensive project to improve rescue and medical care in the Mt Everest area for both foreign travelers and the local Nepalese people.

*Key words:* wilderness medicine, emergency medicine, rescue work, public health

## Introduction

Until 2009, a rescue system for expedition members in the region of the highest mountain on Earth had very limited possibilities: Medical care at high altitude was insufficient in terms of response time, operations, equipment, and medical expertise. The initial focus of the initiative was to improve the rescue system in the Everest region by training Nepalese helicopter pilots and rescuers to undertake rescue missions for tourists, local guides, and porters. In collaboration with a Swiss nongovernmental organization, a program of medical training for the rescuers was added to the technical and operational training.

Unfortunately, the challenges facing Nepalese healthcare providers rival the scale of Mt Everest. Nepal is a large, developing country with extraordinarily difficult terrain that limits efforts to provide medical aid for its inhabitants. It was soon realized that further development of a local rescue system was necessary to ensure durable change and sustainable operations for the Nepalese. This program has established a local rescue chain in the Khumbu region. In the near future, helicopter-based primary care teams will extend medical aid to even very remote areas.

## Mortality in High and Extreme Altitude

In 2008, Firth et al<sup>1</sup> published a retrospective study on the mortality on Sagarmatha (Mt Everest) between 1921

and 2006. During the study period, 125 of 8030 climbers and 67 of 6108 Sherpas died, meaning 1.6% of all climbers and 1.1% of Sherpas climbing above base camp did not return home. The mortality rate on Mt Everest is remarkably higher than on Denali (Alaska, 6194 m) with 0.03% or Cho Oyu (Tibet, 8201 m) with 0.65% mortality.<sup>1</sup> Although Sherpas often died because of objective hazards at lower altitude (eg, falling ice), most other climbers died after symptoms of the high altitude-related health problems HACE (high altitude cerebral edema) and HAPE (high altitude pulmonary edema), often during descent. Making note of the difficulties of rescuing climbers and their employees, the authors write: "...The difficulty of rescues at extreme altitude undoubtedly increases mortality compared with lower altitude, but this does not cause the primary problems leading to the need for rescue...."<sup>1</sup>

Since the 1990s, the numbers of expeditions and climbers to Everest have increased. Additionally, the traditional approach, in which local porters—often synonymously called Sherpas—only climbed up to relatively safe base camps, has changed. Local porters and guides now routinely work above base camp, and so are placed at much higher risk of injury or high altitude illness. Despite this progressive crowding, the odds of death have not increased linearly. This has been attributed to improvements in logistics and extended experience for that specific peak.<sup>2</sup> Climbers recognized the need for a professional rescue system, and in the 1990s, private helicopter companies started to conduct independent rescue missions.

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### International Help for Helicopter Rescues in Nepal

Switzerland has a long tradition of mountain rescue, especially helicopter missions at altitudes higher than 4000 m. Swiss climbers were among the first explorers of the Himalaya, and so it came as no surprise when Swiss rescuers were engaged to help their Nepalese colleagues establish a rescue system in the mountains. In 2009, pilots and rescuers from Air Zermatt, a private Swiss helicopter rescue organization, initiated a project to train Nepalese people to undertake helicopter missions in Nepal. Despite a setback in 2010, when a Nepalese pilot and a rescuer died during a rescue mission on Ama Dablam, the project has trained 2 pilots and 4 rescuers to date. In 2011, a Swiss pilot and rescuer received the Heroism Award for the highest rescue ever at 7000 m in the Annapurna region. Until 2012, the rescues were purely technical (ie, mechanically difficult rescues), and training in prehospital medical care (ie, trauma care, high altitude-related health problems, or hypothermia) was not provided. However, long prehospital transportation times without medical care pose a significant risk of deterioration to the rescued patient. It became evident that the rescuers, and possibly the pilots, should receive basic medical training to be able to handle the most urgent and important medical emergencies that might arise during rescue and transport. Bearing in mind that most of the rescuers have very limited medical knowledge, medical educators and experts in mountain rescue and mountain medicine from Nepal, the United States, and Switzerland developed a curriculum that met these needs. Rescuers would be taught simple and safe methods that should prevent further harm to patients, and stabilize or even improve their condition, until they could be handed over to a hospital-based medical team. The [Table](#) shows the core elements of the curriculum. The practical training started in autumn 2012, when 4 Nepalese rescuers came to Zermatt and were trained beside the Matterhorn by a Swiss pilot, a mountain guide, and an emergency physician and educator.

### Collaboration With Pasang Lhamu Nicole Niquille Hospital in Lukla

This program proved so successful that it has rapidly changed the referral pattern from the Everest region. Traditionally, patients evacuated by helicopter from the Everest region have almost inevitably bypassed local hospitals and been flown to far distant Kathmandu. In spring 2012, as rescue teams with Swiss instructors became familiar with the helipad and capabilities of the local Pasang Lhamu Nicole Niquille (PLNN) Hospital in Lukla (2850 m, Khumbu), this hospital was unexpectedly confronted with a surge of more than 20 patients

arriving from high altitude areas by helicopter. Lukla is the entrance port for the Everest region from the Nepalese side. Its local hospital, founded by the Nepalese Pasang Lhamu Foundation and the Swiss Nicole Niquille Foundation, opened in 2005 and mainly covers the medical needs of the local community. Tourists were rarely seen as patients because most of the medical problems of trekkers and members of expeditions occur at elevations above Lukla. The patients who were flown to the hospital—often without prior announcement to the hospital staff—were frequently severely injured or showed signs of late stages of HACE or HAPE (based on the mission report 2012 by Dr Hanna Gubler, a Swiss expatriate, to the Nicole Niquille Foundation). The medical team struggled to establish a quick triage to decide who could be treated in the local hospital in Lukla and who should be evacuated to a larger hospital in Katmandu. The Nepalese physicians working in Lukla at that time were very experienced general practitioners but had not been trained in medical emergencies secondary to high altitude exposure. Medical training in mountain rescue for the hospital staff and basic medical training for the mountain rescuers would have aided the decision making for these emergencies and facilitated the process of handovers and shared responsibilities. This process was further complicated by a lack of shared training: the helicopter teams and the nurses and physicians from the PLNN Hospital did not know each other and were not aware of each other's operational abilities and needs. A first step to improve the shared knowledge was made in spring 2013 by giving joint medical training for the helicopter rescuers and the medical staff of the PLNN Hospital in Lukla. This continuing education program focuses on high altitude-related health problems, hypothermia, and freezing injuries, as well as traumatology. Additionally, the hospital staff learns how to quickly and safely interact with the rescue helicopter during the landing at the helipad. The idea behind this joint training was not only to improve the competencies of all the participants but also to develop a small and local rescue chain from the mountains to the hospital. A communication system between the helicopter and the hospital was established by using the tower of the local airport in Lukla to alert the hospital staff before the helicopter arrives with a patient. In the future, one of the big challenges will be to improve this chain of survival by achieving and maintaining the technical and medical competency of the rescue teams, while providing the optimal care to the rescued patients in the local hospitals and ensuring optimal communication between the involved parties. As the hospital in Lukla is a small facility with limited resources and competencies, another challenge will be to establish good

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