

# Research team explores causes of death on Mount Everest

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An international research team led by Massachusetts General Hospital (MGH) investigators has conducted the first detailed analysis of deaths during expeditions to the summit of Mt. Everest. They found that most deaths occur during descents from the summit in the so-called "death zone" above 8,000 meters and also identified factors that appear to be associated with a greater risk of death, particularly symptoms of high-altitude cerebral edema. The report, which will appear the December 20/27 issue of the British Medical Journal has been released online.

"We know that climbing Everest is dangerous, but exactly how and why people have died had not been studied," says Paul Firth, MB, ChB, of the MGH Department of Anesthesia, who led the study "It had been assumed that avalanches and falling ice – particularly in the Khumbu Icefall on the Nepal route – were the leading causes of death and that high-altitude pulmonary edema would be a common problem at such extreme altitude. But our results do not support either assumption."

Thousands of climbers have attempted to reach the summit of 8,850-meter (29,000-foot) Mount Everest since the 1920s. In order to examine the circumstances surrounding all deaths on Everest expeditions, the research team – which included investigators from three British hospitals and the University of Toronto – reviewed available expedition records including the Himalayan Database, a compilation of information from all expeditions to 300 major peaks in the world's highest range. Of a total of reported 212 deaths on Everest from 1921 to 2006, 192 occurred above Base Camp, the last encampment before

technical (roped) climbing begins.

Firth and three physician co-authors – all experienced Himalayan mountaineers with expertise in managing high-altitude illness – reviewed records for all deaths and classified them according to available information. More detailed analysis was conducted on deaths occurring above 8,000 meters during the past 25 years. Deaths were categorized as traumatic, from falls or external hazards such as avalanches; nontraumatic, from high-altitude illness, hypothermia or other medical causes; or as disappearances. Expedition participants were classified as either 'climbers,' individuals from outside the Himalayan region, or 'sherpas' – high-altitude porters, most of them ethnic Sherpas or Tibetans, hired to transport equipment and otherwise assist the climbers.

The overall mortality rate for Everest mountaineers during the entire 86-year period was 1.3 percent; the rate among climbers was 1.6 percent and the rate among sherpas was 1.1 percent. During the past 25 years, a period during which a greater percentage of mountaineers climbed above 8,000 meters, the death rate for non-Himalayan climbers descending via the longer Tibetan northeast ridge was 3.4 percent, while on the shorter Nepal route it was 2.5 percent.

Factors most associated with the risk of death were excessive fatigue, a tendency to fall behind other climbers and arriving at the summit later in the day. Many of those who died developed symptoms such as confusion, a loss of physical coordination and unconsciousness, which suggest high-altitude cerebral edema, a swelling of the brain that results from leakage of cerebral blood vessels. Symptoms of high-altitude pulmonary edema, which is involved in most high-altitude-related deaths, were surprisingly rare.

"High-altitude cerebral edema symptoms were common among those that died, but signs of pulmonary edema, or excessive fluid in the lungs,

were unusual" Firth says. "We also were surprised at how few people died due to avalanches and ice falls in recent years – those usually happen at lower altitudes, and overwhelmingly people died during summit bids above 8,000 feet – and that during descents, the mortality rate for climbers was six times that of sherpas."

While the reduced mortality rate among sherpas during descent suggests that taking time to acclimatize to high altitude could improve climber survival, Firth notes that many other factors may be involved. "Most of the sherpas are born and live their lives at high altitudes, and the competitive process for expedition employment probably selects those who are best adapted to and most skilled for the work. So the ability of lowlanders to acclimate to these very high altitudes needs further investigation."

During a 2004 Norwegian-American expedition from the north side of Everest led by Firth, equipment problems led the team to turn around at 8,300 meters, return to 7,900 meters and pool their oxygen supply. Half of the team successfully re-attempted the summit and returned safely, including Randi Skuag, the first Norwegian woman to climb Everest. Seven other climbers from other teams that year were not so fortunate – all dying above 8,000 meters, most while descending from the summit.

"The majority of those who have died on Everest were in the prime of their lives, with families and friends left bereft," stresses Firth, who is an instructor in Anaesthesia at Harvard Medical School. "Mountaineering is for fun; it's not worth dying or leaving others there to die. Appropriate caution is the hallmark of the elite mountaineer – the mountain will always be there next year."

Source: Massachusetts General Hospital

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