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Death on Denali

Fatalities Among Climbers in Mount McKinley National Park From 1903 to 1976—Analysis of Injuries, Illnesses and Rescues in 1976

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Between 1903 and 1975 about 1 percent of climbers on Mount McKinley (Denali) and Mount Foraker in Alaska died. In 1976 a total of ten (1.7 percent) of 587 mountaineers died, but this rate of death was not significantly higher than previously.

Nineteen percent of climbers in 1976 suffered major or minor injuries, illness or death. Acute mountain sickness (AMS), frostbite and fractures were common. Thirty-three rescues or retrievals of bodies were mounted at a cost of more than \$82,000.

Inexperience (particularly with arctic mountaineering), poor leadership, faulty equipment and undue reliance on rescue by helicopter contributed to the alarming incidence of accident, illness and death on big peaks in Mount McKinley National Park in 1976.

MOUNTAIN CLIMBERS flock to Denali* and other high peaks in or near Mount McKinley National Park in Alaska in steadily increasing numbers. They come from around the world. Some are expert alpinists. Many are not. Most are young. All are brave. Some are foolhardy. Few have seen an arctic mountain before.

*Denali, 6,193 m in elevation, is North America's highest mountain. It lies at 63° North Latitude 390 km from the Arctic Circle. It is officially called "Mount McKinley", but the United States Board on Geographic Names is currently considering petitions to rename the peak Denali (the tall one), an older Indian name for the mountain. Close by is Mount Foraker, 5,303 m. Both peaks are within Mount McKinley National Park.

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If weather is fine, over half of the climbers will reach the top of Denali because it is not a difficult ascent by some routes. Few gain the summits of nearby Mount Foraker, Mount Hunter, Mount Huntington and Mount Russell because there are no easy ways to ascend these.

Some climbers fall. Many freeze hands and feet. Some become ill with acute mountain sickness or the mundane illnesses of lowlands. Many climbers die.

Data and Reports of Cases

Table 1 lists numbers of climbers and fatalities on Denali and Mount Foraker since it is first recorded that men attempted to climb Denali in

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ABBREVIATIONS USED IN TEXT
 AMS=acute mountain sickness
 CE=cerebral edema
 HAPE=high altitude pulmonary edema
 RH=retinal hemorrhage

TABLE 1.—Climbers and Deaths on Denali and Mount Foraker, 1903 to 1976*

| Year | Climbers | Deaths | Year | Climbers | Deaths |
|----------|----------|--------|----------|----------|-----------|
| 1903 ... | 9 | 0 | 1960 ... | 37 | 0 |
| 1906 ... | 7 | 0 | 1961 ... | 32 | 0 |
| 1910 ... | 19 | 0 | 1962 ... | 40 | 0 |
| 1912 ... | 8 | 0 | 1963 ... | 50 | 0 |
| 1913 ... | 4 | 0 | 1964 ... | 33 | 0 |
| 1932 ... | 13 | 2 | 1965 ... | 31 | 0 |
| 1934 ... | 6 | 0 | 1966 ... | 22 | 0 |
| 1942 ... | 18 | 0 | 1967 ... | 83 | 8 |
| 1947 ... | 19 | 0 | 1968 ... | 40 | 0 |
| 1948 ... | 6 | 0 | 1969 ... | 71 | 1 |
| 1951 ... | 9 | 0 | 1970 ... | 124 | 2 |
| 1952 ... | 29 | 0 | 1971 ... | 163 | 2 |
| 1953 ... | 9 | 0 | 1972 ... | 181 | 3 |
| 1954 ... | 13 | 1 | 1973 ... | 203 | 0 |
| 1955 ... | 4 | 0 | 1974 ... | 302 | 2 |
| 1956 ... | 18 | 0 | 1975 ... | 381 | 0 |
| 1957 ... | 8 | 0 | 1976 ... | 587 | 10 (1.7%) |
| 1958 ... | 12 | 0 | | | |
| 1959 ... | 8 | 0 | Total .. | 2,599 | 31 (1.2%) |

*There were no climbers in years not listed.

1903. Data were compiled from mountaineering publications and the records of the National Park Service.* A few climbers—but probably no instances of deaths—have been missed. Two fatalities, not considered here, occurred on lesser peaks within Mount McKinley National Park, one on Red Mountain, 2,165 m, in 1973 and one on Mount Brooks, 3,140 m, in 1974.

In the 74-year period 1903 to 1976 a total of 2,599 persons tried to scale Denali or Mount Foraker. In all, 31 (1.2 percent) died—a rate of death of 12 per 1,000 climbers.

Table 2 presents deaths by principal causes. Falls on slopes killed 11 (35 percent), falls into crevasses 4 (13 percent) and an avalanche 3 (10 percent). Eight persons (26 percent) died from exposure; seven of these perished near the top of Denali in a storm in 1967.¹ Five (16 percent) have died on the mountains from high altitude cerebral edema (CE) or high altitude pulmonary edema (HAPE) or from a combination of the two.

The year 1976 was a busy and difficult one on Denali and Mount Foraker.^{2,3} A record number

*Members of the Anchorage and Mount McKinley National Park offices of the National Park Service, United States Department of the Interior, supplied assistance in collecting and studying data.

TABLE 2.—Causes of Death of Climbers on Denali and Mount Foraker, 1903 to 1976

| Cause of Death | Number of Deaths | Percent of Deaths Among Climbers |
|--------------------------------------------|------------------|----------------------------------|
| Fall on slope | 11 | 35 |
| Exposure | 8 | 26 |
| Acute mountain sickness | 5 | 16 |
| Cerebral edema (CE) | 1 | |
| High altitude pulmonary edema (HAPE) | 2 | |
| CE and HAPE | 2 | |
| Fall into crevasse | 4 | 13 |
| Avalanche | 3 | 10 |
| Total | 31 | 100 |

of adventurers, 587, essayed the peaks. Ten (1.7 percent) died—a rate of death of 17 per 1,000 climbers. The difference between the 1976 rate and the rate of death for all previous years combined (1 percent) is, however, not statistically significant ($X^2 = 1.66$; $P = 0.28$).

Of the ten mountaineers who died, four succumbed to falls, three were swept away by an avalanche, two died of CE or HAPE, and one died primarily from exposure. Exposure contributed to the death of two others.

Cases 1 Through 3

The deaths of three rope-mates, each from a separate cause, were intimately interrelated. They illustrate the extreme dependence of companions on one another on lofty, difficult courses.

Three Japanese alpinists were found frozen at 5,000 m on Mount Foraker by a helicopter search crew. The bodies lay in the snow with climbing rope tangled. All had superficial head abrasions and bruises. In addition one had fractured ribs, laceration of a lung, large hemothorax, rupture of a diaphragm and retroperitoneal hematoma. A second had extensive pulmonary edema. In the third no internal derangement was noted.

Comment

It is not possible to reconstruct the sequence with certainty, but it appears likely that the three fell while descending. One died because of internal bleeding. The second, perhaps ill before the fall, suffocated from HAPE. The third was left helpless high on a formidable ridge without an intact companion.

Case 4

Another man was unfortunate in other ways. An 18-year-old youth ascended the Jungfrau, 4,158 m, in Switzerland in 1970. He noted mild

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altitude sickness including headache during a night at the top. Later in the same year he went from Texas to Colorado to ski at 3,600 m elevation. After one day of skiing, intense headache, cough, dyspnea, cyanosis and vomiting developed. He had no fever. He descended by car to 1,800 m elevation and immediately recovered.

During the next five years he climbed extensively in the continental United States and Canada to 4,350 m elevation, climbed in Mexico to above 5,285 m three times, and ascended many European peaks including the Matterhorn, 4,477 m, without illness.

At age 24 in 1976 he became ill at 5,000 m elevation after climbing up onto the steep West Buttress of Denali. He was given furosemide, 40 mg intravenously, by a physician in the party but his condition deteriorated rapidly. Oxygen bottles were not available. He was lowered the next day to 4,330 m, was given more furosemide, but died with bubbling rales in his chest and bloody froth at his lips two hours after reaching the lower camp.

At autopsy the brain was very heavy, weighing 1,750 grams. It was severely edematous. White matter was extensively studded with petechial hemorrhages. Lungs weighed 1,830 grams together. Alveoli were filled with fluid which stained pink on hematoxylin and eosin preparation. Small foci of neutrophilic exudate were present in alveoli. Autopsy findings were consistent with CE and HAPE.^{4,5}

Comment

In retrospect the earlier illness while skiing may also have been HAPE. Why it occurs under certain conditions of altitude and effort on one occasion and does not necessarily recur when similar or greater altitudes and degrees of effort are attained is unknown. Persons once afflicted, however, are prone as in this case to be stricken again.⁶

A total of 30 other persons suffered important injury or illness on Denali and Foraker in 1976.* All but one were examined and treated by physicians in Alaska. There were 18 cases of frostbite. Many were destructive freeze-thaw-refreeze injuries. In 11 cases hands and feet were both involved; in 5 only the feet were frozen; in 2 only the hands. No important freezing injuries to ear, nose or other parts were encountered. Four cases of hypothermia were certain; others probably

occurred. There were four instances of fracture, two cases of concussion and one dislocation of a shoulder.

Illnesses included seven examples of HAPE, five of CE and six of high altitude retinal hemorrhage (RH).⁷ Some cases of RH, which is usually asymptomatic, were undoubtedly missed because ocular fundi were not always examined. There were four cases of advanced dehydration, one of uncomplicated acute mountain sickness (AMS) and one of pulmonary embolism with infarction.

Two diabetic persons got into trouble: one became separated from his insulin supply and profound ketoacidosis developed but he survived after nine days in a hospital; another "deteriorated" at 4,250 m elevation when he did not take insulin which had frozen. He was removed by helicopter from 3,050 m, got insulin and recovered, but was not seen by a physician. Insulin loses little potency on freezing and thawing, but clumps may form requiring extra shaking to resuspend.⁸

Combinations of injuries and illnesses were common. Association of RH, CE and HAPE was frequent. These all may be manifestations of a single process.⁹⁻¹¹

After the climbing season the National Park Service sent questionnaires to the 84 parties which had been on the mountains in 1976 asking questions about medical and other experiences. Exactly half responded. We counted 20 additional cases of mild frostbite (one person requiring admission to hospital outside Alaska for three days), 14 instances of mild AMS (the persons recovering in each case on the mountain) and two sprained ankles—a total of 36 additional disorders.

If minor injuries and illnesses occurred as often among the half not responding, then 36 more medical problems are postulated for a grand total of approximately 112 cases of injury, illness or death among 587 climbers—a rate of 191 per 1,000 (19 percent). Stated in another way, approximately one of five mountaineers suffered injury, illness or death on Denali and Mount Foraker in 1976.

Cases 5 Through 8

The fall of a rope of four illustrates the complex features of illness, injury, death and rescue on a tall and icy mountain:

A group of six men, one of whom had not climbed above 1,500 m elevation before, walked from Wonder Lake, 650 m elevation, 50 km to

*A table detailing 1976 deaths and major nonfatal illnesses and injuries is available from the authors.

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the base of Denali and mounted a ridge toward the North Summit, 5,934 m. The two most experienced went on ahead over the top.

One of the four men behind got an increasingly severe headache—as if “four men at the corners of my head were pounding with sledge hammers.” He also had confusion, nausea and imbalance. They left the ridge at 5,600 m elevation to descend another way, bivouacing overnight. The next day the ill man was too weak to carry his pack but managed to stagger along third in the rope. To negotiate a particularly steep pitch at 5,250 m, a belay was set with two ice axes driven deeply into snow. Ice screws, which would have been safer, were with the companions ahead. The axes loosened and the rope of four slid rapidly down a 40° couloir finally tumbling over a small ice cliff and coming to rest in a bowl at 4,950 m elevation.

How soon two died is uncertain. At autopsy of the frozen bodies several days later one of the men (case 5) had circumorbital hematomas but no brain injury, four fractured ribs, contusion of underlying lung and bilateral lower lobe atelectasis. External evidence of fractures of the hip and ankle also was noted. The other man (case 6) had only minor injuries: contusion of the forehead, contusion and laceration of the cheek, and abrasions of the nose and anterior chest. The brain was normal.

The other two were luckier. One (case 7) lay head downward on the slope, half-conscious, suspended by rope about his legs, wearing fingerless climber's gloves for 17 hours before people from another party reached him. He was first able to speak and take liquids 49 hours after the fall. One day later he was transported by helicopter from an elevation of 4,600 m to a hospital in Anchorage where he remained for one month. Injuries were concussion, suspected previous hypothermia (body temperature at hospital was 36° C [96.8°F]), subconjunctival hemorrhage, papilledema without retinal hemorrhage, deep freezing of fingers eventuating in loss of all fingers and shallow freezing of toes. In the hospital *Klebsiella* septicemia supervened. The patient survived.

The fourth (case 8) was conscious throughout the ordeal but was unable to help himself or his surviving companion much. He lost his hat and mittens. Help arrived, as in the case discussed above, 17 hours later. He too was removed to hospital three days after the fall. There were no

residual signs of the CE which he had undoubtedly suffered before the accident. Injuries were fracture of the femur, fracture-sprain of an ankle and superficial frostbite of a foot. Recovery was good.

Comment

A combination of inexperience, poor leadership, illness and inadequate equipment led to the disastrous fall. One man (case 5) had major injuries which he might not have survived under the best of circumstances. On the mountain he had no chance. The other who died (case 6) had wounds which ordinarily would not have been mortal. He apparently had a concussion and froze before reviving.

In the course of the season on the two mountains the National Park Service arranged for evacuation by helicopter, or in two instances by small fixed-wing airplanes, of 26 persons from 15 climbing parties. This included removal of two dead persons and two tired but intact climbers who had become separated from companions. In addition three parties arranged privately for flights to remove seven other persons, four of them dead. In all, 33 of 587 (5.6 percent), or 1 of 18 climbers, required aircraft rescue. The total number of flights to the mountains is not known, but pickup was often not possible on the first pass. Landings of helicopters were above 4,100 m in all but three instances. The highest helicopter rescues were of two women from 5,950 and 5,700 m.

In a few instances victims were given oxygen in the aircraft on the way to Anchorage 215 km away, but supplemental oxygen for passengers was not usually freighted. There were no aircraft accidents. No person rescued by air subsequently died of illness or injury sustained on the mountains.

National Park Service rescues varied in cost from \$250 for a small airplane trip to \$15,814 for helicopter rescue of two Europeans in an operation requiring many flights. Total cost to the National Park Service was \$82,200. Median cost for 15 rescues was \$3,453; average cost was \$3,162. Subsidy, therefore, to 587 recreationalists in 1976 was \$140 each.

In summary, 40 of 587 (6.8 percent), or one of 15, mountaineers sustained major injury or illness on Denali and Mount Foraker in 1976. Ten (1.7 percent), or one of 59, died. Thirty

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three (5.6 percent), or one of 18, required rescue by air. Approximately 72 other persons suffered minor injury or illness. Including these the overall rate of injury, illness or death was 19 percent, or one of five climbers.

Discussion

The death rate of climbers on Denali and Mount Foraker in 1976 of 17 per 1,000 (1.7 percent) is an appallingly high rate of death for a human activity, particularly for one which is voluntarily undertaken. It is about the same as overall mortality—18 per 1,000 (1.8 percent)—from injury and illness among the United States armed forces in wars in this century.¹²

Fatalities among climbers, however, are compressed into a few days or a few weeks on a mountain contrasted to deaths spread over months or years of military enlistment. This makes jeopardy on mountains in Mount McKinley National Park 40 to 50 times greater than that of military service during wars—more comparable perhaps to risk during an actual battle.

Since the rate of death of alpinists on Denali and Mount Foraker in 1976 was not statistically significantly greater than the rate (1 percent) in previous years combined on the same peaks, we hesitate to assert that the high number of deaths and great incidence of other injury and illness mean that climbers in 1976 were particularly unskillful or especially foolhardy.

Nonetheless, we have the suspicion, shared by old hands on Denali in 1976, that this year was, indeed, a year of unnecessary carnage. It was probably not simply an unlucky year; rather it was a season in which there seemed to be arrogance about alpine experience; prevarication about state of health on pre-climb applications to park authorities; unfamiliarity about arctic conditions; confusion about leadership; over-estimation of strength; carelessness and novel experimentation with equipment, disregard of elementary principles of mountaineering safety and hygiene, particularly with regard to hydration and to care of the feet; ignorance about AMS; casual reliance on helicopters for rescue of the ill and injured and, occasionally, of the merely fatigued, and, worst of all, callousness (with some heroic exceptions) toward the plight of parties other than one's own. If these gloomy trends continue, the outlook for future seasons is grim indeed.

It is generally agreed that the severe forms of AMS are increasingly common because people go to high places rapidly rather than hiking in from lower areas over several weeks.¹³ Climbs on Denali, Foraker, Hunter and Huntington usually begin with a flight in a small airplane onto a flat spot on a glacier at an elevation of 1,500 m to 2,200 m. High altitude brain, eye and lung syndromes begin at about 2,500 m, which is scarcely above the starting point for most expeditions. Walking in from lower levels, however, does not always afford protection; CE, RH and HAPE struck one man, CE another and HAPE a third who began ascents by hiking 50 km from an elevation of 650 m to the base of Denali.

Once serious illness has come, descent is critical to survival.¹⁴ Rescue by helicopter, if available quickly, is by far the best course, although it is hazardous and expensive. Weather was unusually fine during the climbing season on Denali and Mount Foraker in 1976. As many rescues without aircraft accident cannot be expected in a year when the weather is usual. Climbing parties, therefore, must be prepared to lower their stricken companions as soon as possible.

No one saved by helicopter or airplanes died on the way to a hospital or later. This shows how rapidly strong young persons with serious AMS recover after descending, even without oxygen being administered on the way, and how effectively major cold injuries—such as hypothermia and frozen extremities—and other trauma can be stabilized once they are admitted to hospital.¹⁵ Rescue by helicopter is clearly the method of choice if weather and terrain allow it to be used.

Descent of the aircraft to low altitude as quickly as possible after leaving the mountain is of major importance particularly if the victim has CE or HAPE. Ideally oxygen should be administered by mask at a high rate of flow on the way to town to all seriously ill or seriously injured persons. However, if the weight of oxygen equipment compromises the ability of the aircraft to make a rescue high on a mountain or makes it impossible to rescue more than one victim, then it should be left behind. Evacuation is more important than oxygen therapy.

Adventurers will continue to engage the great mountains in Mount McKinley National Park. Injury, illness and death will inevitably come to some, but assiduous attention to party leadership,

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arctic experience, climbing skill, past brushes with sickness in the mountains, equipment, hygiene, starting level of climb, rate of ascent, fall-back positions, willingness to assist others in trouble, and back-up aircraft can lessen loss of limb and life.

Addendum

Some of the lessons of 1976 may have been learned. In 1977 there were 438 persons who essayed Denali and Mount Foraker. No one died. Five were rescued by air, but the National Park Service paid (\$3,369) for rescue of only two of these.

The service stationed rangers at Talkeetna, the principal staging community for climbs, and had rangers on the popular West Buttress route for periods during the season to offer advice and assistance. It was the impression of rangers that climbers were more careful in 1977 and that fewer tyros came than in 1976.

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Straining of Stools for Gallstones

A simple way to find out whether or not a patient has gallstones is to strain stools. This is a very useful way of finding out. Now, how often in the two years since my paper on the subject came out in the *New England Journal of Medicine* have I been able to persuade anybody to strain stools? Once. Nevertheless, it is something that should be kept in mind.

—HOWARD M. SPIRO, MD, *New Haven*

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