ORIGINAL RESEARCH

Mountaineering accidents in the European Alps: have the numbers increased in recent years?

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Objective.—Media reports convey the impression that the incidence of fatal accidents in the European Alps has increased. Because more specific data are lacking, we analyzed available data from the mountain rescue services in Germany, Austria, southern Tirol, Zermatt/Switzerland, and Chamonix/France from 1987 until 1997.

Methods.—Information was gathered from the annual reports of the Austrian Mountain Rescue Service, the Swiss Alpine Club Rescue Station in Zermatt, the Mountain Rescue Service of the Southern Tirol Alpine Club, the Mountain Rescue Service of the Bavarian Red Cross, and the Department of Mountain Medicine and Traumatology from the Hospital in Chamonix.

Results.—Although the total number of rescue missions and injured alpinists increased significantly during the period, the number of fatalities retrieved during such rescue missions showed no significant increase.

Conclusions.—Even taking into account the varying definitions of “mountain accident” used in these countries, available data from the analyzed areas of the European Alps do not demonstrate a drastic increase in the number of fatalities. In the future, data concerning mountain accidents in the European Alps should be monitored according to standard definitions and stored by the International Commission for Alpine Rescue.

Key words: emergency medicine, International Commission for Alpine Rescue (ICAR), mountain accident, mountain rescue

Introduction

Each year, millions of people travel to the European Alps for rest and relaxation. In his address to the 13th International Meeting of Mountain Rescue Physicians, M. Schori¹ indicated that various forms of alpine activities (traditional activities like climbing, mountaineering, hiking, and skiing on slopes or outside the slopes, as well as the modern activities such as paragliding, snowboarding, and canyoning) are growing in popularity among the general public. Unfortunately, despite extensive preventative measures by mountaineering organizations, fatal accidents still occur every year in the summer and winter seasons.

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A few years ago, inadequate equipment was a big factor in such accidents and may still be a major factor, particularly in tourists from eastern countries. Today as in the past, inexperience plays a major role, as well as overconfidence in one's own abilities and underestimation of the forces of nature.

Recent media coverage of mountaineering accidents, especially in the summer, conveys the impression that the number of fatal accidents has increased in recent years. However, the objective data about mountaineering accidents and publicized reports are often incomplete. Preventive measures to guard against accidents and improved rescue procedures will only be possible if exact information is collected concerning the causes, types, surrounding conditions, and outcomes of these accidents. This article analyzes the frequency and severity of mountain accidents in some areas of the European Alps.

Methods

This analysis of mountaineering accidents is based on available statistics from Germany, Austria, and southern Tirol/Italy from 1987 until 1997. The Chamonix (Mont Blanc) region in France was the only alpine area in France for which data were available. In Switzerland, accident information is based on statistics from the Zermatt area. Complete Swiss data for the period 1987–1997 are unavailable due to a 1991 change in the definition of “mountaineering accident.”

Information was gathered from the following sources: annual reports of the Austrian Mountain Rescue Service,² the Swiss Alpine Club Rescue Station in Zermatt,³ the Mountain Rescue Service of the Southern Tirol Alpine Club,⁴ and the Mountain Rescue Service of the Bavarian Red Cross,⁵ as well as written communication from B. Marsigny (Department of Mountain Medicine and Traumatology, Hospital de Chamonix, Chamonix, France, 1999).

To get some impression about the increasing popularity of alpine activities, we also analyzed the membership numbers of the alpine organizations in the investigated countries by oral communication with the German Alpine Club, München, Germany (1998); the Southern Tirol Alpine Club, Bozen, Italy (1998); the Swiss Alpine Club, Bern, Switzerland (1998); and the Austrian Alpine Club, Innsbruck, Austria (1998).

In addition, we conducted numerous telephone conversations and oral interviews with representatives from the above-mentioned organizations and with G. Barbisch, Rankweil, Austria (1998/1999) from the International Commission for Alpine Rescue (ICAR).

The data in Table 1 are presented as the sum, median, and range, and data in Table 2 and Figures 1 and 2 are presented as the sum of all mentioned countries. Because of the small population (number of data per year), non-parametric repeated measurement analysis of variance was done using a Friedman test, followed by the Dunnett or Bonferroni multiple comparison post hoc test. Statistical significance was assumed at $P < .05$.

Results

FREQUENCY OF MOUNTAINEERING ACCIDENTS

During the relevant period (1987–1997), there was a significant increase in the number of rescue efforts due to mountaineering accidents in the 5 areas of the European Alps that were analyzed. The total number of reported rescue missions increased from 9608 in 1987 to 12337 in 1997 (Figure 1, Table 1).

NUMBER OF DEAD RETRIEVED DURING MOUNTAIN RESCUE MISSIONS

In contrast to the total number of mountaineering rescue efforts during the relevant time period, there was no significant increase in the number of fatalities retrieved through such efforts. The total number of fatalities in 1987 was 374; in 1997 the number was 462 (Figure 1, Table 1).

NUMBER OF RESCUED ALPINE SPORTSMEN/WOMEN

The Mountain Rescue Service in Germany does not document the number of persons assisted in a rescue effort. However, it was possible to analyze the number of persons recovered (ie, uninjured, injured, deceased) through mountain rescue efforts for Austria, the southern Tirol, Chamonix, and Zermatt. In the 4 regions analyzed, the number of rescued persons increased significantly from 6885 in 1987 to 9632 in 1997 (Figure 2, Table 1).

NUMBER OF RESCUED, INJURED ALPINE SPORTSMEN/WOMEN

During the observation period, the total number of persons recovered through rescue efforts who sustained injuries of various degrees of severity increased significantly from 5429 in 1987 to 7973 in 1997 (Figure 2, Table 1).

NUMBER OF DECEASED ALPINE SPORTSMEN/WOMEN

The number of deceased alpine sportsmen/women retrieved through rescue efforts in the 4 regions analyzed did not increase significantly. In 1987, a total of 310 deceased persons were recovered in comparison to 391 in 1997 (Figure 2, Table 1). Along these lines, the percentage of fatalities among the total rescue efforts in 1987 was 4.5%, compared to 4.1% in 1997.

MEMBERSHIP NUMBERS OF ALPINE ORGANIZATIONS

The total membership numbers of the Austrian Alpine Club, the Swiss Alpine Club, the Southern Tirol Alpine Club, and the German Alpine Club increased from 792778 members in 1987 to 985916 members in 1997 (Table 2). No membership numbers were available for the France Alpine Club and the Italian Alpine Club.

Table 1. Total number of rescue missions, total number of dead retrieved during rescue missions, number of rescued, number of injured, and number of deceased Alpine sportsmen/women in different areas of the European Alps in 1987–1997*

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	P
Total no. of rescue missions†	9608 580 166–6248	9843 622 139–6426	11 198 800 186–7628	9354 849 161–6466	10 710 926 144–7250	11 795 960 234–7314	10 787 824 173–7145	10 656 948 272–6538	11 191 766 130–690	11 497 880 160–7028	12 337 995 248–7672	<.01
Total no. of dead retrieved during rescue missions†	374 64 25–188	470 50 22–269	399 59 25–199	410 72 30–200	415 70 21–202	421 77 19–215	447 56 27–247	412 67 30–206	359 41 11–204	383 48 30–199	462 51 26–268	n.s.
Total no. of rescued alpine sportsmen/women‡	6885 419 166–5881	7136 458.5 139–6080	8530 553 186–7238	7579 530.5 161–6357	8807 591.5 144–7480	8986 677.5 234–7397	8217 596 173–6852	8260 695.5 272–6597	8317 611 130–6965	8550 632 160–7126	9632 810.5 248–7763	<.01
No. of injured sportsmen/women‡	5429 253 36–4887	5563 265.5 45–4987	7303 349 46–6559	6065 367.5 33–5297	6667 406.5 34–5820	7127 425.5 49–6227	6683 394 62–5832	6413 422 50–5519	6776 382 73–5939	6999 394.5 44–6166	7943 531.5 70–6840	<.01
No. of deceased sportsmen/women‡	310 48.5 25–188	388 48.5 22–269	313 44.5 25–199	338 54 30–200	325 51 21–202	344 55 19–215	370 48 27–247	335 49.5 30–206	291 38 11–204	313 42 30–199	391 48.5 26–268	n.s.

* Data presented as sum, median, and range. n.s. indicates not significant.

† From Germany, Austria, southern Tirol/Italy, Zermatt/Switzerland, and Chamonix/France.

‡ From Austria, southern Tirol/Italy, Zermatt/Switzerland, and Chamonix/France.

Table 2. Total membership numbers of the Austrian Alpine Club, the Swiss Alpine Club, the Southern Tirol Alpine Club, and the German Alpine Club in 1987–1997

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Austrian Alpine Club	214 754	215 560	220 047	222 254	227 727	233 794	238 931	242 585	252 625	259 810	267 687
Swiss Alpine Club	75 668	75 943	76 454	77 164	78 319	80 010	80 109	80 664	81 067	89 116	90 145
Southern Tirol Alpine Club	27 400	28 200	28 500	28 800	29 600	31 100	31 200	31 300	31 200	31 300	32 000
German Alpine Club	474 956	485 221	498 181	510 284	526 756	541 612	557 912	571 387	580 672	588 444	596 084
Total membership	792 778	804 924	823 182	838 502	862 402	886 516	908 152	925 936	945 564	968 670	985 916

Figure 1. Total number of documented rescue missions and total number of fatalities during rescue missions in Germany, Austria, southern Tirol/Italy, Zermatt/Switzerland, and Chamonix/France from 1987 until 1997 (* $P < .01$, Friedman test 1987 vs 1997).

Discussion

Tourist accidents in the mountains are tragic events caused by one or a combination of the following factors: lack of information, inadequate training, insufficient equipment, overestimation of one's abilities, or underestimation of the forces of nature. Despite the extensive information, advice, and training available through alpine organizations, the inherent risks present in the upper alpine regions can lead to serious, and often fatal, accidents.

The significant increase in the number of rescue efforts associated with mountaineering accidents must be viewed in conjunction with the growing popularity of all kinds of alpine sports.¹ The European Alps offer rest and relaxation to millions of people from all over the world each year. People with different backgrounds are increasingly participating in mountain sports of all kinds. Despite advancements in alpine techniques, proximity to the mountains is still associated with dangers that do not allow much room for human error.

During the period analyzed, there have been increases in the total number of alpine enthusiasts (with increasing membership numbers in the Alpine organizations), as well as in the number of rescue efforts due to mountaineering accidents. Today, due to the popularity of cellular (mobile) telephones, it only takes seconds to call the rescue services after an accident for evacuation by helicopter, whereas it took hours or days to climb down to an alpine hut and inform the rescue services in the past. This may also lead to an increase in the numbers of rescue missions.

Accompanying these statistics is a rise in the number of injured persons during mountaineering accidents. Because of the topographical, climatic, and mountain-related factors, medical emergencies that would be considered minor in a nonalpine environment can be quite se-

Figure 2. Documented numbers of rescued alpinists (top), injured alpinists (middle), or deceased alpinists (bottom) in Austria, Chamonix/France, southern Tirol/Italy, and Zermatt/Switzerland from 1987 until 1997.

rious in the mountains. Therefore, an apparently insignificant injury can often result in death in the mountains.

Fortunately, although there has been an increase in the number of reported mountaineering accidents, the number of fatalities involving alpine sports enthusiasts has not increased significantly. Despite the growing popularity of different alpine sports, it is presumably due to the competency of the rescue organizations that the number of fatal mountaineering accidents in the European Alps has not increased as drastically as that of the total number of mountaineering accidents. A contributing factor is certainly the increase in the use of rescue helicopters. These helicopters carry physicians who are able to administer preclinical emergency medical procedures in high mountain areas. Additionally, improved communication technology in alpine areas is often responsible for the positive outcome of mountain accidents. Through the popular use of cellular phones or emergency radio systems (eg, in Switzerland), mountaineering accidents can be reported quickly to rescue coordination centers where rescue missions can be organized promptly. Direct communication with the victims and/or their companions allows quick localization and specification of the emergency scene and facilitates the preparation and execution of the entire rescue mission.

With regard to the remaining regions of the European Alps, ie, Italy and France, it should be mentioned that complete accident statistics are not collected or documented centrally, which is the reason that only certain regions of these countries could be analyzed in this study.

There are also no common definitions of mountaineering accidents, locations or types of accidents, and severity of injuries. Data in the reports from the Austrian Mountain Rescue Service distinguished between different locations of rescue missions (ie, on slopes or outside slopes, on ice or rocks, or in alpine areas), because of avalanches or missing people. The data from Austria also documented the total number of rescued or deceased alpinists during rescue missions. In the reports from the Mountain Rescue Service of the Southern Tirol Alpine Club, data are distinguished for the alpine activity (skiing, hiking, climbing, etc) and for the location (ice, rocks, glacier, etc), as well as for rescued, injured, or deceased alpinists. The Swiss Alpine Club Rescue Station in Zermatt distinguished between rescued, injured, deceased, and missing alpinists, as well as the cause for the alpine accident (fall, avalanches, struck by lightning, etc). In the reports of the Mountain Rescue Service of the Bavarian Red Cross, one can find data for the summer (mountaineering accident and evacuation) and winter (ski accident and avalanches) seasons, as well as the number of deceased alpinists, whereas the Department of

Mountain Medicine and Traumatology from the Hospital de Chamonix presents numbers of annual rescue missions and the number of unharmed, injured, and deceased alpinists.

Sometimes, as in the case of Switzerland, the definitions of "mountaineering accident" have changed over the years (eg, since 1991, exclusion of fatal ski accidents on normal slopes as well as acute cardiac failure during hiking, but inclusion of fatal paragliding or mountain-biking accidents). All of these factors make it difficult to report a trend in the documented statistics.

Improved measures to prevent mountaineering accidents are only possible if exact information about the cause, type, surrounding conditions, and outcome of accidents is collected and analyzed. This fact makes the collection of data in a central European databank for mountaineering accidents very important. The ICAR, the central international body for regional mountain rescue organizations, should maintain this databank. All fatal and nonfatal mountain emergencies, as defined by common terminology from different countries, should be included in the "mountaineering accident databank." The data can then be transmitted to the individual rescue organizations and analyzed according to their needs. Recognized international definitions should be used, for example, the National Advisory Committee for Aeronautics index concerning the severity of injuries. Missing definitions can be formulated by a committee of experts organized by ICAR. According to ICAR (G. Barbisch, oral communication, 1998/1999), there is already a good basis for building such a central databank.

Despite the missing information from the regions mentioned, the data available permit certain statements concerning changes in mountaineering accidents. The areas studied in Germany, Austria, and southern Tirol are among the most frequented areas in the European Alps. The area surrounding Zermatt in Switzerland with its altitudes of more than 4000 m above sea level, as well as of the Chamonix region with Mount Blanc (highest summit in the European Alps, 4808 m above sea level), are some of the highlights of mountaineering and are visited each year by very experienced climbers. Because these areas are difficult and challenging, both in winter and in summer seasons, they belong to the high-risk regions of the European Alps and have a corresponding number of mountaineering accidents.

Another reason for the reported increase in the number of accidents in the high European Alps in the last few years may be the changing weather and environmental conditions (as described for the European Alps by the Swiss Alpine Club⁶) combined with the increased popularity of alpine sports. Long periods of good weather in winter, together with avalanche-conducive condi-

tions, do not always result in an increase in accidents, even though the rate of "tours" may increase. Good summer weather leads to an even larger increase in tourist activity in the alpine area. Altered route conditions caused by unusually high temperatures (ie, melting of ice, soft snow layer on top of hard ice, difficult crossings from glacier ice to rocks at the bergschrund), require adequate preparation, attentiveness, and caution, even when dealing with apparently easy treks.

In contrast to the European data, the data concerning mountaineering accidents in North America (data not shown⁷), reported by the American Alpine Club for the years 1987–1997, do not show a comparable increase in the number of mountaineering accidents or in the number of persons involved in such accidents. Rather, there appears to have been a slight decrease in the number of accidents and in the number of persons involved. The number of deceased and injured persons in the US data remains the same. According to the Alpine Club of Canada (data not shown⁷), there has been a slight increase in the number of accidents, persons involved, and deaths in Canada in the same time period. The markedly smaller total number of accidents and persons involved, despite the larger geographical areas of both countries, is notable. A reason for this difference could be that alpine sports in the United States and Canada are becoming less popular. On the other hand, this could also be due to inadequate or nonuniform documentation from various states in North America, national parks, and mountain areas. Based on the information at hand,⁷ it is presumed that the statistics of the American Alpine Club or the Alpine Club of Canada mentioned pertain mostly to members of these organizations. Other accidents are not included in these numbers or are recorded in other data collections.

Differing definitions of the many alpine sports on which the statistics are based also make it impossible to reach any conclusions concerning changes in the North American or Canadian accident rates as compared to those in Europe.

Many people owe their lives and continued good health to volunteer mountain rescue organizations. This is the motivation and reward for difficult rescue missions, which are often extremely dangerous for the rescue service members, but are carried out with dedication and expertise.

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