



ICAR

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International Commission for Alpine Rescue

Commission for Mountain Emergency Medicine

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Medicine**

of September 01, 2005

about

a Survey of

Emergency Medical Services

in Mountain Areas of

Europe and North America

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a survey of emergency medical services in mountain areas of europe and north america

OFFICIAL RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION FOR MOUNTAIN EMERGENCY MEDICINE (ICAR MEDCOM)

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This article reflects the consensus of opinion of the International Commission for Mountain Emergency Medicine which has full responsibility for the content.

Summary

Aims and methods: inquiry about on-site treatment of patients in mountain areas in 14 countries in Europe and North America (non-responder rate 33%) aiming to compare emergency medical services. *Results:* 37,535 ground rescuers and 747 helicopters are ready for the evacuation of casualties and patients in mountain areas. And 1316 physicians and 50,967 paramedics take part in ground and air mountain rescue operations. In Europe, 63.2% helicopters have a physician on board, 17.8% are staffed with a paramedic and 19% have no medically trained personnel on board. In North America, 31.6% ($p < 0.001$) of helicopters are staffed with a doctor, 59.3% ($p < 0.001$) with a paramedic and 9.1% ($p < 0.001$) have no medical personnel on board. The percentage of on-site treatment according to the recommendations of the International Liaison Committee on Resuscitation (ILCOR) or International Commission for Alpine Rescue (ICAR) varies among all countries ($p < 0.001$) and is positively related to the percentage of physician-staffed helicopters ($r = 0.76$, $p < 0.001$). Paramedics in 90.9% countries are obliged to be medically trained, but physicians only need to have a standardised training in emergency medicine in 50% ($p = 0.042$). *Conclusions:* On-site treatment according to ILCOR or ICAR recommendations is performed more often in countries where physicians are regularly involved in mountain rescue operations. However, no conclusions can be drawn from the data as to the efficiency of treatment. The data show a lack of medical education in specific, mountain rescue related problems. Physicians involved should undergo suitable training.

Key words

Emergency medical service, helicopter emergency medical service, mountain medicine, mountain rescue, paramedic, prehospital care.

Introduction

The International Commission for Mountain Emergency Medicine (ICAR MEDCOM) is a subcommission of the International Commission for Alpine Rescue (ICAR) and represents the emergency medical systems in the mountains of 21 countries in Europe and North America. The Commission acts as a forum for mountain emergency medicine with the aim of establishing and publishing statements, recommendations and guidelines dealing with all medical aspects of mountain rescue.

Some retrospective studies on mountain rescue including ground and helicopter transport as well as medical on-site treatment, have been published in Scotland (Waddell, 1975; Hearn, 2001, 2003), England (Cowper-Smith, 1977; Guly, 1996), Switzerland (Lauber and Arnold, 1981; Helleberg, 1992; Durrer, 1993; Malacrida et al., 1993), France (Marsigny et al., 1999; Scrimgeour, 2003) and the European Alps (Hohlrieder et al., 2004; Lischke et al., 2001). Two studies deal with safety standards in air rescue (Kroesen, 1996) and the legal aspects of mountain rescue (Restellini, 1992). ICAR MEDCOM established consensus guidelines for the use of rescue helicopters in the mountains (Tomazin, 2003; Tomazin and Kovacs, 2003), as well as for the qualifications for emergency doctors in mountain rescue operations (Rammlmair et al., 2003) and training guidelines for rescue personnel (Elsensohn, 2003). Peters (2000, 2003a; Peters and Plotz, 1998) published several studies on mountain medical education, the professional profile (2003b), and mountaineering qualifications of physicians (2002) in Europe.

This study is the first international research on emergency medicine in the mountains aiming to establish a database about the different emergency medical services in Europe and North America. The results are expected to enable ICAR MEDCOM and other organisations dealing with medical aspects of mountain rescue to understand national differences of medical care in the mountains and to improve both authenticity and plausibility of standardised recommendations in the future.

Methods and materials

This study is a cross-sectional inquiry using a standardised questionnaire with 47 items. The ICAR MEDCOM representatives, who are nominated by the mountain rescue services of the 21 member countries, were asked for participation and completion of the questionnaire. Participating representatives gathered data in cooperation with the responsible heads of the national emergency medical systems, mountain rescue services and public services of their country in September 2003. SPSS 7.5 (SPSS Inc., Chicago, IL, USA) software was used for statistical analysis and MEDLINE to search for the literature (1975 to the present) and citations for papers evaluating the national or international status of mountain rescue.

Results

The following 14 out of 21 (66.7%) countries returned the completed questionnaire: Austria, Canada, Croatia, Czech Republic, England and Wales, Germany, Italy, Poland, Scotland, Slovakia, Slovenia, Spain, Switzerland, and the United States of America. 7 countries (33.3%) did not reply: Bulgaria, France, Ireland, Norway, Principality of Liechtenstein, Romania, and Sweden. Data specifications on geography and population of the countries are shown in Table 1. Out of all rescue operations 55.1% are carried out in the range of altitude 0 to 1500 m, 38.1% in the range of 1500 to 3000 m, 6.7% in the range of 3000 to 5000 m and 0.1% above 5000 m.

Ground Rescue Services

Ground Rescue Services are defined here as mountain rescue organisations who work on the ground in mountain areas. Respective data are given in Table 2. In all the countries surveyed, there is an organised ground mountain rescue service. In 11 of 14 (78.6%) countries mountain areas are completely covered by the national ground rescue services. A governmental organisation is defined here as any organisation which is part of a regional or central government (e.g., national park service, fire brigade, police, army, state-run mountain rescue services), while nongovernmental organisations are any nonprofit organisations that are independent from government and based mainly on voluntarism (e.g., some mountain rescue services). Privately financed organisations charge the patient the costs of the rescue operation and/or are sustained by private grants without any governmental support. In contrast, financially sustained organisations are financed exclusively by governmental funds without charging the patient the costs of the rescue operation. In total, 97.4% of all ground rescuers belong to nonprofit organisations and 87.1% mountain rescuers are not

paid for rescue operation on the ground (i.e., some of the ground rescuers in nonprofit organisations are paid for rescue operations).

Air Rescue Services

In all countries that replied, there is a helicopter rescue service for evacuation of casualties or ill persons in mountain areas. In 5 of the 14 (35.7%) countries, mountain areas are completely covered by helicopters. Respective data are shown in Table 3. Rescue operations are defined as mountain rescue operations if the evacuation of casualties occurs in difficult, poorly accessible terrain that can not be performed by the ordinary emergency medical system, but only by especially trained members of the mountain rescue organisations. The definitions of governmental or nongovernmental and privately financed or financially sustained operators are equal to the definitions given above.

Air rescue equipment

Data on helicopter staffing with physicians and paramedics, medical equipment, frequencies of winch operations, flight ranges, and involvement of mountain rescuers in air rescue operations are shown in Table 4. Some mountain rescue helicopters are equipped with a winch or fixed line (centre line) for the evacuation of casualties when difficult terrain does not allow landing or hovering manoeuvre. The average range in flight minutes indicates the geographical range that is covered by the helicopter bases with helicopters used for the evacuation of injured or ill persons in the mountain areas. In all countries, mountain rescuers are involved in air rescue operations. In 4 of 14 (28.6%) countries, they are a regular part of the helicopter crew at the helicopter base; in the remaining 10 (71.4%) countries, they are picked up on demand by the helicopter during mountain rescue operations from prearranged places. In 5 of 14 countries (35.7%), mountain rescuers operating with helicopters are paid for their activities.

Skill level of rescue medical care providers

Frequencies and skill levels of physicians and paramedics involved in mountain rescue are given in Table 5. Physicians are available in all countries and paramedics in 11 of 14 (78.6%) countries that replied. In this inquiry, a paramedic is defined as any medically trained rescuer (minimum Basic Life Support). In the United States, intermediates (emergency medical technicians, EMT-Basic and EMT-Intermediate) have to be distinguished from EMT-Paramedics (basically referring to one with intubation and Advanced Life Support [ALS] drug capability), who have different training programmes, skills, and competences. We found significant differences among the countries in the equipment of helicopters with electrocardiographs (ECG), ALS drugs, and automated or nonautomated defibrillators ($p < 0.001$ chi-square test). Training in mountain rescue techniques is mandatory in 10 of 11 (90.9%) countries for paramedics and in 12 of 14 (85.7%, $p = 0.59$ Fisher's exact test n.s.) for physicians. In Poland, Scotland, and Switzerland, 59 to 100% of the paramedics are estimated to be able to perform ALS, in Canada the percentage is 25%, and in all remaining countries less than 7%. Paramedics are selected by their mountaineering abilities in 8 of 11 (72.7%) and physicians in 11 of 14 (78.6%, $p = 0.55$ Fisher's exact test n.s.) countries. While paramedics in 10 of 11 (90.9%) countries are obliged to be medically trained, only in 7 of 14 (50%, $p = 0.042$ Fisher's exact test) physicians are obliged to perform a standardised training programme in emergency medicine beyond that required as part of their original postgraduate training requirement. In Austria, Germany, Italy, Slovakia, Spain, and the United States, a total of 119 additional helicopters without medical equipment are available for the evacuation of uninjured persons or for recovering dead bodies (technical operations, data not shown).

Compliance with treatment guidelines

Table 6 shows the frequencies of on-site treatment according to ILCOR or ICAR standards in relation to the respective percentages of helicopters staffed with physicians. The percentage of treatment according to international standards varies significantly among the questioned countries ($p < 0.001$ One Sample Kolmogorov-Smirnov test) and is positively correlated to the percentage of helicopters with physicians on board ($r = 0.76$, $p < 0.001$ Spearman rank correlation).

Discussion

In the 14 European and North American countries questioned in this survey, 230 ground rescue services, totaling more than 37,500 rescuers, are ready for the evacuation and medical treatment of casualties and patients in mountain areas, covering the whole Alps and more than 75% of the mountains in the United States (Table 2). Also, 615 air rescue operators with 747 helicopters for the evacuation of casualties and patients cover more than 75% of the Alps, but less than 25% of the mountain areas in North America, reflecting the large remote areas with limited visitation (Tables 3 and 4). The data show the great value of volunteerism and the high grade of readiness in the field of mountain rescue in Europe and North America.

We found significant differences between the emergency medical services in Europe and North America. In European countries, 6 out of 32 (18.8%) ground rescue services are privately financed and 26 (81.3%) are financially sustained by the governments, while in North America 174 out of 201 (86.6%) rescue services are privately financed and 27 (13.4%) are financially sustained ($p < 0.001$ chi-square test) (Table 2). Similarly, in Europe 21 out of 88 (23.9%) helicopter rescue operators are privately financed and 67 (76.1%) are financially sustained, in contrast to North America, where 367 out of 527 (69.6%) are privately financed and 160 (30.4%) are financially sustained ($p < 0.001$ chi-square test) (Table 3).

In Europe, 110 out of 174 (63.2%) helicopters are available with a physician on board, 31 (17.8%) are staffed with a paramedic, and 33 (19%) have no medically trained personnel on board. In North America, 181 of 573 (31.6%) helicopters are staffed with a doctor, 340 (59.3%) with a paramedic, and 52 (9.1%) have no medically trained personnel on board ($p < 0.001$ chi-square test) (Table 4). In considering this, significant differences in finance and legal issues that prohibit physicians in the United States from flying in rescue helicopters, in contrast to European countries, should be taken into account.

Altogether 1316 physicians participate actively in ground and air rescue operations, 1206 (91.6%) in Europe and 110 (8.4%) in North America. In Europe, 601 (49.8%) physicians are family physicians and general practitioners and 605 (50.2%) are specialists; in North America 33 (30%) physicians are family physicians or general practitioners and 77 (70%) are specialists ($p < 0.001$ chi-square test) (Table 5). In 11 countries, a total of 50,967 paramedics participate actively in ground and air rescue operations, 5597 (11%) in Europe and 45,370 (89%) in North America ($p < 0.001$, One Sample Kolmogorov-Smirnov test) (Table 5).

Competence of paramedics in the performance of medical interventions, such as volume replacement, administration of ALS drugs and opioids, defibrillation, and orotracheal intubation varies among the different countries (Table 5). It should be noted that in North America the skills of a paramedic vary greatly from full ALS skills (according to ILCOR guidelines) in densely populated or high-demand locations to partial or no ALS skills in remote locations. In contrast, in many European countries, paramedics' ALS skills are restricted due to the fact that paramedics act as assistants to emergency physicians.

Though medical equipment of the helicopters varies significantly in all countries, it is a positive result that 90% of all helicopters are equipped with ECG and automated or nonautomated defibrillators and 86% with ALS drugs. The inquiry also shows that the mission range of the helicopter rescue bases is 15 to 30 minutes in the Alps, while on the North American continent the respective range is more than 30 minutes, due to the large remote areas with limited visitation (Table 4).

In some Alpine countries (e.g., Austria and Switzerland), data show an excessive concentration of helicopters in relation to the geographical surface (Table 4) due to numerous sporting activities during the winter season. In these regions, evacuation of skiers and mountaineers with minor injuries is common. We assume that some operations are carried out without appropriate indication and personal, as well as technical resources for a helicopter rescue according to the standards approved by the International Commission for Mountain Emergency Medicine (Tomazin and Kovacs, 2003). The risk of using a helicopter for the evacuation of a casualty in mountain areas should be balanced with the patient's benefit.

In 71% of the countries mountain rescuers are picked up on demand by the helicopter during mountain rescue operations (Table 4). This procedure is considered less efficient than a rescue team which is a part of the helicopter base, according to approved international guidelines that emphasize that "no delaying factors should be permitted" (Tomazin and Kovacs, 2003). Thus, keeping professional rescuers permanently on the helicopter base is considered the ideal condition for professional air rescue in mountainous terrain. However, frequency of rescue operations in the mountains, the availability of a sufficient number of rescuers, and financial considerations may play a role.

Limitations and Conclusions

Generalization of this study is somewhat limited due to the nonresponder rate of 33.3% among the ICAR-MEDCOM member countries. Some missing, highly frequented mountainous countries such as France might have influenced the results, and a potential bias cannot be excluded with certainty. Moreover, objective comparison of staffing and equipping is limited due to the lack of injury severity-acuity data. Data show that on-site treatment of casualties and patients in the mountains according to ILCOR or ICAR recommendations is being performed more often in the countries where physicians are regularly involved in mountain rescue operations. Though it is not possible to draw any conclusion concerning the efficiency of on-site treatment and the patient's outcome in relation to whether physicians or ALS skilled paramedics are operating at the scene (Rammlmair et al., 2003), further research should be carried out to clarify this essential issue. The data show also a considerable lack of standardised education and training in specific, mountain rescue-related problems of emergency medicine for physicians who operate in mountain rescue. Respective protocols have been established jointly by the International Commission for Mountain Emergency

Medicine ICAR MEDCOM, the Medical Commission of the International Mountaineering and Climbing Federation UIAA MEDCOM and the International Society of Mountain Medicine ISMM (Peters and Plotz 1998; Peters, 2000; Elsensohn, 2003). Ideally, physicians, paramedics and mountain rescuers in a helicopter mountain rescue team should be integrated as part of a regular flying crew wherever logistically and economically possible. This would enable the highest possible reliability for a safe evacuation of the casualty.

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	A ¹	CA ²	CH ³	CR ⁴	CZ ⁵	D ⁶	E+W ⁷	E ⁸	I ⁹	PL ¹⁰	SCO ¹¹	SK ¹²	SLO ¹³	USA ¹⁴
Geographical surface (km ²)	82,000	9,984,670	40,000	56,500	79,000	357,023	151,200	506,000	301,300	312,700	175,500	49,000	20,200	9,162,000
Highest peak (m)	3797	5959	4515	1834	1602	3000	1085	3718	4810	2499	1344	2655	2863	6194
Inhabitants (millions)	8	31.8	7.2	4.5	10	82.4	50	41.8	58	38.8	5	5.4	2	290
Range of altitude (m) where mountain rescue operations are carried out														
0-1500	15%	0%	10%	95%	97%	60%	100%	30%	50%	90%	100%	60%	50%	14%
1500-3000	70%	80%	60%	5%	3%	40%	0%	60%	45%	10%	0%	40%	50%	70%
3000-5000	15%	19%	30%	0%	0%	0%	0%	10%	5%	0%	0%	0%	0%	15%
>5000	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%

Table 1: Geography and population living in mountain areas of the countries, distribution of mountain rescue operations in relation to the altitude. ¹Austria, ²Canada, ³Switzerland, ⁴Croatia, ⁵Czech Republic, ⁶Germany, ⁷England and Wales, ⁸Spain, ⁹Italy, ¹⁰Poland, ¹¹Scotland, ¹²Slovakia, ¹³Slovenia, ¹⁴United States of America.

	A ¹	CA ²	CH ³	CR ⁴	CZ ⁵	D ⁶	E+W ⁷	E ⁸	I ⁹	PL ¹⁰	SCO ¹¹	SK ¹²	SLO ¹³	USA ¹⁴	Total
Mountain areas covered by ground mountain rescue services	100%	<25%	100%	100%	100%	100%	100%	100%	100%	100%	100%	>75%	100%	>75%	
Ground mountain rescue services total	3 (100%)	51 (100%)	4 (100%)	1 (100%)	1 (100%)	1 (100%)	2 (100%)	5 (100%)	7 (100%)	2 (100%)	2 (100%)	3 (100%)	1 (100%)	150 (100%)	233 (100%)
Governmental	2 (66.7%)	6 (11.8%)	1 (25%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	5 (100%)	5 (71.4%)	0 (0%)	1 (50%)	1 (33.3%)	0 (0%)	15 (10%)	37 (15.9%)
Nongovernmental	1 (33.3%)	45 (88.2%)	3 (75%)	1 (100%)	1 (100%)	1 (100%)	1 (50%)	0 (0%)	2 (28.6%)	2 (100%)	1 (50%)	2 (66.7%)	1 (100%)	135 (90%)	196 (84.1%)
Financially sustained	3 (100%)	11 (21.6%)	1 (25%)	0 (0%)	1 (100%)	1 (100%)	1 (50%)	5 (100%)	7 (100%)	2 (100%)	1 (50%)	3 (100%)	1 (100%)	16 (10.7%)	53 (22.7%)
Privately financed	0 (0%)	40 (78.4%)	3 (75%)	1 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	134 (89.3%)	180 (77.3%)
Ground mountain rescuers total	9000 (100%)	1020 (100%)	3150 (100%)	250 (100%)	550 (100%)	4280 (100%)	2520 (100%)	300 (100%)	7735 (100%)	1778 (100%)	1100 (100%)	702 (100%)	785 (100%)	4365 (100%)	3,7535 (100%)
Governmental	0 (0%)	120 (11.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (0.8%)	300 (100%)	0 (0%)	0 (0%)	100 (9.1%)	82 (11.7%)	20 (2.5%)	320 (7.3%)	962 (2.6%)
Nongovernmental	9000 (100%)	900 (88.2%)	3150 (100%)	250 (100%)	550 (100%)	4280 (100%)	2500 (99.2%)	0 (0%)	7735 (100%)	1778 (100%)	1000 (90.9%)	620 (88.3%)	765 (97.5%)	4045 (92.7%)	36,573 (97.4%)
Paid	0 (0%)	920 (90.2%)	3150 (100%)	0 (0%)	50 (9.1%)	0 (0%)	20 (0.8%)	300 (100%)	0 (0%)	78 (4.4%)	100 (9.1%)	82 (11.7%)	20 (2.5%)	130 (3%)	4850 (12.9%)
Not paid	9000 (100%)	100 (9.8%)	0 (0%)	250 (100%)	500 (90.9%)	4280 (100%)	2500 (99.2%)	0 (0%)	7735 (100%)	1700 (95.6%)	1000 (90.9%)	620 (88.3%)	765 (97.5%)	4235 (97%)	32685 (87.1%)

Table 2: Ground mountain rescue services (organisations) and ground mountain rescuers available in the countries, separated into governmental and nongovernmental operators, financially sustained by governmental funds or completely privately financed (organisations) and paid or not paid (rescuers, apart from administrative personnel). ¹Austria, ²Canada, ³Switzerland, ⁴Croatia, ⁵Czech Republic, ⁶Germany, ⁷England and Wales, ⁸Spain, ⁹Italy, ¹⁰Poland, ¹¹Scotland, ¹²Slovakia, ¹³Slovenia, ¹⁴United States of America.

	A ¹	CA ²	CH ³	CR ⁴	CZ ⁵	D ⁶	E+W ⁷	E ⁸	I ⁹	PL ¹⁰	SCO ¹¹	SK ¹²	SLO ¹³	USA ¹⁴	Total
Mountain areas covered by helicopter rescue services	100%	<25%	100%	100%	100%	100%	100%	50-75%	>75%	<25%	100%	100%	100%	<25%	
Mountain rescue operations*	25-50%	25-50%	25-50%	10-25%	<5%	50-75%	>75%	>75%	50-75%	10-25%	>75%	50-75%	>75%	5-10%	
Helicopter rescue operators total	6 (100%)	21 (100%)	3 (100%)	2 (100%)	5 (100%)	5 (100%)	11 (100%)	23 (100%)	22 (100%)	4 (100%)	3 (100%)	2 (100%)	2 (100%)	506 (100%)	615 (100%)
Governmental	1 (16.7%)	6 (28.6%)	0 (0%)	2 (100%)	2 (40%)	2 (40%)	1 (9.1%)	23 (100%)	22 (100%)	4 (100%)	2 (66.7%)	2 (100%)	2 (100%)	143 (28.3%)	212 (34.5%)
Nongovernmental	5 (83.3%)	15 (71.4%)	3 (100%)	0 (0%)	3 (60%)	3 (60%)	10 (90.9%)	0 (0%)	0 (0%)	0 (0%)	1 (33.3%)	0 (0%)	0 (0%)	363 (71.7%)	403 (65.5%)
Financially sustained	2 (33.3%)	11 (52.4%)	0 (0%)	2 (100%)	5 (100%)	2 (40%)	1 (9.1%)	23 (100%)	22 (100%)	4 (100%)	2 (66.7%)	2 (100%)	2 (100%)	149 (29.4%)	227 (36.9%)
Privately financed	4 (66.7%)	10 (47.6%)	3 (100%)	0 (0%)	0 (0%)	3 (60%)	10 (90.9%)	0 (0%)	0 (0%)	0 (0%)	1 (33.3%)	0 (0%)	0 (0%)	357 (70.6%)	388 (63.1%)

Table 3: Helicopter rescue operators available for the evacuation of injured casualties or ill persons in mountain areas, separated into governmental and nongovernmental operators, financially sustained by governmental funds or completely privately financed (bill to the patient, private grants). * Intended as an evacuation of casualties in difficult, hardly accessible terrain, performed by especially trained rescue teams. ¹Austria, ²Canada, ³Switzerland, ⁴Croatia, ⁵Czech Republic, ⁶Germany, ⁷England and Wales, ⁸Spain, ⁹Italy, ¹⁰Poland, ¹¹Scotland, ¹²Slovakia, ¹³Slovenia, ¹⁴United States of America.

	A ¹	CA ²	CH ³	CR ⁴	CZ ⁵	D ⁶	E+W ⁷	E ⁸	I ⁹	PL ¹⁰	SCO ¹¹	SK ¹²	SLO ¹³	USA ¹⁴	Total
Helicopters total:	30 (100%)	70 (100%)	28 (100%)	4 (100%)	13 (100%)	8 (100%)	15 (100%)	26 (100%)	35 (100%)	2 (100%)	4 (100%)	7 (100%)	2 (100%)	503 (100%)	747 (100%)
Staffed with physician	20 (66.7%)	0 (0%)	17 (60.7%)	4 (100%)	10 (76.9%)	5 (62.5%)	0 (0%)	19 (73.1%)	25 (71.4%)	1 (50%)	2 (50%)	5 (71.4%)	2 (100%)	181 (36%)	291 (39%)
Staffed with paramedic	5 (16.7%)	70 (100%)	7 (25%)	0 (0%)	0 (0%)	1 (12.5%)	15 (100%)	0 (0%)	0 (0%)	1 (50%)	2 (50%)	0 (0%)	0 (0%)	270 (53.7%)	371 (49.7%)
Without medically trained personnel	5 (16.7%)	0 (0%)	4 (14.3%)	0 (0%)	3 (23.1%)	2 (25%)	0 (0%)	7 (26.9%)	10 (28.6%)	0 (0%)	0 (0%)	2 (28.6%)	0 (0%)	52 (10.3%)	85 (11.4%)
Equipped with ECG monitoring	25 (83.3%)	70 (100%)	10 (35.7%)	1 (25%)	10 (76.9%)	6 (75%)	15 (100%)	26 (100%)	35 (100%)	1 (50%)	4 (100%)	5 (71.4%)	2 (100%)	465 (92.4%)	675 (90.4%)
Equipped with ALS drugs	20 (66.6%)	70 (100%)	20 (71.4%)	1 (25%)	10 (76.9%)	5 (62.5%)	15 (100%)	19 (73.1%)	22 (62.9%)	1 (50%)	4 (100%)	5 (71.4%)	2 (100%)	450 (89.5%)	644 (86.2%)
Equipped with nonautomated defibrillators	20 (66.6%)	20 (28.6%)	18 (64.3%)	0 (0%)	8 (61.5%)	5 (62.5%)	15 (100%)	19 (73.1%)	15 (42.9%)	1 (50%)	0 (0%)	5 (71.4%)	2 (100%)	453 (90.1%)	581 (77.7%)
Equipped with automated defibrillators	5 (16.7%)	50 (71.4%)	2 (7.1%)	1 (25%)	2 (15.4%)	0 (0%)	0 (0%)	0 (0%)	7 (20%)	0 (0%)	4 (100%)	0 (0%)	0 (0%)	22 (4.4%)	93 (12.4%)
Equipped with winch or centre line	30 (100%)	40 (57.1%)	28 (100%)	2 (50%)	5 (38.5%)	8 (100%)	5 (33.3%)	9 (34.6%)	28 (80%)	1 (50%)	4 (100%)	4 (57.1%)	2 (100%)	55 (10.9%)	221 (29.6%)
Winch (or fixed rope) operations	10-25%	5-10%	10-25%	<5%	<5%	<5%	50-75%	<5%	25-50%	<5%	>75%	25-50%	25-50%	<5%	
Average range in flight minutes	15-30	30-60	15-30	30-60	15-30	15-30	30-60	15-30	15-30	15-30	30-60	15-30	15-30	>60	
National criteria for helicopter equipment	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	
Mountain rescuers involved*	a	a	b	b	B	a	b	b	a	b	b	b	b	b	
Mountain rescuers paid	No	Yes	Yes	No	No	No	No	Yes	Yes	No	No	Yes	No	No	

Table 4: Helicopter staff, medical and technical equipment, and involvement of mountain rescuers. * a = rescuers as a constant part of the helicopter crew; b = rescuers picked up on demand during the rescue operation.
¹Austria, ²Canada, ³Switzerland, ⁴Croatia, ⁵Czech Republic, ⁶Germany, ⁷England and Wales, ⁸Spain, ⁹Italy, ¹⁰Poland, ¹¹Scotland, ¹²Slovakia, ¹³Slovenia, ¹⁴United States of America.

	A ¹	CA ²	CH ³	CR ⁴	CZ ⁵	D ⁶	E+W ⁷	E ⁸	I ⁹	PL ¹⁰	SCO ¹¹	SK ¹²	SLO ¹³	USA ¹⁴	Total
Physicians total:	300 (100%)	10 (100%)	150 (100%)	12 (100%)	40 (100%)	213 (100%)	40 (100%)	12 (100%)	300 (100%)	39 (100%)	30 (100%)	43 (100%)	27 (100%)	100 (100%)	1316 (100%)
Family physicians/general practitioners	150 (50%)	3 (30%)	80 (53.3%)	4 (33.3%)	15 (37.5%)	170 (79.8%)	25 (62.5%)	4 (33.3%)	120 (40%)	1 (2.6%)	20 (66.7%)	1 (2.3%)	11 (40.7%)	30 (30%)	634 (48.2%)
Anaesthetists	100 (33.3%)	0 (0%)	60 (40%)	1 (8.3%)	11 (27.5%)	5 (2.4%)	5 (12.5%)	0 (0%)	30 (10%)	2 (5.1%)	5 (16.6%)	4 (9.3%)	2 (7.4%)	0 (0%)	225 (17.1%)
Other specialists	50 (16.7%)	7 (70%)	10 (6.7%)	7 (58.4%)	14 (35%)	38 (17.8%)	10 (25%)	8 (66.7%)	150 (50%)	36 (92.3%)	5 (16.7%)	38 (88.4%)	14 (51.9%)	70 (70%)	457 (34.7%)
Trained in emergency medicine	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes	No	No	No	Yes	
Trained in mountain rescue techniques	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	
Selected by mountaineering abilities	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	
Paramedics* total:	500 (100%)	720 (100%)	17 (100%)	0	0	459 (100%)	500 (100%)	0	3050 (100%)	61 (100%)	10 (100%)	500 (100%)	500 (100%)	44,650 (100%)	50,967 (100%)
Able to perform ALS	0 (0%)	180 (25%)	10 (58.8%)			12 (2.6%)	20 (4%)		0 (0%)	61 (100%)	9 (90%)	30 (6%)	0 (0%)	150 (0.3%)	472 (0.9%)
Allowed to set IV access	<25%	25-50%	100%			<25%	<25%		0%	100%	100%	<25%	0%	25-50% ⁺	
Allowed to administer ALS drugs	0%	25-50%	50-75%			<25%	<25%		0%	100%	>75%	<25%	<25%	25-50% ⁺⁺	
Allowed to administer opioids	0%	25-50%	50-75%			0%	100%		0%	100%	>75%	0%	0%	25-50% ⁺⁺	
Allowed to use nonautomated defibrillators	<25%	100%	100%			>75%	100%		0%	100%		0%	0%	25-50% ⁺	
Allowed to perform orotracheal intubation	0%	<25%	<25%			<25%	<25%		0%	100%	>75%	<25%	0%	25-50% ⁺	
Trained in first aid	Yes	Yes	Yes			Yes	Yes		No	Yes	Yes	Yes	Yes	Yes	
Trained in mountain rescue techniques	Yes	Yes	Yes			Yes	Yes		Yes	Yes	No	Yes	Yes	Yes	
Selected by mountaineering abilities	Yes	Yes	No			Yes	No		Yes	Yes	No	Yes	Yes	Yes	

Table 5: Mountain emergency medical system. Physicians and their specialisations, paramedics and their medical and mountaineering abilities and training programmes. * Paramedics are intended as any medically trained rescuer (minimum Basic Life Support). ⁺ U.S. intermediates and U.S. paramedics. ⁺⁺ U.S. paramedics only (for definitions, see text). ¹ Austria, ² Canada, ³ Switzerland, ⁴ Croatia, ⁵ Czech Republic, ⁶ Germany, ⁷ England and Wales, ⁸ Spain, ⁹ Italy, ¹⁰ Poland, ¹¹ Scotland, ¹² Slovakia, ¹³ Slovenia, ¹⁴ United States of America.

	A ¹	CA ₂	CH ³	CR ⁴	CZ ⁵	D ⁶	E+W ⁷	E ⁸	I ⁹	PL ₀ ¹⁰	SC _O ¹¹	SK ¹²	SLO ₁₃	USA ₁₄
On-site treatment according to ILCOR or ICAR guidelines	>75 %	<25 %	100 %	25-50%	>75 %	>75 %	25-50 %	50-75%	100 %	>75 %	>75 %	>75 %	50-75%	<25 %
Helicopters total	30	70	28	4	13	8	15	26	35	2	4	7	2	503
Helicopters staffed with a physician	20 (66.7 %)	0 (0%)	17 (60.7 %)	4 (100 %)	10 (76.9 %)	5 (62.5 %)	0 (0%)	19 (73.1 %)	25 (71.4 %)	1 (50 %)	2 (50 %)	5 (71.4 %)	2 (100 %)	181 (36.0 %)

Table 6: On-site treatment according to ILCOR or ICAR standards in relation to the respective percentages of helicopters staffed with physicians. ¹Austria, ²Canada, ³Switzerland, ⁴Croatia, ⁵Czech Republic, ⁶Germany, ⁷England and Wales, ⁸Spain, ⁹Italy, ¹⁰Poland, ¹¹Scotland, ¹²Slovakia, ¹³Slovenia, ¹⁴United States of America.