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Photo by Franco Marinangeli, courtesy of Abruzzo Rescue Service in L'Aquila, Italy

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Correction

R. MacDonald and M. Schull were not included as authors of the abstract "Characterization and Determination of Critical Events during Air Medical Transport in Adult Patients in Ontario, Canada," which was published in the September/October issue (page 234) of *Air Medical Journal*. The abstract listings on the journal Web site at www.airmedicaljournal.com and on Science Direct at www.sciencedirect.com/science/journal/1067991X have been corrected to read J Singh, R MacDonald, S Bronskill, M Schull.

Helicopter Emergency Medical Service in Italy: Reality and Perspectives

Franco Marinangeli, MD, Marco Tomei, MD, Maria Laura Ursini, MD, Valeria Ricotti, MB, BCh, and Giustino Varrassi, MD

Abstract

Objective: The organization of a homogeneous medical emergency system was developed in Italy in 1999. Currently, 104 stations manage medical emergencies with ambulances and 47 helicopter-capable bases for more difficult missions. The current study describes the organization of the helicopter emergency system in Italy.

Methods: Data were collected from questionnaires filled in by each base commander.

Results: Six hundred twenty-seven physicians are enrolled in helicopter-capable base emergency teams. Of those physicians, 89.5% are specialists in anesthesiology. Professional nurses are enrolled in 46 bases. Twenty-six bases specialize in search-and-rescue (SAR) missions (which take place in geographically unfriendly terrain), where a mountain rescue technician (CNSAS) is part of the team. Twenty-one bases are for missions in geographically friendly terrain (HEMS bases). Eight bases provide 24-hour service. Specialized training is given to physicians and nurses: it is considered of first level (high standard) in 21 bases, of second level (intermediary) in 17 bases, and of third level (low) in nine bases. In the mountain bases (Alps and Apennines), the more widely used helicopters are the AB412 and the BK117C1. During 2004, there were 20,660 primary interventions and 7,790 secondary interventions. From 1999 to 2004 there was a 33% increase of activity for primary and 35% for secondary interventions.

Conclusions: The data show the activity of the helicopter-ambulance service, the role of anesthesiologists within the helicopter-based Advanced Cardiac Life Support (ACLS) team, and the diverse organization of training for medical staff in different regions of Italy.

Introduction

Italy was politically united in 1861. The first institution appointed for the management of serious emergencies was the Italian Army Red Cross. The Army Red Cross was formed by the Minister of War on the 1st of June 1866, when the "First-Aid Platoons" (derived from the Italian Association for the Help of Wounded Soldiers), was subjugated with military discipline, similar to that of the army. From 1861 to 1991, civilian medical emergency cover had been provided by the Fire Brigades, the Italian Red Cross, voluntary first aid providers, and in serious circumstances by the military. Until then emergencies nationally have been covered by nonmedical personnel. In 1991, personnel specifically trained to manage medical emergencies were recruited for the first time. In the 20 regions of Italy, 104 stations under the National Health System were created for medical emergency. Each station had an ambulance team and specialized cars. They operated to provide both emergency cover in their catchment area and inter-hospital patient transfer. In 1996, the European legislation directed that all member states must have a unique emergency number to dial to seek medical help. The number chosen was 112, but in Italy this number was already in use by the "Carabinieri" (a branch of the police); therefore, the number 118 was assigned specifically for medical emergencies. Since 1983, well before the foundation of the 118 service, Valle D'Aosta (a region of northern Italy) had a helicopter emergency service with one helicopter. It was necessary for the geography of the region and for the massive winter sports tourism industry. Valle D'Aosta is a mountainous region, with the highest Italian peaks: 16 are over 4,000 meters. Mont Blanc (4,810 meters), Monte Rosa (4,634 meters), and Cervino (4,478 meters) are the highest. It became clear that an emergency system organized with only terrestrial ambulances was incapable of coping with the diverse topology of Italy (the Alps in the north, the Apennines along the Peninsula surrounded by numerous islands). One must bear in mind that the National Health System target for emergency response time is 8 minutes in urban areas and 20 minutes in rural areas. Therefore, the National Health System encouraged all regions to equip themselves with helicopters, either directly or by private contract.

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Objective

The primary objective of the current study is to examine the current organization of the helicopter emergency medical service in Italy. The secondary objectives are:

- To evaluate the progress in the organization over the 5-year period from 1999 to 2004, taking in consideration that there is only one study on the topic, carried out in 1999¹
- To evaluate the type of helicopter used in the bases

Materials and Methods

The study was approved by the local institutional ethical review committee.

In June 2005, a questionnaire (Table 1) was sent to the 104 Italian stations, to be filled in only by those who offered a helicopter ambulance service. The questionnaire aimed to glean information on the organization of all the helicopter ambulance bases within Italian territories (Fig. 1). Emergency medical cover from the armed forces was not included in this study because its primary role is in major emergencies and not in civilian medical emergencies.

The requested data aimed to evaluate:

1. The number of operational helicopter ambulance bases
2. The number of physicians working in each base
3. The specialization of the physicians
4. The involvement of any specialized nonmedical corps, such as Corpo Nazionale Soccorso Alpino e Speleologico (CSNAS)
5. The training received by medical personnel, grouping the bases in four different levels (level 1 = four or more training sessions per year; level 2 = two to three training sessions per year; level 3 = one annual training session; level 4 = no annual training)
6. The helicopter type and whether a spare helicopter was available
7. The possibility of using a rescue winch
8. The possibility of night flying
9. The number of primary interventions in 2004
10. The number of secondary interventions in 2004
11. The types of primary and secondary interventions
12. The correlation between helicopters used and physical geography
13. The correlation between the number of interventions and presence of spare helicopters

Data from 2004 were compared with those from 1999.¹

Results

In 12 months, all the bases had responded to the questionnaire. There are 47 bases of helicopter ambulance service nationally, organized as reported in Figure 2. According to the geographical features of the areas of intervention, 13 are considered mountain bases, 12 sea bases, 22 lowland-hill bases.

The total number of physicians employed is 627 [Mean = 13 (SD 8.04); median = 12]; 561 of them are specialized in anaesthesia and intensive care (89.5%), eight specialized in general surgery, seven specialized in emergency surgery, six specialized in general medicine,

Table 1. Questionnaire Sent to Helicopter Ambulance Bases

QUESTIONNAIRE HELICOPTER-AMBULANCE BASES	
Region	
Station (City)	
Address	
Tel.	
Fax.	
Helicopter contractor	
Helicopter model	
2 nd helicopter model	
Base e-mail address	
Base Commander	
Physician	
Commander Telephone number	
Commander email address	
Number of Physicians	
• Number of Anaesthesists/Intensivists	
• Number of General Medicine physicians	
• Specialized in..... number....	
• Specialized in..... number....	
• Specialized in..... number....	
Professional nurse Yes. No.	
• If yes, specify the number.....	
Rescue winch Yes. No.	
Medical personnel trained to use rescue winch Yes. No.	
Number of days of training of medical personnel per year	
Modality of training	
Alpine rescue Yes. No.	
Alpine rescue available 365 days/year	
Training available on the helicopter for medical personnel and nurses	
Number of primary interventions in 2004	
• Road trauma	
• Sport injuries	
• Home accidents	
• Work accidents	
• Other..... (specify)	
Number of secondary interventions in 2004	
• Specify type.....	
Base operational hours in July and August	
Platform certified for nocturnal flying Yes. No.	

one expert in ear, nose, and throat (ENT), one in pediatrics, three in trauma, 10 in emergency medicine, 27 general practitioners, one neurosurgeon, and two specializing in anaesthesia and intensive care.

A professional nurse is part of the team in 46 bases; the base in Valle d'Aosta does not have any. The total number of nurses is 839 [mean = 17 (SD 11.37); median = 18].

A mountain rescue technician is present in 26 bases, considered SAR bases (service in unfriendly terrain); 21 bases are HEMS bases (service in friendly terrain).

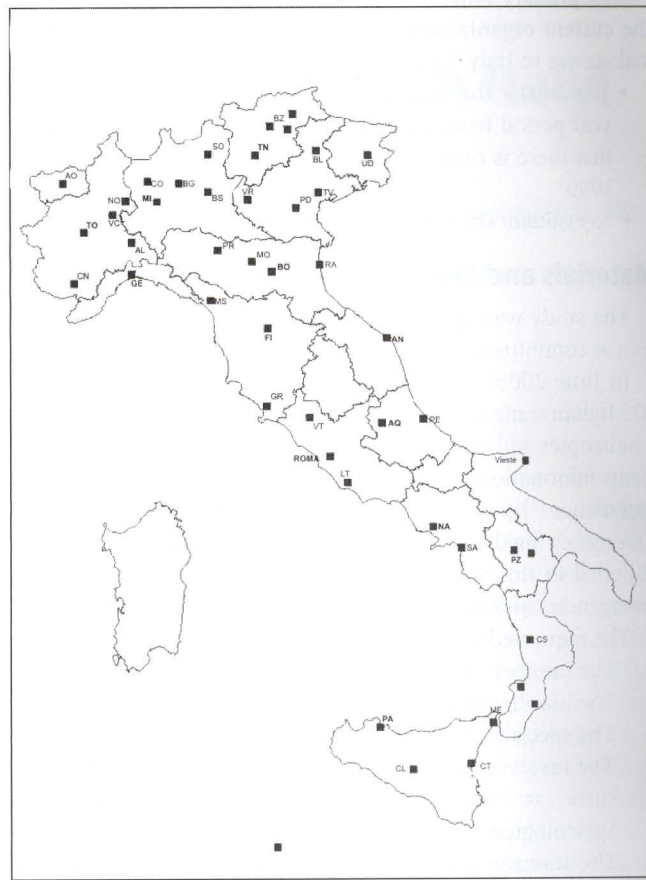
The training is level 1 in 21 bases, level 2 in 17 bases, and level 3 in 9 bases. Technical training (operations in unfriendly terrain, use of the rescue winch, embarkation and disembarkation in hovering) is part of the training in 37 bases.

The HEMS base that has the most thorough training is Aosta (Valle d'Aosta), consisting of 2 days in June with maneuvers in the mountains on ice and rock faces, winching,

Figure 1. Illustration of 118 stations in Italy.



Figure 2. Illustration of helicopter-ambulance bases in Italy.



and barycentric hook, one day in July of abseiling in the low valley, one day in autumn of rock climbing, one day in winter of exercise on an iced waterfall, and finally one day of simulation on avalanches with a probe and shovel. Training in 27 bases is available to external physicians and nurses.

The helicopter used is a BK 117 in 14 bases, an Agusta A109 in 16 bases, an Agusta Bell 412 in nine bases, a Dauphin SA365N3 in three bases, an EC135 in three bases, and an AB139 in two bases. Because of the geography of the Alps and the Apennines, in those bases the most popular helicopters are the AB412 and the BK117C1. A spare helicopter is available in 45 bases, used as an emergency backup (only bases in Caltanissetta and Cosenza do not have spare helicopters). The base of Aosta has two helicopters ready for departure, although one is used mainly for minor services such as secondary transfers. As the spare helicopter, 16 bases use an Agusta 412, 17 bases a BK 117, 10 bases an Agusta A109, and one base a Dauphin SA365N3. In the Palermo (Sicily) base, the type of helicopter varies according to the contractor's availability. In the 28 SAR bases, the most popular helicopters are the AB412 and the BK117.

Helicopters in 28 bases have a rescue winch. The location of those helicopters is shown in Figure 3. In the base of Catania (Sicily), although the rescue winch is available, it is not used by the medical personnel because of the lack of a license. Conversely, 27 bases train their medical personnel in its use.

Eight bases operate 24 hours per day (Fig. 4), and 26 have a platform certified for nocturnal flights.

During 2004, there were 20,660 primary interventions in the whole of Italy and 7,790 secondary interventions. In 1999, there were 13,896 primary interventions and 5,124 secondary interventions.¹ In the 5-year period from 1999 to 2004, the increase of activity was 33% for primary interventions and 35% for secondary interventions. A comparison between data in 1999 and data in 2004 for each region is shown in Figures 5 and 6. The total number of primary and secondary interventions from 1999 to 2004 is illustrated in Figure 7. Figure 8 illustrates the types of primary interventions in 2004. The secondary interventions in 2004 were all interhospital transfers. The types of interventions in 1999 are not available to compare data. Five bases (Lampedusa, Palermo, Rome, Latin, and Viterbo) were not able to distinguish between primary and secondary interventions according to ailment, because of a lack of computerized data system. One base (Pavullo-Modena) classifies interventions according to degree of emergency and not according to ailment.

Discussion

The effectiveness of helicopter ambulances has been recently discussed by other authors.² Many studies show how improved outcomes are possible for major trauma and cardiac patients if transported by helicopter ambulances.^{3,4} Thomas⁵ has reviewed helicopter medical emergency trans-

Figure 3. Illustration of helicopter-ambulance bases equipped with rescue winch.



Figure 4. Illustration of bases that provide 24-hour service.



port for trauma and nontrauma patients from 2000 to 2003. This analysis shows a positive cost-effectiveness. The benefit of helicopter ambulances is undoubted in unfriendly terrain (SAR), where the helicopter is the only transportation, which allows overcoming the geographic difficulties.

However, it is widely agreed that helicopter ambulance service alone is not enough to maximize the good outcome of patients. Reinhardt⁶ believes that to maximize the results, a common European system should be organized, with the objective of integrating and coordinating everything from primary emergency care to primary transport, intensive therapy, terrestrial ambulances, and helicopter ambulances. He emphasizes that to reach this target it is vital to take into account the skills of technicians and medical personnel of each state member, but also to share common basic principles.⁶ Reinhardt seems to take for granted that each European State has a homogeneous sociocultural background. Lubin et al⁷ also hope for optimization of service, and they stress the need for precise guidelines. As Lubin et al dealt with trauma patients, they underlined numerous problems concerning the helicopter ambulance service, including the difficulty of performing an optimal triage and therefore transporting the patient to the most suitable trauma center.⁷ Even the most technologically advanced countries need to organize the helicopter emergency medical system more thoroughly. The current study aimed to

evaluate the degree of organization of the Italian helicopter ambulance service, which has hitherto not been done. This study shows a completely heterogeneous organization of the service nationally, with a great disparity in team members and training level. Some regions (Molise, Umbria, and Sardinia), although inhabited by 4.8% of the population (Italian Statistical Institute data 2005), are still not equipped with helicopter ambulances.

Not all member states of the European Union recognize specialization in emergency medicine, causing contrasting opinions as to which specialty should be in the helicopter ambulance. Langhelle et al⁸ did a very interesting study on the matter, evaluating the HEMS organization in Nordic countries. In four of the five countries studied (Norway, Sweden, Denmark, and Finland) the role falls to intensivists (a subspecialty of anesthesiology). In Iceland, doctors specialized in emergency medicine are part of the team because this specialty exists. The role played by anesthesiologists in prehospital emergency care in the Nordic countries is restated by Lippert and Soreide.⁹

From the results of the current study, one may deduce that in Italy as well the anesthesiologist is considered the expert member of the Advanced Life Support (ALS) team in helicopter ambulances. Although intensive care is core to the anesthesiology postgraduate curriculum, there is a lack of

Figure 5. Comparison of regional primary interventions between 1999 and 2004.

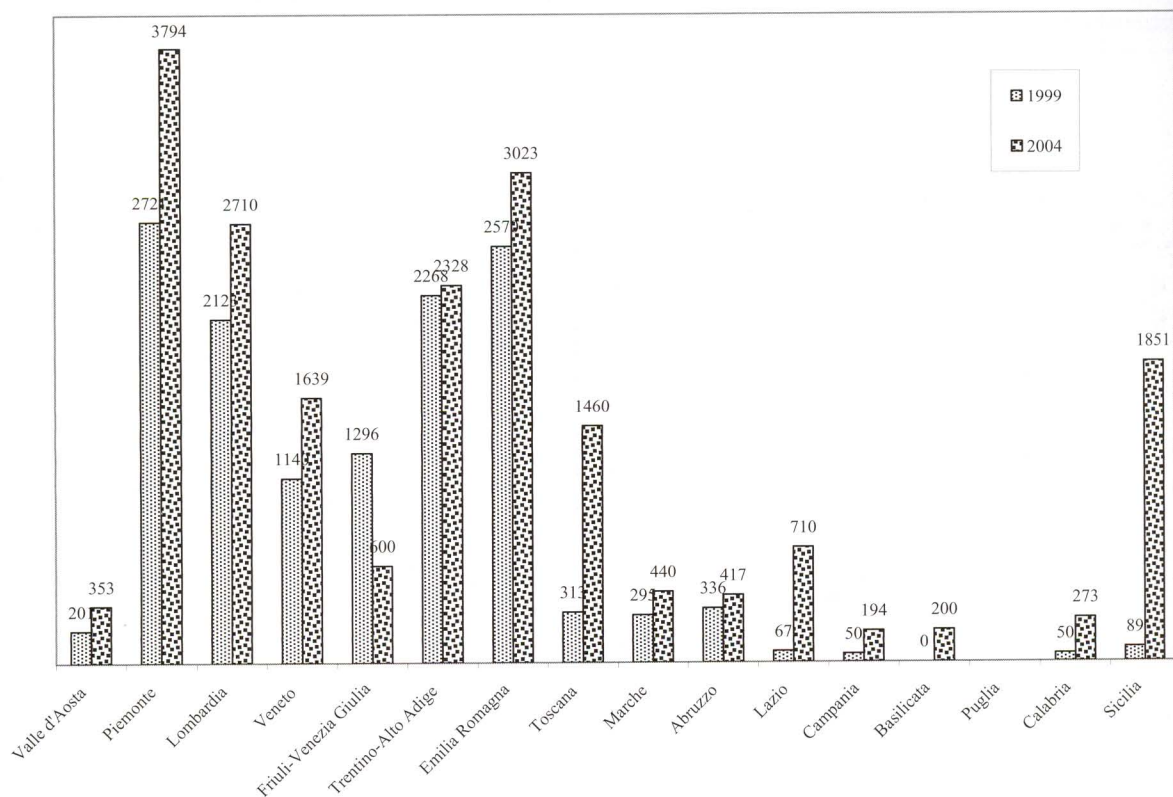
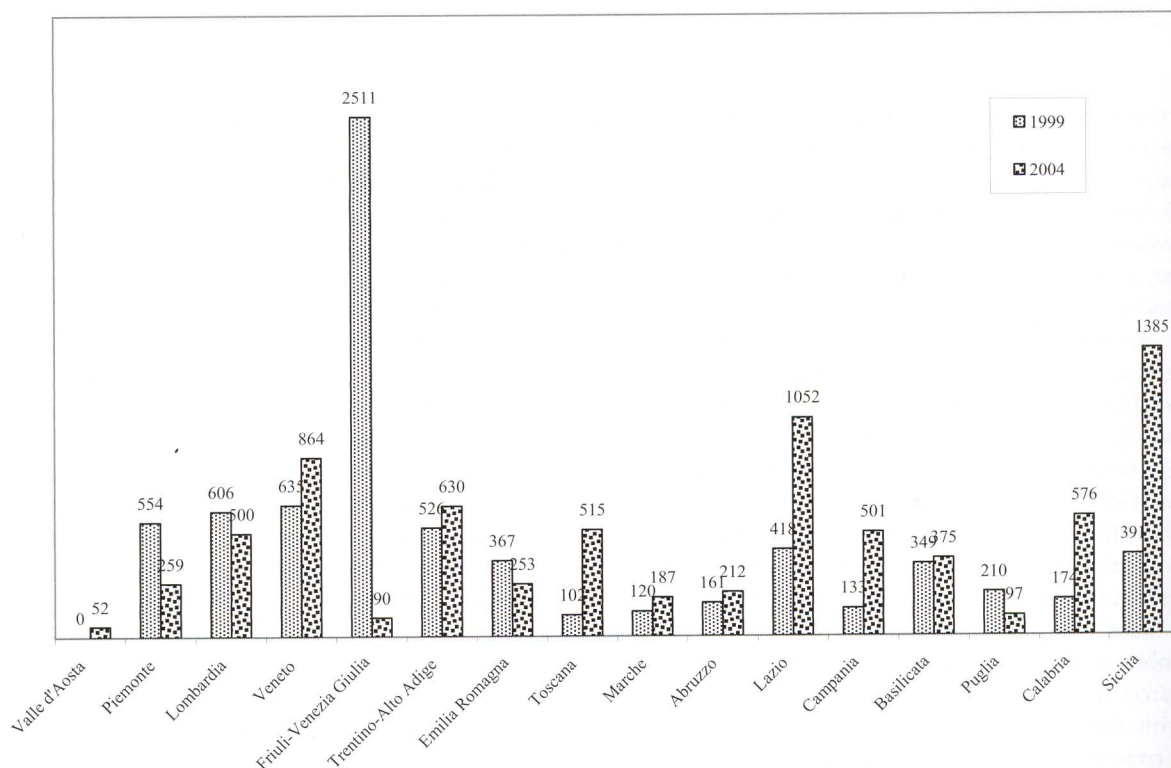


Figure 6. Comparison of regional secondary interventions between 1999 and 2004.

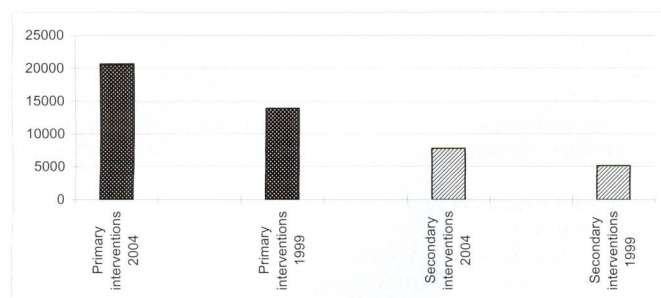


exposure to emergency training outside hospital and in unfriendly terrain.

In 2006, new national guidelines stressed the need for formal training for medical personnel in helicopter ambu-

lances. The curriculum should be of international standard to create uniform training for the personnel. It should consist of a theoretical module and a practical one, alternating with each other. Exercises should include exposure to

Figure 7. Comparison of number of interventions between 1999 and 2004.



mountainous (Alpine) and aquatic environments. It is very important to test the personnel in each phase of the training. Those guidelines, however, are simply an agreement between the government and regions; therefore, they have no legal value, creating a discrepancy among how each region applies them. From 2007, a specialization in emergency medicine should be available in Italy. Internal medicine is the specialty used as a reference point according to Italian law (G.U. May 26, 2006). However, it is believed that such a field does not fulfill the needs for a civilian emergency service, considering that specialists in internal medicine perform only 20 endotracheal intubations during the 5-year training.

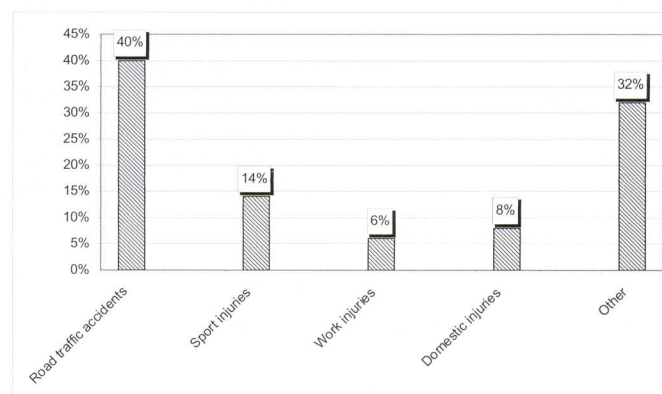
In the current study, the professional nurse plays a non-specific role. Currently no law states whether a professional nurse has to be part of the team in the helicopter ambulance. Therefore, some bases do not employ professional nurses (Valle D'Aosta); in those cases, however, appropriately trained technicians (CNSAS) take their place.

The number of the physicians working in the Italian bases varies from a minimum of four (Matera) to a maximum of 48 (Catania). There are not set rules; however, it is believed that the members of the team should work in the helicopter at least twice a month to improve their skills and so as not to lose confidence when operating in an unfriendly terrain, or in a confined environment such as the ambulance. They would not be normally at risk of losing clinical acumen because all members of the helicopter ambulance team would be generally working in a hospital setting.

Some regions are planning to replace the anesthetist (who works in the intensive care unit and operating theater when not on call for the helicopter ambulance base) with a physician specialized in emergency medicine, who would work for the base 38 hours per week. This is debatable. Considering the small number of interventions each base does per year, this would quickly result in a lack of experience for the medical personnel, consequently leading to the need for continuous training and enormous additional costs. Burillo-Putze et al.¹⁰ share this view. In a study similar to ours, done in Spain in 1999, they underline the advantages of members not being exclusively employed in the HEMS. These include better professional growth and less chance of burnout.

According to Lossius et al.,¹¹ the better results achieved by the helicopter ambulance service compared with the

Figure 8. Classification of primary interventions done in 2004.



land-based service is mostly attributable to more competent and professional personnel. In Italy, frequently, it is because anesthetists are part of the team.¹¹

According to this study, the number of interventions done nationally justifies a helicopter ambulance service and explains the increase in interventions in the 5-year period 1999 to 2004. In the literature, the only foreign data available that can be compared with our study are from Spain. In Spain there are 29 helicopters for 40 million people; in 1998, 4,870 patients were transported in total (primary and secondary interventions); and finally, there is very inconsistent organization.¹⁰

In comparison with these data, the situation in Italy seems comforting. However, there are still national areas not covered by the service; therefore, people living in those areas are not guaranteed the same standard of care.

A correlation exists between helicopter type and geography of intervention area (in mountainous areas, AB 412 and BK117 are the preferred helicopters); on the contrary, there appears to be no correlation between having a spare helicopter available and the number of interventions performed.

Few studies exist on the organization of the helicopter emergency system in Europe, and those few are not sufficiently detailed. In a study done in Finland, Martikainen¹² underlines some crucial points: the vital necessity of helicopter ambulance service in geographically unfriendly countries; the need for devoted medical services, considering that police helicopters do not guarantee a timely intervention because they are used for services other than medical emergency; the urgency of increasing the number of helicopters; and finally the necessity to locate the helicopter bases close to a teaching hospital (hospitals with a high reputation.) Therefore, they emphasized the importance of optimizing each link of the emergency chain.¹²

In Sardinia and Liguria, fire brigade helicopters are used for medical emergencies; fire brigade helicopters being used for fire emergency are not available for other medical emergencies. In Spain, a similar problem exists, as mentioned previously.

In summary, the helicopter medical emergency system has become an important resource for the Italian National Health System. However, as this study shows, there is still space for a big improvement. The system so far has failed to achieve its potential because of the non-uniform training

offered, scattered clinical management, poor planning according to background sociocultural necessity, and lack of international guidelines shared among other European states. Considering the huge costs of the helicopter ambulance bases, it is undoubted that a mediocre standard of service has been achieved at a high price. A better collaboration between the National Health System, universities, and the government would be sufficient to achieve better results with less expenditure. Apart from human lives saved, an efficient emergency system will reduce the indirect social costs of disability and inappropriate patient transfers.

It is hoped that this study will contribute to a standardization of helicopter emergency medical service in Italy and in Europe, and will motivate improvements. This study may serve as a useful reference for future authors. We hope that other European countries will perform and publish similar studies.

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