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Emergency medical service system in the Nordic countries

ABSTRACT:

Emergency medicine service (EMS) systems in the five Nordic countries have more similarities than differences. One similarity is the involvement of anaesthesiologists as prehospital physicians and their strong participation in the care of all critically ill and injured patients in-hospital. Discrepancies do exist, however, especially within the ground and air ambulance service, and the EMS systems face several challenges. Main problems and challenges emphasized by the authors are: 1. Denmark: The dispatch centres are presently not under medical control and are without a national criteria based system. Access to on-line medical advice of a physician is not available; 2. Finland: The autonomy of the individual municipalities and their responsibility to cover for primary and specialised health care, as well as EMS, and the lack of supporting or demanding legislation regarding EMS; 3. Iceland is the only country that has emergency medicine (EM) as a recognised speciality but there is a need for more fully trained specialists in EM; 4. Norway: The ordinary ground ambulance is pointed out as the weakest link in the EM chain and a new health reform demands extensive cooperation between the new health enterprises to re-establish a nationwide air ambulance service; 5. Sweden: To create evidence based medicine standards for treatment in emergency medicine, a better integration of all parts of the 'chain of survival' and a formal education in EM as well as a nation wide physician staffed helicopter EMS (HEMS) cover.

Key words: Emergency medical services, emergency treatment, advanced life support (ALS), ambulance, trauma, triage.



Introduction

The Nordic countries encompass Scandinavia (Denmark, Norway, Sweden) together with Iceland and Finland. This region shares some common geographical, climatic and historical phenomenon making it natural to give a united account of the Emergency Medical Service (EMS) system. The EMS system in this area has gone through major changes the last few years and has common features, but also major differences. The EMS system for some Nordic cities and counties has been described previously (1-5) but a mutual national description has not been

given before. We give a collective update of the EMS system in the five Nordic countries.

Background

Denmark

This description of Denmark does not include the Faroe Islands and Greenland, though part of the Kingdom of Denmark, are self-governing overseas administrative units.

Denmark has 5.4 million inhabitants (2003) (Table 1). 18.7% of the population are from 0-14 years old, and 15% of 65 years or more. Birth rate is 1174 pr 1000 population. Life expectancy is 79.7 years for female and 74.3 years for male. Population growth rate is 0.29% (6).

Denmark is a small (43.093 km²) and flat country, which consists of one main land and two main islands. The capital Copenhagen is located on the biggest island, which is connected to the rest of the country and to Sweden by bridges. The average temperature is 20°C during summer and minus 2.9°C during winter.

The total population density is 123 per km². Denmark is divided in 14 administrative counties and two boroughs. However, 1.2 million people are leaving in the capital and its suburbs.

Table 1. Demographic data, level of physicians involved in the EMS system and number of hospitals with emergency departments

	Denmark	Finland	Iceland	Norway	Sweden
Inhabitants (mill)	5.4	5.3	.288	4.5	8.9
Land area (km ²)	43 093	337 000	103 000	385 155	486 661
Main category of physicians in EMS	Anaesthesiologist	Anaesthesiologist	Emergency medicine	Anaesthesiologist	Anaesthesiologist
National standard or curriculum for EMS physicians	No	No ¹	Yes	No	No
Emergency medicine as recognised speciality	No	No	Yes	No	No
Hospitals with Emergency Department, N	55	25	2	45	67

¹ Special competence program available

A special administrative body, the Copenhagen Hospital Corporation, covers the municipalities of Copenhagen and Frederiksberg.

The health care services are divided into two sectors: the primary health care and the hospital sector. The general practitioners (GPs) provide essential primary care and act as gatekeepers referring patients, if appropriate, to hospital or specialist treatment. In case of immediate need of hospital treatment a referral from a GP is not required. In Denmark the vast majority of health services are free of charge for the users. Public expenditures constituted 82% of the total expenditure on health care in 1999. The total public and private health care expenditure was 8.4% of the gross national product in 1999.

The Danish health care sector has three political and administrative levels: the State, the counties and the municipalities, (i.e. national, regional and local levels). The 14 counties are responsible for the hospitals including EMS and the private sector. The counties have wide-ranging powers to organize the health services for their citizens, according to regional wishes and needs. The task of the National Board of Health on behalf of the Ministry of Health is to initiate, coordinate and advise within the frame of the national health policy (7).

Finland

Finland is covering an area of 337 000 km² with a population of 5.3 million (Table 1). The population density is thus 17 per km². The cold winter season may last from October to April during which the average temperature is below zero (°C) in Middle and Northern Finland.

Half of the population lives in the south, whereas the middle and especially northern parts of the country are rural. In larger

cities, the fire brigade is the usual EMS provider, whereas private entrepreneurs are most frequent in rural areas.

The country is divided in some 450 administratively independent municipalities, each responsible for providing basic health care and emergency medical services for their citizens. The municipalities may contract with the local fire brigade or a private entrepreneur for these services. Health care including EMS is publicly funded, and a nominal fee is charged for a visit to the health centre or for ambulance transport.

Iceland

Iceland has 288.000 inhabitants (Table 1) with 180.000 living in the capital and suburbs. Iceland is 103.000 km² with practically no forest and 77% of the country has no vegetation. Ten percent of the country is covered with glaciers. Almost all of the population lives close to the shore, with the central highlands being uninhabited and with very difficult access. Population density for all of Iceland is 2.5 per km². The health care system in Iceland is publicly funded, with some out-of-pocket payments. The EMS system in Reykjavik has been previously described (1). As approximately 63% of the nation is living in the Reykjavik area, and the rest of the nation in smaller towns, villages or rural areas, there is a huge difference in the availability of emergency services. Roads can be inaccessible during the winter and in some cases, transport by air is also difficult.

Norway

The Kingdom of Norway includes the mainland (323 758 km²) (Table 1) together with the archipelago Svalbard and the lonely island Jan Mayen in the northern part of the Atlantic Ocean. Norway's 4.5 million inhabitants live in a total land area of 385 155 km², thus, the population density is 14 per

km², making it one of the most sparsely populated countries in Europe. Norway has common frontiers with Sweden, Finland and Russia. The shortest north-south extension is 1752 km, and it is situated at the same latitude as Alaska, Greenland and Siberia.

The climate is influenced by conditions from the cold north and the warm Gulf Stream in the eastern Atlantic and Barents Sea, the latter making the coast almost entire ice-free. Average temperature during the summer is about 15°C. In the winter there are subzero temperatures and snow from November to March. In the northern part of the mainland it is total darkness a couple of months mid-winter.

A long coastline (25000 km including fjords), and the fact that a large part of the country is mountainous and covered with glaciers, creates a potential for difficult rescue and patient transports in hazardous geographic areas. It has been a matter of national policy to maintain a decentralized settlement pattern in the country, but in spite of this, 16% of the population lives in and around the capital Oslo, where the population density has reached 1144 per km² (8).

Each year Norway spends approx 6.2 billion Euros on hospitals, making it the Nordic country with the highest level of public spending on the health service per capita (9). The most important feature of the Norwegian health care system is the predominance of tax-financed public provision. It is a universal, tax-based system and public expenditure consists of more than 80% of the total health expenditure. In addition, all residents are insured under the National Insurance Scheme. Accordingly, voluntary insurance has a markedly residual role, while out-of-pocket payments are small (about 10% of total public expenditure), so as to guarantee equity of access.

Norway has almost only public hospitals, 5 regional and 80 county hospitals. Approx 13 000 running beds are available in the somatic sector (3 per 1000 population) and currently 3.8 physicians under 67 years of age per 1000 citizens. This is the clearly highest physician's density among the Nordic countries and within the Organisation for Economic Co-operation and Development (OECD) only Italy, Spain and Greece have a clearly higher physician's density. There are 540 certified anaesthesiologists (0.12 per 1000 citizens) (10).

Table 2. Number of health care services in different regions in Sweden

County	ED and ICU 24 h	ED 24 h	Public Health Centre	GP 24 h
Blekinge	NA	NA	NA	NA
Dalarna	2	2	25	2
Gotland	1	0	8	1
Gävleborg	1	0	16	0
Halland	2	0	44	1
Jämtland	1	0	25	4
Jönköping	3	0	38	0
Kalmar	3	0	30	3
Kronoberg	2	0	26	0
Norrbottn	5	0	32	7
Skåne	9	0	92	0
Stockholm	7	0	180	0
Sörmland	3	0	21	0
Uppsala	1	1	30	0
Värmland	3	0	35	1
Västerbotten	3	0	31	5
Västernorrland	3	1	39	1
Västmanland	1	3	37	0
Västra Götaland	11	1	100	7
Total	67	8	940	39
Örebro	3	0	28	4
Östergötland	3	0	43	3

ED: Emergency Department; ICU: Intensive Care Unit; GP: General Practitioner; NA: Not available. Adopted from Swedish National Board of Health and Welfare, 2002

Norway is divided into 19 counties, with a population ranging from 76,000 – 500,000 inhabitants. By Jan 1st 2002, responsibility for the hospital was transferred from the counties to central government – as part of the government's objective of modernizing the public sector. Five regional health enterprises have been established, which in turn have organised the hospitals under around 50 hospital trusts. The regional health enterprises have statutory responsibility for ensuring the provision of health service to inhabitants in their geographical area (9). Except for patients transported directly from the scene by an ambulance, only patients referred by a GP on-call, or another physician, can be hospitalised. The in-hospital emergency services are notified by the referring doctor, the ambulance service, the dispatch centre, or the triage nurse in the emergency departments (EDs) of the hospitals.

Sweden

Sweden has a population of 8.9 million people (Table 1). The southern part is mainly flatland with a good road network

while forests and vast mountain areas dominate the middle and northern parts. Weather conditions during the winter half year, commonly presents substantial access problems for road EMS services. Helicopter EMS (HEMS) operations are also often restricted during this time for the same reasons. During the winter half year, the hours of daylight are few and in the northern areas barely becomes more than a bleak dawn which also puts navigational and performance constraints on road and air EMS.

Apart from the bigger city areas in the southern and central parts of the country, the population is dispersed over vast areas with long response and transfer times for EMS units. The population density is only 22 per km², which makes provision of EMS services cumbersome in rural parts of the country.

The full responsibility and funding for the health service lies with the government which provide the medical services through county operated hospitals and EMS services. Twenty-four hour full medical service is provided by 92 hospitals out of which nine are region hospitals located in densely populated areas. These hospitals have a service area of about 300 000 to 500 000 people and are university affiliated. Special units for burns are located at four regional hospitals and an extra corporal membrane oxygenation (ECMO) service is provided at one centre. All regional hospitals have level one trauma care capability but due to long transfer distances, trauma care is also provided in the 58 larger county hospitals. About 1/3 of the county hospitals service a population of less than 60 000 people and have difficulty maintaining an appropriate case load to maintain full emergency services (11).

Various operators run the county EMS services. Thus, both private ambulance companies and local fire departments run EMS services on an entrepreneur basis (Table 3). Most EMS operations are carried out by ground facilities and only the Gothenburg, Stockholm, parts of the northern mountain region and part of the Baltic area around Gotland and Stockholm are covered by HEMS facilities. A special intensive care unit (ICU) HEMS facility at Uppsala University Hospital is dedicated for inter hospital ICU and ECMO referrals. The armed forces participate to a small extent in search and rescue (SAR) operations and carry mainly trained to basic life support (BLS) level.

Apart from the southern and central parts of the country, the transfer distances to level one trauma and emergency facilities can be very long and sometimes require secondary patient transfers between EMS facilities to cover the distance and not leave the response area uncovered for long periods. The population is concentrated in the central and southern regions which is also where most of the medical level-one facilities are located. Because of this there is regular demand for transfers from distant locations.

Table 3. EMS operators in different regions in Sweden

County	County	Fire Department	Private Company
Blekinge	X		
Dalarna	X		
Gotland		X	
Gävleborg	X		
Halland	X		
Jämtland	X		
Jönköping	X		
Kalmar	X	X	X
Kronoberg	X		
Norrbottn	X		X
Skåne		X	X
Stockholm		X	X
Sörmland	X		
Uppsala	X		
Värmland	X	X	
Västerbotten	X		X
Västernorrland	X		X
Västmanland	X		
Västra Götaland	X	X	X
Örebro	X		
Östergötland			X

Adopted from Swedish National Board of Health and Welfare, 2002



Prehospital care

Denmark

The national emergency phone number is 112 used for access to all emergency services including EMS, rescue, fire and police. Denmark has 9 dispatch centres. The dispatch is operated by the police outside the capital and by EMS in Copenhagen. Personnel at the dispatch centre are either police or dispatch operators with a locally defined education. There is no national criteria based dispatch system in use. EMS personnel can be divided into ambulance personnel, nurses and physicians. The ambulance personnel are educated according

Table 4. The ground ambulance service

	Denmark	Finland	Iceland	Norway	Sweden
Dispatch centres, N	9	27 ¹	2	44 ²	20
Emergency phone number	112	112	112	113	112
Operating ground ambulances, N	500	350	75	547	630
Ambulance boats, N	None	70	9	37	90
Assignments per 1000 inhabitants per year, N	101	98	77	101	101
One-manned ambulances (%)	None	None	None	7	None
Gross expense (mill Euro per year)	NA	NA	5	160	200

NA = data not available

¹ By the end of 2006, the number of dispatch centres will be 13

² As by late 1990s. A dramatic reduction in the number of dispatch centres is ongoing. By 2005 probably only 50% will be left.

Table 5. The air ambulance service

	Denmark	Finland	Iceland	Norway	Sweden
National/regional	National	Regional	National	National	Regional
Ambulance helicopter bases, N	None	4 ²	1 ⁴	11	7
SAR helicopter bases, N	3	3	1 ⁴	5	4
Fixed wing aircraft bases, N	1 ¹	2 ³	2	6	5
Gross expense, mill Euro per year	NA	NA	4	35	NA

NA = data not available

¹ Military

² Two purely medical, two multipurpose

³ Private companies in Helsinki, perform any kind of flights. No dedicated ambulance fixed wing

⁴ Combined helicopter service for ambulance and SAR

to a national standard and curriculum for EMS divided into three well defined levels: basic, intermediate and advanced. The competence of the ambulance personnel does not include tracheal intubation (12).

Half of the population is covered by a two-tired response dispatch according to resources needed, i.e. a physician-manned vehicle can be sent to the scene as a rendezvous-system.

Physicians involved in well-established organisations are predominantly anaesthesiologists. In some rural areas the GP have established a local on-call support for emergencies. No national curriculum or standards are available for nurses or physicians in prehospital care.

All ambulances should by year 2008 be manned with at least one person capable of providing advanced life support. In general only EMS transport by ground is available. However the SAR helicopter run by the military defence is available for evacuation from the islands or interhospital transfers in special cases.

The county provides policies for admittance to hospitals. Usually ambulances go to the closest ED. However in the regions with physician manned ambulances the physician decides on an appropriate hospital. Four regions have trauma centres and bypass policies operate in three.

Minimum response time and other indicators are not set nationally but by the responsible county as part of a contract with ambulance service providers. In Copenhagen the average response time is less than five minutes (13).

Automatic external defibrillators (AED) can be used by laypeople though no national program for public use has yet been implemented. However, the Danish Resuscitation Council encourages the implementation of AED programs including training in basic life support by laypersons. A national registry for out-of hospital cardiac arrest was established in 2001 and data is being collected for all out of hospital cardiac arrests in Denmark.

In each county a medical director should according to a new law be appointed as being responsible for prehospital care and emergency medicine within each region. This responsibility includes medical responsibility of the dispatch and the EMS in general. The two major ambulance services (one private firm Falck Denmark in the majority of the country and Copenhagen Fire brigade in Copenhagen city) have additional medical directors for the EMS within their area of responsibility.

Finland

The national emergency phone number 112 connects the caller to the local dispatch centre. Currently, there are 27 centres responsible for dispatching EMS and fire services, while the

police have centres of their own. By the end of 2006, the number of dispatch centres will be 13, covered by the same number 112 and responsible for dispatching EMS, fire and police without diversion of calls to different dispatchers or centres. A national criteria based dispatch system is in use. Dispatchers use a tiered response with AED equipped fire engines acting as first responding units when closest.

The basic ambulance level mainly employs fire fighters educated at the national Emergency Services College. They have a 1.5-year education, a third of which is related to EMS. The advanced level employs nurses and paramedics with a four-year training.

A decree on EMS defines a basic and an advanced level without describing specific aims or competence, and there are no requirements for, e.g., response or access times.

Basic level skills include the use of an AED, orotracheal intubation of a lifeless patient, and vascular access. No parenteral drugs are in use. The advanced level also uses intravenous drugs. There are full time physicians in a few EMSs. Ground transport by EMTs or paramedics is the rule. A physician manned ground vehicle is used in the city of Helsinki (1) and four helicopter based physician manned systems in the south, south western and middle parts of the country. In cities, response times for basic units average 5–7 minutes. Advanced life support (ALS) response times vary between 10–15 minutes. Emergency medicine is not a recognised speciality, and more than 90% of the EMS physicians are anaesthesiologists or residents in anaesthesiology. The physician-manned units act as second or third tier but respond to primary scene missions in more than 95% of their calls. The calls are not restricted to e.g., trauma. Great variations exist in the level of prehospital care, due to municipality independence.

Iceland

All emergency services in Iceland are accessed via a centralized dispatch number, 112.

In all of Iceland, ca. 10.000 volunteers are available at all times for SAR missions. Iceland has no army, so large volunteer forces are necessary in the scarcely populated country.

Emergency Medical Technicians (EMT) both of basic (EMT-B) and intermediate (EMT-I) level are trained in Iceland in accordance with the curriculum of the National Registry of Emergency Medical Technicians in the USA (1,14). To date, 13 paramedics (EMT-P) trained in National Registry curriculum in Pittsburgh, USA are working in Iceland. One is working in Akureyri, Iceland's second largest town, the others in Reykjavik.

In Reykjavik, an ambulance with residents or specialists trained for working in the prehospital setting is always available. In rural areas, the local GP is responsible for medical services on

scene, with their training for that task being quite variable. Over the past 10 years a significant number of all physicians have completed a course in advanced resuscitation, and a somewhat smaller number also done a course in prehospital trauma care. A 3-day course in prehospital emergency medicine has recently started which covers the most important aspects of the equipment, scene safety, resuscitation, trauma evaluation and care, paediatrics and obstetrics. Three days is not a long time for such a comprehensive course, but it has turned out to be a realistic goal to get GPs and other physicians interested in prehospital emergency medicine to attend.

Nurses are not routinely working in the prehospital setting in Iceland, but they do participate in the work of the disaster teams of the hospitals. Patients are transported in ambulances in Reykjavik area and other towns. Most transport of patients from the rural areas further than 300-400 km from Reykjavik is via helicopters run by the coast guard or airplanes. The physicians of the helicopter service are all affiliated with the ED in Reykjavik, but medical transport via airplanes is organized from Akureyri in the northern part of Iceland with all flight doctors having received special training.

After a fatal accident with the cost of two lives during a bypass in Reykjavik in 1987 bypass policies were made stricter. The dispatch centre categorizes ambulance runs as to whether bypass is needed. Recently all of their standing orders were reviewed and in many cases the need for bypass driving was downgraded.

The ambulance response time for cardiac arrests in Reykjavik area is just less than 5 min. In the same area there is one ambulance manned permanently with a physician trained for working in the pre-hospital setting. The physician treats the most serious cases on scene, and is a backup for all EMT personnel in Reykjavik and in the suburbs via radio. The physician on call also supervises the dispatch centre by online medical advice and by review of all major incidences, such as cardiac arrests and major trauma. A medical director of EMS is now being appointed in Reykjavik, who will be responsible for issuing standing orders for EMTs. In all other areas in Iceland GPs are responsible for the EMS system and work on scene with the EMTs.

Data has been collected on out-of-hospital cardiac arrest in Reykjavik area since 1982, in recent years in accordance with the Utstein template (15-17). In the last published review 31% of patients survived to hospital admission and 17% survived to discharge (18), but in the last few years these numbers seem to be increasing (HMB unpublished data). No data has been collected on in-hospital cardiac arrest or out-of-hospital cardiac arrest outside Reykjavik.

In Reykjavik all ambulances are staffed with EMT-I or EMT-P. Some other areas have EMT-I as part of their team but most towns and villages rely on EMT-B only working with the local GP.

Norway

Registered nurses coordinate the overall pre-hospital EMS response using a criteria-based dispatch system (19). One toll free phone number (113) is used to access the EMS system through one of the emergency medical communication centres (EMC). More than forty EMCs are located nationwide, but a 50% reduction is expected in the near future.

GPs and ground ambulances are the backbone of the pre-hospital system. The ground ambulances are owned and operated, on behalf of the five regional health enterprises, by private and public bodies like hospitals, fire brigades, limited companies, private persons, and voluntary organisations – for example the Red Cross.

The use of the ambulance service has steadily increased in the last 5 years. During 2002 for the first time there were more than 100 calls per 1000 inhabitant. (20). The number of operating ground ambulances and ambulance boats in 2002 was 547 and 37 respectively. The latter carry out approx 1600 calls per year. On average each ground ambulance has 830 assignments per year, driving 60 km on each call (20). Six percent of the ground ambulances and 60% of the ambulance boats are one-manned operated. The gross expenses of this service were 160 million Euros in 2001 (21).

There have been large discrepancies throughout the country in terms of formal training, staffing, and coverage of the ground ambulance system. Until now the ambulance service has not been subject to government guidelines or regulations. No demands exist re. education, competence, readiness, response time or medical standard. Nevertheless, all the regional authorities make certain professional minimum demands of their employees. The requirements are most extensive in the larger services, which may teach their staff to “paramedic”-level. In smaller services, the requirements are more basic, for instance according to a model issued in an Official Norwegian Report by 1976 (22), consisting of 120 h emergency medicine, 70 h rescue technique, 3 weeks hospital duty and 80 h driving lessons in ambulance. This 3-month minimum education requirement is today regarded as insufficient for professional ambulance personnel. By the mid 1990s, 10% of the ambulance personnel had still not fulfilled this minimum goal.

Basically, there are two levels of ambulance personnel; those with basic training and those trained and certified to defibrillate, insert peripheral IV lines, give adrenaline in cardiac arrest and perform endotracheal intubation in victims of cardiac and/or respiratory arrest. Individual ambulance personnel are given delegated authority from the local medical director. Recently, prehospital life support certification has become available on a national level.

By 2001 ambulance training consisted of two years theory and two years practical training with a company after which

certification of completed apprenticeship and authorisation to practice as health personnel is achieved.

The GP on-call is community based and it is not required to have any formal emergency medical training or certification to work in this system. Hence, the level of care varies between individual doctors. The GP on-call is a casualty doctor working 24-hour in the public, local Emergency Clinic, but may also make house calls and responds to the scene of an accident or emergency.

The first pre-hospital emergency medical service manned with anaesthesiologists was established in 1953 in response to a dramatic outbreak of respiratory failure in patients suffering from polio (23). In 1967, a mobile intensive care unit (MICU) manned with an anaesthesiologist was started in Oslo (23). Today a specially designed MICU with ECMO capability is available around the clock. This vehicle, with the patient on board may be transported en block within the transport plane (Hercules) run by the Royal Norwegian Air Force.

Air ambulance transports have been carried out in Norway from the 1920's (23), and in 1950 Lind et al published the first scientific report in this regard (23). In 1978, dr. Jens Moe started the first anaesthesiologist manned air ambulance service, the Norwegian Air Ambulance as a private foundation (24) outside Oslo. The idea was adopted from the German and Swiss air ambulance system, Rettungsflugwacht Garde Aérienne (REGA).

In 1988, the government formed a national air ambulance system covering the whole country, using helicopters, airplanes and rapid response cars. The goal is to ensure as far as possible that the whole population enjoys the same access to medical-staffed air ambulances. The National Air Ambulance Service now embraces 11 helicopter bases, six fixed-wing air ambulances bases and five SAR helicopter bases. The helicopters help to fulfil the governmental aim that 90% of the population can be attended by a physician-manned ambulance within 45 min. The Norwegian Air Ambulance (24) is now the largest sub-contractor in the system.

This nation-wide anaesthesiologist-manned pre-hospital EMS, using helicopters and rapid response cars, carry out more than 5000 missions per year. According to an annual report by 2001, 41% of the missions are due to trauma and 27% to cardiovascular disease (25). Typically, 80% of the call-outs concern patients outside hospital. The remaining 20% relate to inter-hospital transfers.

In Norway as in many other western countries, several of the interventions representing ALS are both legally and educationally limited to specially trained physicians. Emergency medicine is not a certified medical speciality, but advanced out-of-hospital emergency medicine is traditionally attached to the speciality of anaesthesiology. Pre-hospital ALS

and pain treatment beyond that provided by the GP on-call is therefore the responsibility of hospital-based anaesthesiologists working part-time in pre-hospital EMS systems.

The Ministry of Health recommends that anaesthesiologists in the service must have a minimum of two years of training (in anaesthesia) and also specifies other practical medical skills and procedures that the air ambulance must be able to provide (26). Currently more than 80% of the physicians are certified specialists in anaesthesiology. However there are no mandatory national medical requirements, formal qualifications or attendance at life support courses (27-29). In contrast, the Ministry of Justice and Ministry of Health has recently issued national standards for rescue paramedics in the HEMS system (30,31).

The air ambulance annual national report in 1998 (32) showed that 17% of the patients received analgesics, 12% vasoactive medication, 12% tracheal intubation, and 9% general anaesthesia. The SAR helicopters in the Royal Norwegian Air Force were established in 1973 and consist of four coastal squadrons. The most northerly base maintains a Sea King helicopter on 24-hour standby, covering 1.3 mill km². Accounting for more than 90% of this area, the Barents Sea contains at any given time up to 10 000 fishing people and seafarers spread over as many as 600 vessels from 15 nations. Air ambulance call-outs in this area cover distances up to 1000 km – with 3200 km as the record – and can last for 24 hours. Due to the wide use of physicians, prehospital use of nurses is almost non-existent in Norway except in fixed wing operations. These nurses are intensive care nurses or nurse anaesthetists. The Norwegian Air Ambulance Foundation is a voluntary organisation dedicated to strengthening the EM chain in Norway. Roughly 800 000 members (close to 20% of the population) allow it to contribute substantial funds to enhance EM responses nationwide. These supporters help to sustain the foundation as a strong player in the development of Norway's health services. Traditionally, most of the organisation's work and financial support has focused on the air ambulance service. A large proportion of its resources are also devoted to strengthening other links in the rescue chain as well as training and research in EM. Funding is provided for a chair and a fellowship in EM as well as various research projects which has resulted in thesis on cardiopulmonary resuscitation (CPR) (33-35) and ALS provided by emergency physicians in the Norwegian EMS system (36). The foundation helps to raise the quality of Norway's EMS above minimum government requirements. Its effort has improved medical standards at a number of helicopter bases. In 2002, the Norwegian Parliament instructed the government to start a first responder defibrillator and training program after which cooperation between the Norwegian Air Ambulance Foundation and the Norwegian Department of Health for implementation of AEDs in the municipalities has started. The project, with a price of more than 2 mill Euros, is funded completely by the members of the Foundation.

No national EM society or independent medical EM specialty exists in Norway, but there are various organizations which address some of the relevant issues – two located in the Norwegian Medical Association: The Norwegian Society for Disaster Medicine and the Committee for prehospital acute medicine. In addition one EM speciality journal, The Scandinavian Journal of Trauma and Emergency Medicine, and two academic chairs in EM are located in Norway.

After recommendations made in an Official Report (37), the Norwegian Competence Center for Emergency Medicine was established along with one regional centre for emergency medical research and development in the southwest region of Norway. These centres are expected to carry out independent research, education, quality specification and development, and advise the government and the regional enterprises on prehospital emergency medical issues. A web-based registry for national uniform reporting of out-of-hospital cardiac arrest according to the Utstein-style has recently been developed.

Sweden

All EMS services are dispatched from 20 dispatch centres with 112 as a common access emergency telephone number. The dispatch centres, are funded by the government but are run as independent companies with a consultant as medical director. These centres also coordinate police and rescue services as well as global medical support and medical counselling. Coordination of SAR operations, major disasters and public medical events are carried out in cooperation with air and sea rescue command centres located in Stockholm and Gothenburg.

The operators at the dispatch centre are not required to have any formal medical training even though it is common for dispatchers to be recruited from the health service. All operators are certified on a yearly basis and have to complete a mandatory training program before the initial certification. For initial triage, a “medical index manual” is used to triage the call and dispatch a response. This manual gives the operator a mandatory questions to ask and depending on the answers the response is given using a fixed algorithm. It has become increasingly common to have nursing staff at the dispatch centres and an EMS doctor is available for triage during office hours. The dispatch centres handles 18 million calls a year of which 900,000 are ambulance missions. About 25,000 of these are priority 1 (11).

The ambulance service operates a national total of 630 ambulances at 250 stations. In addition to this all the main city areas uses several fast response vehicles either stationed at the hospitals or at ambulance stations.

The ambulances have a crew of two. One, usually the driver, is a “paramedic” with 40 weeks training and ALS skills. This training is provided by the county and might differs slightly between regions. The second crewmember is, in 50% of all EMS vehicles a qualified nurse specialized in ambulance and

emergency medicine. In 5 years there is a target for 100% of EMS vehicles to have this level of competence. Both have a mandatory continual medical education (CME) training of 10 days a year and are re-certificated at regular intervals.

Fast response vehicles are situated mainly in urban areas and in densely populated areas. These are operated either by the county (staffed with a paramedic driver and an anaesthetic nurse) by private companies (usually staffed with an anaesthesiologist).

The HEMS services usually operate with a crew of four: two pilots, one anaesthetic nurse and one anaesthesiologist or with one pilot replaced by an HEMS crew member. A medical doctor, usually an anaesthesiologist, supervises all EMS services. In the urban regions medical directory board of several physicians and health care administrators supervises the EMS services.

The target is for 80% of the population should be reached by an EMS vehicle within 8 min and 95% within 15 minutes. Currently, this standard is met in urban and densely populated areas where the response times are down to around 5 minutes, while in rural and remote areas difficulties still remains in providing a rapid emergency response.

All ambulance units are now using telemedical equipment for data transfer and online contact with medical staff at the referral centre. Decentralised use of semiautomatic defibrillators by lay personnel is becoming increasingly common.

Doctors are becoming increasingly involved in EMS services, both in the field and in teaching and tutoring for nurses and paramedics in training. Currently a two-year education and certification in ambulance and emergency medicine are available for nurses but a medical subspecialty in emergency medicine for doctors is still absent.

The cost for an ambulance mission in urban areas has been estimated at 110 Euros and twice that in rural areas. The cost for a HEMS mission has been estimated at 3200 Euros.

Emergency departments

Denmark

Denmark has presently 55 hospitals with ED. However the number of hospitals and ED with free access is being reduced. All hospitals with ED have access to surgery, internal medicine and anaesthesiology for emergency cases. EM is not established as a separate medical speciality in Denmark. No national grading of EDs is presently available but four trauma centres with level one facilities are present in Copenhagen, Odense, Aarhus and Aalborg.

Major incident command centre (MICC) is presently being established in each region to coordinate major incidents and disasters.

Emergency cases are usually cared for by an orthopaedic surgeon (surgical cases), internist (medical cases) and an

anaesthesiologist in case of major trauma or life threatening conditions.

In some EDs patients are initially seen and triaged by a nurse – either on a telephone or at the ED. Referrals are arranged by physician-to-physician contact based on local hospital agreements. The National Board of Health gives guidelines for specified groups like burn patients and patients with severe head injury.

Finland

EDs are part of the 20 central and five university hospitals. They are administratively managed either by internal medicine or surgery, and at least these two specialities are represented at the ED 24 h a day. Anaesthesiology services are available in all central and university hospitals 24 h a day, while the anaesthesiologist is on call from home in regional hospitals. The primary on-call physicians are residents in training, backed up by senior specialists on call either in the hospital (university hospital) or at home. No formal trauma team or life support certification exists.

Emergency medicine is not a recognised speciality. The prehospital on-site physician does specialist onward referral directly from the scene after consultation with the receiving hospital specialist. In areas without prehospital physicians, paramedics and EMTs triage patients to hospitals according to local directives.

Iceland

EDs are at the hospital in Reykjavik and Akureyri. In Reykjavik, the ED physicians are responsible for the initial work up of problems due to trauma, neurosurgery, ear-nose-throat, ophthalmology and most problems related to internal medicine. The clinics for other specialities are run by the respective specialities with practically no input from the ED physicians.

Currently there are two doctors who are fully trained in emergency medicine working in Iceland and emergency medicine is a recognized speciality. In the ED, there is growing experience among physicians originally trained in surgery, paediatrics, general practice and other specialities in working in the field of emergency medicine.

Nurses in the Emergency Room (ER) do a triage evaluation of all patients admitted to the ER. They mostly take care of ECGs, drawing blood samples, urinary catheters, bandages and casts, but a physician is responsible for all patients treated in the ER.

Due to the small size of the country, a full program is not available in emergency medicine training in Iceland. A 2-year program in surgery and internal medicine, and a full program in general practice can be completed in Iceland.

Specialists are in all areas generally easy to contact, either by calling them directly or their resident.

Norway

Norway has approximately 40 hospitals with 24 h emergency readiness. There has been no national system for in-hospital organisation of EDs. Emergency medicine is not a recognised speciality. Residents and consultants from speciality departments cover the ED. The capability of the receiving hospital depends on the speciality departments available in each individual hospital, and the qualifications of the medical doctors on call. Only five hospitals can deliver definitive care to multi-trauma patients. The anaesthesiologist plays an important role (38), both as a key member of the various emergency medical teams securing the vital functions of the patients, and as the co-ordinator for further treatment in the operating room and/or the intensive care unit. Outstanding Norwegian anaesthesiologists have contributed to the scientific foundation of this important medical speciality (38). There is no national system for in-hospital organisation of trauma care and trauma surgery is not a sub-speciality. General surgeons, sub-specialised surgeons and orthopaedic surgeons co-operate in the treatment of trauma patients.

Sweden

In the teaching hospitals dedicated doctors, usually organised within a separate unit, staff the ED. Here, both surgeons and physicians work in one organisation but the division between internal medicine, surgery and orthopaedics etc still remains and the patients are separated to short term wards with some high dependency capacity. Emergency surgery is taken care of by the regular surgical departments or in some cases by the ED surgeon. The hospital emergency response teams take care of medical emergencies like CPR, trauma and patients in need for intensive care. These teams are organised by the anaesthesia department and work in cooperation with the ED staff in the ER.

In local and non-teaching hospitals the ED services are usually run by the different specialities themselves and are divided into medical, surgical and in some cases paediatric emergency wards. Junior doctors mostly perform the work in the ED with supervision from doctors at consultant level.

There is an ambition to centralise trauma care to larger units, usually regional teaching hospitals. However, due to long transportation times and the lack of a rapid referral system many patients remain at the admitting hospital for long times and have to be treated locally.

Although more of the ER service is becoming organised into proper EDs with dedicated doctors, apart from life support programs, there is still no formalised training in emergency medicine leading to certification as a specialist in emergency medicine. As for the prehospital services, doctors only

participate in the HEMS / fast response organisation and as supervisors for ground EMS.

Most transfer of patients is done by ground vehicles. HEMS can in certain circumstances or areas carry out ICU transfers. Examples include referral for ECMO treatment or to regional burn centres.

Challenges and future perspectives

Denmark

The dispatch centre is the key to control of EMS and use of resources. The dispatch centres are presently not under medical control, and are without a national criteria based system. Access to on-line medical advice of a physician is not available.

Documentation of skills, competence and experiences is crucial to further progress and development. A differentiated medical response should be defined nationally and an integration of the care provided from prehospital care to hospital needs attention.

Indicators for good practise and documentation are crucial and accreditation of EMS is being developed. Defining a curriculum for emergency physicians in prehospital care is important for further quality improvement and so is formal training and certification.

Reorganising ED including defining responsibilities and grading of ED according to resources available is a challenge. The Danish system is well-organized and highly developed with anaesthesiologists as emergency physicians and prehospital care providers as an important advanced medical response in most parts of Denmark.

Finland

For general health care, a problem is the independence of the individual municipalities in the provision of primary and specialised health care, as well as EMS, and the lack of supporting national legislation regarding EMS.

The possible role of emergency medicine as a speciality needs to be addressed particularly in the light of increased specialisation in surgical and medical specialities. The role of prehospital emergency care is growing because of the closure of smaller hospitals out-of-office hours, thus increasing transport times from the scene to definitive care. An evolution of national standards for the level and funding of prehospital care is needed, and an integration of prehospital physicians into the ED should be evaluated.

Iceland

There is a need for more fully trained specialists in emergency medicine. To reach that goal, the ER doctors will probably be made responsible for initial diagnosis and treatment of most presenting problems. Further training of both EMTs

and physicians in working in prehospital medicine is clearly a future task.

In rural areas, not all ambulance personal have completed EMT-B training. Highest priority should be, and is currently, given to train all ambulance personal. Also, development of a quality control system and training review is in progress. Clinical guidelines or standing orders for EMTs have not yet been issued for Iceland but are needed.

In Reykjavik, one of the principal advantages of the EMS is the day and night availability of doctors trained for working in the pre-hospital setting. The doctors have a critical input in the care of patients and have contributed strongly to a high rate of successful resuscitations in the area. With the introduction of fully trained paramedics to the EMS, and the growth in number of dispatches, the work of the physician has changed, so that less time is spent on direct treatment of patients and more on supervision and guidance. Direct online access to a physician, trained in working in the prehospital setting, is also extremely valuable to the services of the dispatch centre. If they encounter a problem that they are not certain of how to deal with, they can always consult the physician.

A review of all major or difficult cases, cardiac arrests and major trauma is carried out on a regular basis with the physician immediately after the run has been completed. This has turned out to be very useful, both in improving the quality of care, learning from mistakes, and to enable the staff to debrief after a difficult case. Doing all reviews on duty, and not at a scheduled point later, also makes it very easy to bring together all of the team that handled the case, the dispatcher, EMT and the physician.

Since every doctor can be required to be able to function in an emergency setting, whether on call or as a bystander, it is very important in Iceland to teach medical students the basics of dealing with emergencies outside the hospital. All medical students spend approx 30 hours of their training on call with a physician in the ambulance in Reykjavik, during which they get to experience a medical emergency of some kind. Such training of medical students would be difficult, or at least not as efficient if not in the hands of a physician.

The training of EMTs is now well established in Iceland and the quality of care is good, even though there are regional variations. Both the training and quality of care have rapidly and steadily improved during the last 20 years.

The worst feature of the prehospital system in Iceland is the lack of standing orders for EMTs. This is partly compensated for in the Reykjavik area by having physicians on for 24 hours, but standing orders would increase standardisation and probably lead to better quality of care. In rural areas where supervision of EMTs by physician can be somewhat less, standing orders are even more important.

The training of GPs need to be upgraded, the ideal situation being all of them having completed full courses in trauma-, cardiac- and paediatric life support. The revalidation system should also be improved, both for the EMTs and the physicians.

The Icelandic Resuscitation council is currently issuing guidelines on the availability and use of AEDs. Although training in their use will be recommended, it will only be required for professional rescuers.

Norway

Similar to other countries the Norwegian EMS system has been challenged by cost-effectiveness and cost-containment issues. In 1998, two governmental reports on these issues have been published (26,37). It is expected that a centralisation of the hospital structure will be undertaken. However, concerns against the move towards fewer hospitals with 24 h coverage for advanced emergency medical services have been raised. The hot issue at the moment is the right for people in rural areas to have the same access to hospital emergency care as those living in urban areas.

At present, the GP on-call system is also criticised for being too ambitious and exhausting for the physicians involved. Most likely the number of GP on-call systems will be reduced, despite lack of physicians in primary health care in rural parts where 15-25% of the positions are vacant. Due to political and geographical reasons, the extensive Norwegian air medical system will probably not be changed much in the future. However, safety and cost-containment issues will force the system to reorganise. Effect and efficiency of ALS by specially trained physicians in emergency medical teams, like the air medical system, has recently been studied and evaluated (36). In the future, to minimise differences in care given there will be increased focus on formal training, certification and re-certification for all those involved in prehospital EMS, doctors and ambulance officers alike. At present, it is unlikely that emergency medicine will become a speciality in Norway.

The ordinary land- or boat ambulance has been highlighted as the weakest link in the EM chain. Within this service quality and capacity are suboptimal because manning is unsatisfactory and the organisation and directives are unclear.

Proposed solutions are to make two-crew ambulances – of which at least one shall be certified. Ambulance- and dispatch centres working in a common organisation with the same professional management and aims including improved response times would address some of the problems. Currently the aim is that 90% of the population shall be attended within 12 min in the cities and 25 min in rural areas. The cooperation between the ambulance service and the local physicians should be formalised by establishing multiprofessional emergency teams in every region.

With respect to the air ambulance service the division of labour between the regional health enterprises and central authorities is unclear. Experiences after a year with new arrangements show that it is extremely demanding to follow up this service, especially the aviation part. Administration of contracts, implementation of new procurement processes etc, require competence and resources far beyond what is available at the regional health level currently. At the same time, central authorities claim that the regional health enterprises should coordinate their activities and that the service shall appear as a national and equal service. Thus, one of the tasks for the new health enterprise is to re-establish a nationwide air ambulance service, which demands extensive cooperation between the five boards. In the near future, a suggested solution is to organise the flight operation activities in a general partnership, an inter-regional coordination overseeing the whole service (except the medical part).

Sweden

The demands and costs for emergency and intensive care are constantly increasing as new techniques and equipment calls for a higher degree of medical competence and skill. With the advent of new techniques such as prehospital thrombolysis and therapeutic hypothermia as well as an increasing diversity of other therapeutic options there is a need for early triage to direct patients to the appropriate medical facilities and for a higher degree of medical expertise early in the chain of survival. Both in- and pre hospital trauma care needs firm implementation of life support standards as well as dedicated doctors for education and clinical management of the emergency service (39). To meet with the demands of cost efficiency and high quality care there is a need for formalisation of training and certification of ER staff (40,41). There is also, an increasing demand for pre-hospital doctors to triage and treat early in to achieve good standards of care.

Today, shortness of staff and lack of standards for education and treatment protocols put constraints on the emergency service. As only a few hospitals have dedicated doctors running emergency departments there are marked geographical variations in standards of care. Transfer times are still too long in rural parts of the country and the prehospital part of the chain of survival is not fully integrated with hospital procedures.

Priority tasks are to create evidence based medicine standards for emergency medical treatment, a better integration of all parts of the chain of survival and a formalised training programme in emergency medicine as well as nationwide HEMS cover (42).

Summary

The Nordic EMS systems have more similarities than differences. One similarity is the involvement of anaesthesiologists as prehospital physicians (43). Discrepancies do exist, however, especially within the ground and air ambulance service, and the EMS systems face several challenges. At the moment, Iceland is the only country that has EM as a recognised

speciality. Various forums have been established to exchange ideas and cooperate within the Nordic countries such as the Nordic Trauma Forum, Scandinavian Resuscitation Council, the Scandinavian Society for Disaster Medicine, and the Northern Hypothermia Network. These bodies arrange meetings and congresses on a regular basis, and may also be a suitable forum to discuss some of the common problems and future challenges within the Nordic EMS systems.

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