

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/8622386>

# International EMS Systems: The Nordic countries

Article in *Resuscitation* · May 2004

DOI: 10.1016/j.resuscitation.2003.12.008 · Source: PubMed

CITATIONS

136

READS

766

7 authors, including:



**Hans Morten Lossius**

Norsk Luftambulanse

123 PUBLICATIONS 2,820 CITATIONS

[SEE PROFILE](#)



**Tom Silfvast**

Helsinki University Central Hospital

95 PUBLICATIONS 2,674 CITATIONS

[SEE PROFILE](#)



**Freddy Lippert**

Emergency Medical Services, Copenhagen University of Copenhagen Denmark

297 PUBLICATIONS 5,708 CITATIONS

[SEE PROFILE](#)



**Anders Ersson**

Region Skåne

33 PUBLICATIONS 805 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



European Emergency Data Project [View project](#)



Out-of-hospital cardiac arrest in psychiatric patients [View project](#)



## International EMS Systems: the Nordic countries

Audun Langhelle<sup>a,\*</sup>, Hans Morten Lossius<sup>b</sup>, Tom Silfvast<sup>c,d</sup>, Hjalti Már Björnsson<sup>e</sup>,  
Freddy K. Lippert<sup>f</sup>, Anders Ersson<sup>g</sup>, Eldar Søreide<sup>h</sup>

<sup>a</sup> Norwegian Air Ambulance, Box 27, Høvik, N-1322, Norway

<sup>b</sup> Regional Centre for Emergency Medical Research and Development Stavanger, Norway

<sup>c</sup> Department of Anaesthesiology and Intensive Care Medicine, Helsinki University Hospital, Helsinki, Finland

<sup>d</sup> Helsinki Area Helicopter Emergency Medical Service, Helsinki, Finland

<sup>e</sup> Department of Accident and Emergency Medicine, Landspítali-University Hospital, Reykjavík, Iceland

<sup>f</sup> Copenhagen Hospital Corporation, Head Office, and Trauma Centre, Department of Anaesthesiology, Rigshospitalet, Copenhagen University Hospital, Copenhagen, Denmark

<sup>g</sup> Intensive Care Unit, University Hospital of Malmö, Sweden

<sup>h</sup> Intensive Care Unit, Division of Acute Care Medicine, Rogaland Central Hospital, Stavanger, and University of Bergen, Norway

Received 1 December 2003; accepted 12 December 2003

### Abstract

Emergency medicine service (EMS) systems in the five Nordic countries have more similarities than differences. One similarity is the involvement of anaesthesiologists as pre-hospital physicians and their strong participation for 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 the EMS, and the lack of supporting or demanding legislation regarding the 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 health reform demands extensive co-operation between the new health enterprises to re-establish a nation-wide air ambulance service; (5) Sweden: to create evidence based medicine standards for treatment in emergency medicine, a better integration of all part of the chain of survival, a formalised education in EM and a nation wide physician staffed helicopter EMS (HEMS) cover.

© 2004 Elsevier Ireland Ltd. All rights reserved.

**Keywords:** Emergency medical services; Emergency treatment; Advanced life support (ALS); Ambulance; Trauma; Triage

### Resumo

Os Serviços de Emergência Médica (EMS) nos cinco países Nórdicos têm mais semelhanças que diferenças. Uma das semelhanças é o envolvimento de Anestesiologistas como médicos pré-hospitalares e a sua forte participação em todas as situações de doentes críticos e traumatizados no hospital. No entanto, existem discrepâncias, principalmente com os serviços de ambulâncias terrestres e aéreas e, os sistemas de EMS enfrentam vários desafios. Os principais problemas e desafios enfatizados pelos autores são: (1) Dinamarca: os centros de coordenação actualmente não estão sob controlo médico não têm um sistema de critérios nacional. O acesso a conselho médico on-line não está disponível; (2) Finlândia: a autonomia individual dos municípios e a sua responsabilidade para cobrir os cuidados de saúde primários e especializados, bem como o EMS e a sua falta de apoio ou exigência de legislação em relação ao EMS; (3) A Islândia é o único país que tem a Medicina de Emergência (EM) como especialidade reconhecida, mas existe a necessidade de mais especialistas treinados em EM; (4) Noruega: o serviço normal de ambulâncias terrestres é apontado como o elo mais fraco na cadeia da EM e uma reforma da saúde exige uma cooperação extensa entre as novas empresas da área da saúde para restabelecer um serviço nacional de ambulâncias aéreas; (5) Suécia: para criar padrões médicos baseados na evidência para tratamento em medicina de emergência, é necessária melhor integração de todas as partes da cadeia de sobrevivência, uma formação formal em EM e uma cobertura nacional de serviço de helicópteros com pessoal médico.

© 2004 Elsevier Ireland Ltd. All rights reserved.

**Palavras chave:** Serviços médicos de emergência; Tratamento de emergência; Suporte de vida avançado (ALS); Ambulância; Trauma; Triagem

\* Corresponding author. Tel.: +47-67592752; fax: +47-67592758.

E-mail address: audun.langhelle@snla.no (A. Langhelle).

## Resumen

Los Servicios de emergencias médicas (EMS) en 5 países nórdicos tienen mas semejanzas que diferencias. Una semejanza es que involucran médicos anestesiólogos como médicos prehospitales y su fuerte participación para todos los pacientes críticamente enfermos o lesionados en el intrahospitalario. Sin embargo existen discrepancias, especialmente en el servicio de ambulancias de terreno y aire, y los sistemas de EMS enfrentan varios desafíos. Los principales problemas y desafíos enfatizados por el autor son: (1) Dinamarca: los centros de despacho en este momento no están bajo control médico y no tienen un sistema basado en un criterio nacional. El acceso a consejo médico en línea no está disponible; (2) Finlandia: Autonomía de las municipalidades individuales y su responsabilidad para dar cobertura de cuidados médicos primarios y especializados, al igual que los EMS, y la falta de legislación de apoyo o demanda con respecto a los EMS; (3) Islandia es el único país que tiene medicina de emergencia(EM) como una especialidad reconocida pero existe una necesidad de especialistas mas completamente entrenados en EM; (4) Noruega: la ambulancia terrestre está enfocada como el eslabón mas débil en la cadena de EM y la reforma de salud demanda una cooperación extensa entre las nuevas empresas de salud para reestablecer un servicio de ambulancias aéreas a lo largo de la nación; (5) Suecia: crear estándares médicos basados en evidencia para tratamiento en medicina de emergencia, una mejor integración de todas las partes de la cadena de sobrevida, una educación formalizada en EM y cobertura nacional de EMS con helicópteros con médico a bordo. © 2004 Elsevier Ireland Ltd. All rights reserved.

**Palabras clave:** Servicios de emergencias médicas; Tratamiento de emergencia; Soporte vital avanzado (SVA); Ambulancia; Trauma; Triage

## 1. Introduction

The Nordic countries encompass Scandinavia (Denmark, Norway, Sweden) together with Iceland and Finland. This region shares some common geographical, climatic and historical phenomena making it natural to give a united account of the Emergency Medical Service (EMS) system. The EMS system in this region has gone through major changes during the last few years and has common features, but also obvious diversities. 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.

## 2. Background

### 2.1. Denmark

This description of Denmark does not include the Faroe Islands and Greenland, which, 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 to 14 years old, and 15% of 65 years or more. Birth rate is 11.74 per 1000 population. Life expectancy is 79.7 years for females and 74.3 years for males. Population growth rate is 0.29% [6].

Denmark is a small (43,093 km<sup>2</sup>) and flat country, which consists of one part contiguous with the continent of Europe 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 km<sup>2</sup>. Denmark is divided into 14 administrative counties and two boroughs. However, 1.2 million people live in the capital and its suburbs. A special administrative authority, the Copenhagen Hospital Corporation, covers the municipalities of Copenhagen and Frederiksberg.

The health care services are divided into two sectors: primary health care and the hospital sector. The general practitioners (GPs) provide essential primary care and act as gatekeepers referring patients as appropriate for 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 funds contributed 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).

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	0.288	4.5	8.9
Land area (km <sup>2</sup> )	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 <sup>a</sup>	Yes	No	No
Emergency medicine as recognised speciality	No	No	Yes	No	No
Hospitals with emergency department, <i>N</i>	55	25	2	45	67

<sup>a</sup> Special competence program available.

The 14 counties are responsible for the hospitals including the 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, co-ordinate and advise within the framework of the national health policy [7].

## 2.2. Finland

Finland covers an area of 337,000 km<sup>2</sup> with a population of 5.3 million (Table 1). The population density is thus 17 per km<sup>2</sup>. The cold winter season may last from October to April during which period 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 into 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 the EMS, is publicly funded, and a nominal fee is charged for a visit to the health centre or for ambulance transport.

## 2.3. Iceland

Iceland has 288,000 inhabitants (Table 1) with 180,000 living in the capital and suburbs. Six percent of the inhabitants of Iceland are of foreign origin.

Iceland is 103,000 km<sup>2</sup> 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 km<sup>2</sup>.

The health care system in Iceland is publicly funded, with some out-of-pocket payments. The EMS system in Reykjavik has been thoroughly described previously [1].

As approximately 63% of the population lives in the Reykjavik area, and the rest 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 several cases, transport via air is also impossible.

## 2.4. Norway

The Kingdom of Norway includes the mainland (323,758 km<sup>2</sup>) (Table 1) together with the Svalbard archipelago 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 km<sup>2</sup>, thus, the population

density is 14 per km<sup>2</sup>, making it one of the most sparsely populated countries in Europe.

Norway has common frontiers with Sweden, Finland and Russia. The shortest north–south dimension 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 Barent 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 there is total darkness for a couple of months in mid-winter.

A long coastline (25,000 km including fjords), and the fact that a large part of the country is mountainous and covered with glaciers, creates difficulties for rescue and patient transport 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 km<sup>2</sup> [8].

Each year Norway spends NOK 50 billion (approximately 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 constitutes more than 80% of the total health expenditure. In addition, all residents are insured under the National Insurance Scheme. Accordingly, voluntary insurance has a very residual role, while out-of-pocket payments are small (about 10% of total public expenditure), so as to guarantee equity of access.

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

Norway is divided into 19 counties, with a population ranging from 76,000 to 500,000 inhabitants. From 1 January 2002, responsibility for hospitals 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 into 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 admitted to hospital. 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.

## 2.5. 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 reason. During the winter half year, the hours of daylight are few especially in the northern part, where daylight is more of a bleak dawn. This puts navigational and performance constraints on both the 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 km<sup>2</sup>, 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 regional hospitals located in densely populated areas. These hospitals have a service area of about 300,000–500,000 people and are university affiliated. Special units for burns are located at four regional hospitals and 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, qualified trauma care is also provided in the 58 bigger county hospitals. About 1/3 of the county hospitals have a service area of less than 60,000 people and thus have difficulties with obtaining an appropriate case load to maintain full emergency services [11] (Table 2).

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 only to a small extent in search and rescue (SAR) operations which carry mainly medical crews equipped 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 patient transits between different EMS facilities to cover the distance and to ensure that the response area is not left uncovered for

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
Örebro	3	0	28	4
Östergötland	3	0	43	3
Total	67	8	940	39

ED: emergency department; ICU: intensive care unit; GP: general practitioner; NA: not available. Adopted from Swedish National Board of Health and Welfare (2002).

long periods. The population is concentrated in the central and southern parts where also most of the medical level-one facilities are located. Because of this there is a high demand for referral transfers from distant locations and local hospitals.

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).



Table 4  
The ground ambulance service

	Denmark	Finland	Iceland	Norway	Sweden
Dispatch centres, <i>N</i>	9	27 <sup>a</sup>	2	44 <sup>b</sup>	20
Emergency phone number	112	112	112	113	112
Operating ground ambulances, <i>N</i>	500	350	75	547	630
Ambulance boats, <i>N</i>	None	70	9	37	90
Assignments per 1000 inhabitants per year, <i>N</i>	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.

<sup>a</sup> By the end of 2006, the number of dispatch centres will be 13.

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

### 3. Pre-hospital care (Tables 4 and 5)

#### 3.1. Denmark

The national emergency phone number 112 is used for access to all emergency services including EMS, rescue, fire and police. Denmark has nine dispatch centres (Table 4). The dispatch is operated by the police outside the capital and by the 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 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-tiered response dispatch according to resources needed, i.e., a physician-manned vehicle can be sent to the scene using 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 in pre-hospital care are available for nurses or physicians.

By the year 2008 all ambulances should be manned with at least one person capable of providing advanced life support.

In general EMS transport by ground only is available. However the SAR helicopter run by the military defence service is available for evacuation from the islands or inter-hospital transfers in special cases (Table 5).

The county gives policies for admittance to hospitals. Usually ambulances go to the closest ED. However, in the regions with physician manned ambulances the physician makes the decision. In the four regions with trauma centres patients are taken directly to the trauma centre in three of these if appropriate.

The minimum response time and other indicators are not set nationally but by the responsible county as part of a contract with the providers of the ambulance services. In Copenhagen city the average response time is less than five minutes [13].

Automatic external defibrillators (AED) can be used by laypersons and is not regulated by law. No national programme for public use of AED has been implemented yet. However, the Danish Resuscitation Council encourages the implementation of AED programmes including training in basic life support of laypersons. A national registry for out-of-hospital cardiac arrest has been 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 pre-hospital care and emergency medicine within each region. This responsibility includes medical responsibility for the dispatch and the EMS in general. The two major ambulance services (one private firm Falck Denmark in the majority of the coun-

Table 5  
The air ambulance service

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

NA: data not available.

<sup>a</sup> Two purely medical, two multipurpose.

<sup>b</sup> Combined helicopter service for ambulance and SAR.

<sup>c</sup> Military.

<sup>d</sup> Private companies in Helsinki, perform any kind of flights. No dedicated ambulance fixed wing.

try and Copenhagen Fire Brigade in Copenhagen city) have additional medical directors for the EMS within their area of responsibility.

### 3.2. 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 (Table 4). 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 4-year high school training.

A decree on EMS defines a basic and an advanced level without describing specific aims or competence, and there are no requirements for 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 at that level. 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 (Table 5).

In cities, response times for basic units average 5–7 min. Advanced life support (ALS) response times vary between 10 and 15 min.

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 and respond to primary scene missions in more than 95% of their calls. The calls are not restricted to trauma.

Great variations exist in the level of pre-hospital care, due to independence of each municipality.

### 3.3. Iceland

All emergency services in Iceland are accessed via a centralized dispatch number, 112 (Table 4).

Around 10,000 volunteers are available at all times for SAR missions throughout the country. Iceland has no army, so large volunteer forces are necessary in the sparsely populated country.

Emergency Medical Technicians (EMT) both at 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 work in the pre-hospital setting is always available. In rural areas, the local GP is responsible for medical services at the scene, with their training for that task being quite variable. Over the past 10 years a significant proportion of all physicians have completed a course in advanced resuscitation, and a somewhat smaller number have also done a course in pre-hospital trauma care. A 3-day course in pre-hospital 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 encourage GPs and other physicians interested in pre-hospital emergency medicine to attend for 3 days.

Nurses do not work routinely in the pre-hospital setting in Iceland, but they do participate in the work of the disaster teams of the hospitals.

Patients are transported in ground 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 by fixed wing aircraft (Table 5). The physicians in the helicopter service are all affiliated with the ED in Reykjavik, but medical transport via fixed wing aircraft is organized from Akureyri in the northern part of Iceland with all flight doctors having received special training.

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

The average time from a call answered in our dispatch center until an ambulance arrives on site is just less than 5 min in cardiac arrests in Reykjavik area.

In the Reykjavik area there is one ambulance manned permanently with a physician trained for work in the pre-hospital setting. This 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 an online medical advice and by review of all serious incidents, such as cardiac arrests and major trauma.

A medical director of the EMS is now being appointed in Reykjavik, which 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 the Reykjavik area 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, who work with the local GP.

### 3.4. Norway

Registered nurses co-ordinate 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 nation-wide, but a 50% reduction is expected in the near future (Table 4).

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 instance, the Red Cross.

The use of the ambulance service is increasing steadily over the last 5 years. During 2002 for the first time more than 100 assignments per 1000 inhabitants were carried out [20]. The number of operative ground ambulances and ambulance boats in 2002 was 547 and 37, respectively. The latter carry out approximately 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-man operated. The overall expense of this service was 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, this ambulance service has not been the object for government guidelines or regulations. No requirements exist in relation to education, competence, readiness, response times or medical standards. Nevertheless, all the regional authorities make certain professional minimum demands to their employees. The requirements are more extensive in the larger services, which may teach their staff to “paramedic”-level. In smaller services, the requirements are more basic, and may, for instance, according to a model issued in an Official Norwegian Report by 1976 [22], consist of 120 h emergency medicine, 70 h rescue technique, 3 weeks hospital duty and 80 h driving lessons in an ambulance. This 3-month minimum education requirement is regarded today 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 tracheal intubation in victims of cardiac and/or respiratory arrest. The individual ambulance personnel are given delegated authority from the local medical director. Recently, pre-hospital life support certification has become available on a national level.

By 2001, ambulance work became an optional subject in the upper secondary school and consist of 2 years theory and 2 years practical training after which the students may be given a certificate of completed apprenticeship and authorisation as health personnel according to the new health personnel law—similar to nurses and physicians—and which gives them the opportunity to operate more independently.

The GP on-call is community based and is not required to have any formal emergency medical training or certification to work in this system. Hence, the level of care will vary with the individual doctor. The GP on-call is a casualty doctor working 24-h in the public, local emergency clinic, but may also make house calls and respond to the scene of an accident or emergency.

The first pre-hospital emergency medical service manned with anaesthesiologists was established in 1953, based on a dramatic case of respiratory distress in a patient 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 bloc within the transport plane (Hercules) run by the Royal Norwegian Air Force.

Air ambulance transports have been carried out in Norway from the 1920s [23], and in 1950 Lind et al. published the first scientific report on this subject [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 (Table 5) covering the whole country, using helicopters, fixed wing aircraft 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 government goal that 90% of the population can be attended by 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 the annual report of 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 anaesthesiologists in the service must have a minimum of 2 years of training in anaesthesia according to recommendations in an Official Norwegian Report from the Ministry of Health, that determines the actual, practical medical skills and procedures that the air ambulance must be able to provide [26]. At present, more than 80% of the physicians are certified specialists in anaesthesiology. However, no national medical requirements are expressed and formal certifications, like life support courses [27–29] are not mandatory. In contrast, the Ministry of Justice and Ministry of Health has recently issued a national standard for the rescue paramedics in the HEMS system [30,31] including medical competence requirements.

The air ambulance annual national report from 1998 [32] showed that 17% of the patients received analgesics, 12% vasoactive medication, 12% underwent orotracheal intubation, and 9% general anaesthesia.

The SAR helicopters in the Royal Norwegian Air Force were established in 1973, consisting of four squadrons along the coast. The base far north maintains a Sea King helicopter on 24-h standby, covering 1.3 mill km<sup>2</sup>. Accounting for more than 90% of this area, the Barent Sea at any given time contains 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 h.

Due to the wide use of physicians, nurses rarely participate in pre-hospital care in Norway except in the fixed wing air ambulance operations. Nurses in this service are intensive care nurses or nurse anaesthetists.

The Norwegian Air Ambulance Foundation is a voluntary organisation dedicated to strengthening the EM chain in Norway. Its roughly 800,000 members (close to 20% of the population) allow a contribution of substantial funds to enhance EM responses nation-wide. 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 the other links in the rescue chain as well as to training, multidisciplinary courses 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 theses 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 programme after which co-operation 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 million Euros, is funded completely by the members of the Foundation.

No national EM society or independent medical EM speciality exist in Norway, but there are various organizations which take care of some aspects of these issues—two located in the Norwegian Medical Association: The Norwegian Society for Disaster Medicine and the Committee for pre-hospital acute medicine, are both consultative bodies for the parent association. In addition to that, 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 Norwegian Report [37], the Norwegian Competence Center for Emergency Medicine was established recently, 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 pre-hospital 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.

### 3.5. Sweden

All EMS services are dispatched from 20 dispatch centres with 112 as a common emergency phone number (Table 4). The dispatch centres, SOS Alarm centres, are funded by the government but run as an independent company with a consultant as medical director. These centres also co-ordinate police and rescue services as well as global medical support and medical counselling. Co-ordination of SAR operations, major disasters and public medical events are carried out in co-operation 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 or practical medical training even if it is common that dispatchers are recruited from the health service. All operators are certified on a yearly basis and have to complete a mandatory training programme before the initial certification. For initial triage, a “medical index manual” is used to triage the call and dispatch the response. This manual gives the operator a line of mandatory questions to ask

and, depending on the answers, the response is given using a fixed decision algorithm. It has become more common to have nursing staff posted at the dispatch centre and in the main city areas, and an EMS doctor is available for triage during office hours. The dispatch centres handles 18,000,000 calls a year of which 900,000 are ambulance missions. About 25,000 of these are priority 1 ambulance missions [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 a 40 weeks training resulting in ALS skills and competence. This training is provided by the county and might because of this differ slightly between different regions. The second crewmember is, in 50% of all EMS vehicles, a qualified nurse specialized in ambulance and emergency medicine. In another 5 years it is to be required that all EMS vehicles should have this competence. Both paramedics and nurses have mandatory continual medical education (CME) training of 10 days annually 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 and are staffed with a paramedic driver and an anaesthetic nurse or, if run by private companies they are usually staffed with a qualified anaesthesiologist.

The HEMS services (Table 5) usually operate with a four person crew of 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 a medical directory board of several physicians and health care administrators supervises the EMS services.

The general goal is that 80% of the population should be reached by an EMS facility within 8 min of the call and 95% within 15 min. Today, this standard is met in urban and densely populated areas, and within city limits the response time usually are down to about 5 min, while in rural and remote areas difficulties still remain in providing a rapid emergency facility.

All ambulance units now use tele-medical 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 more involved in EMS services, both in the field and also in teaching functions and tutoring for nurses and paramedics in training. Today, a 2-year education and certification in ambulance and emergency medicine is available for nurses but a subspecialty in emergency medicine for doctors is still absent in medical education.

The cost for one ambulance mission in urban areas has been estimated to 110 Euros and twice as much in rural areas. The same cost per mission in the HEMS programmes has been estimated to be 3200 Euros.

## 4. Emergency departments (Table 1)

### 4.1. Denmark

Denmark at present has 55 hospitals with an ED. However the number of hospitals and EDs with free access is being reduced. All hospitals with an 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. Four level one trauma centres are present in Copenhagen, Odense, Aarhus and Aalborg.

A major incident command centre (MICC) is presently being established in each region to co-ordinate major incidents and disasters.

Emergency cases are usually cared for by an orthopaedic surgeon (surgical cases), an internist (medical cases) and an anaesthesiologist in case of major trauma or life threatening conditions.

As a new concept, in some EDs patients are initially seen and triaged by a nurse—either on the telephone or at the ED.

Referrals are arranged by physician-to-physician contact based on local agreements between hospitals. The National Board of Health gives guidelines for specified groups like burn patients and patients with severe head injury. However, the responsibility is within each county.

### 4.2. Finland

EDs are part of the 20 central and five university hospitals. They are 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 at home in regional hospitals. The first line physicians on call 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 pre-hospital on-site physician does specialist referral directly from the scene after consultation with the receiving hospital specialist. In areas without pre-hospital physicians, paramedics and EMTs triage and refer patients to hospitals according to local directives.

### 4.3. Iceland

EDs are at the hospitals 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 clinic for general surgery, paediatric patients, cardiology, nephrology and urology is run by their 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 take care of ECG, drawing blood samples, urinary catheters, bandages and plaster casts, but a physician is responsible for all patients treated in the ER.

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

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

#### 4.4. 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 sub-speciality. Residents and consultants from the various speciality departments cover the ED. The capability of the receiving hospital strongly depends on the speciality departments available in each individual hospital, and the qualifications of the medical doctors on call. Only five hospitals can deliver definite care to multi-trauma patients. The anaesthesiologist plays an important role [38], both as a key member of the emergency medical teams supporting 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 very important medical speciality [38]. There has been no national system for in-hospital organisation of trauma care. Trauma surgery is not a sub-speciality. General surgeons, sub-specialised surgeons and orthopaedic surgeons co-operate in the treatment of trauma patients.

#### 4.5. Sweden

In the teaching hospitals dedicated doctors, usually organised within a separate unit, normally 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 different short time wards, some with the capacity of a high dependency unit. Emergency surgery is taken care of by the 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 co-operation with the ED staff in the ER.

In local and non-teaching hospitals the ED services are usually run by the different specialities and as divided into medical, surgical and in some cases paediatric emergency wards. Junior doctors perform most of the work in the ED with supervision from consultants.

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

Although more of the emergency service has become organised into well equipped EDs with dedicated doctors, apart from the life support courses and programmes, there is still no formalised training in emergency medicine leading to certification as a specialist in emergency medicine. As for the pre-hospital services, doctors only participate in the HEMS/fast response organisation or as supervisors for ground EMS.

Most referral of patients is done by ground vehicles. HEMS can in certain circumstances or areas carry out ICU transfers. Such situations include international referral for ECMO treatment, which is located in Stockholm, or to regional burn centres.

## 5. Challenges and future perspectives

### 5.1. 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 care provided from the pre-hospital phase to hospital treatment needs more attention.

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

Reorganising the ED, including defining responsibilities and grading according to the resources available is a challenge.

The Danish system is well-organized and highly developed with anaesthesiologists as emergency physicians and pre-hospital care providers as an important advanced medical response in the majority of Denmark.

### 5.2. Finland

For general health care, a problem lies in the independence 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.

The role of emergency medicine as a possible speciality needs to be addressed in the light of the present progress of specialisation in surgery and internal medicine. The role of pre-hospital emergency care is growing because of the closing of smaller hospitals during 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 pre-hospital care is needed, and the integration of pre-hospital physicians into the ED should be evaluated.

### 5.3. *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 problems. Further training of both EMTs and physicians in working in pre-hospital medicine is clearly a future task.

In rural areas, not all ambulance personnel have completed EMT-B training. The highest priority is being given to train all ambulance personnel fully. Further organization of a quality control system and a review of training 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 work 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 resuscitation 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 pre-hospital setting, is also extremely valuable to the services of the dispatch centre, as they can always consult the physician if they have a problem that they are not certain how to deal with.

A review of all major cases, cardiac arrests, major trauma or any difficult case is done on 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 and learning from mistakes, and debriefing of staff after a difficult case. Doing all reviews while 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, including the dispatcher, the EMT and the physician.

Since every doctor can be required to be able to function in an emergency, 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 approximately 30 h of their training on call with a physician in the ambulance in Reykjavik, dur-

ing which they all 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 variations can be found between the different parts of the country. Both the training and quality of care have rapidly and steadily improved during the past 20 years.

The worst feature of the pre-hospital system in Iceland is the lack of standing orders for EMTs. This is partly compensated for that in Reykjavik area by having physicians on duty day and night, but standing orders would certainly make things more uniform and probably lead to better quality of care. In rural areas where the supervision of EMTs by physician can be somewhat less, standing orders would be even more important.

The training of GPs need to be upgraded, ideally with all completing full courses in trauma-, cardiac- and paediatric life support. The retraining system should also be improved, both for the EMTs and 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.

### 5.4. *Norway*

As in other countries the Norwegian EMS system has been challenged by cost-effectiveness and cost-containment factors. In 1998, two governmental reports on these issues have been published [26,37]. It is expected that centralisation of the hospital structure will be introduced. However, concerns against the move towards fewer hospitals with 24 h coverage for advanced emergency medical services have been raised. The major issue at the moment is the right for people in rural areas to have equal access to hospital EMS compared to those living in more urban areas.

At present, the GP on-call system is also criticised for being too ambitious and exhausting for the physicians involved. It is 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. The effectiveness 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 pre-hospital EMS, doctors and ambulance officers alike. At present, it is unlikely that emergency medicine will become a speciality of its own in Norway.



The ordinary land- or boat ambulance has been pointed out as the weakest link in the EM chain. Within this service quality and capacity deteriorate because manning is not satisfactory and the organisation and directives are not clear.

Proposed solutions and aims are to make two person crew the ambulances—of which at least one shall be certificated. An ambulance and dispatch centre in a common operating organisation with the same professional management and co-ordinated operative leadership is also mentioned as an improvement, including more strict response intervals. The aim is that 90% of the population shall be reached within 12 min in the cities and 25 min on the country. The co-operation between the ambulance service and local physicians should be formalised by establishing emergency teams among all professionals in every council.

In the air ambulance service the principal management arrangements and the division of labour between the regional health enterprises and central authorities is unclear. Experiences after 1 year with the new arrangement show that it is extremely demanding to follow up this service, especially the aviation part. Administration of contracts, implementation of new procurement processes, etc., take competence and resources far beyond what is available at the regional health level to date. At the same time, central authorities claim that the regional health enterprises should co-ordinate their activities and that the service shall appear as a national and equal service. Thus, one of the tasks for the new health enterprises is to handle and re-establish a nation-wide air ambulance service, demanding extensive co-operation between the five boards—to establish a new platform for this service. In the near future, a suggested solution is to organise the flight operation activities in a separate so-called general partnership, an inter-regional co-ordination, being totally responsible for the whole service, except the medical part. This general partnership will have joint ownership by the five regional health enterprises.

### 5.5. 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 as pre-hospital thrombolysis and therapeutic hypothermia as well as an increasing diversity of therapeutical options there is a need for early triage to direct the patient to the correct medical facility and for a higher degree of medical competence early in the chain of survival. Both the in- and pre-hospital trauma care needs a 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 requirements and certification of ER staff and doctors [40,41]. There is also an increasing demand for doctors in the pre-hospital field as more sophisticated treatment and triage has to be done early in order to

comply with time and cost constraints and good standard of care.

Today, shortage 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 the daily work, marked incongruence exists in the standards of care among different facilities. Transfer times are still too long in rural parts of the country and the pre-hospital part of the chain of survival is not fully integrated with hospital procedures.

Prioritised tasks should be to create evidence based medicine standards for emergency medical treatment, a better integration of all parts of the chain of survival and a formalised education in emergency medicine as well as nation wide HEMS cover [42].

## 6. Summary

The Nordic EMS systems have more similarities than differences. One similarity is the involvement of anaesthesiologists as pre-hospital 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 fora have been established to exchange ideas and co-operation 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 on a regular basis, meetings and congresses, and may also be suitable to discuss some of the common problems and future challenges within the Nordic EMS systems.

## References

- [1] Herlitz J, Bahr J, Fischer M, Kuisma M, Lexow K, Thorgeirsson G. Resuscitation in Europe: a tale of five European regions. *Resuscitation* 1999;41:121–31.
- [2] Sunde K, Eftestøl T, Askenberg C, Steen PA. Quality assesment of defibrillation and advanced life support using data from the medical control module of the defibrillator. *Resuscitation* 1999;41:237–47.
- [3] Weydahl PG, Stoen AM, Jorgensen B, Arnulf V, Steen PA. Utstein registration used as a tool in organisational development. *Resuscitation* 1999;40:103–6.
- [4] Langhelle A, Tyvold SS, Lexow K, Hapnes S, Sunde K, Steen PA. In-hospital factors associated with improved outcome after out-of-hospital cardiac arrest. A comparison between four regions in Norway. *Resuscitation* 2003;56:247–63.
- [5] Skogvoll E, Sangolt GK, Isern E, Gisvold SE. Out-of-hospital cardiopulmonary resuscitation: a population-based Norwegian study of incidence and survival. *Eur J Emerg Med* 1999;6:323–30.
- [6] Statistics Denmark. [www.dst.dk](http://www.dst.dk). Last update: 31-3-2003. Access date: 29-10-2003.
- [7] National Board of Health. [www.sst.dk](http://www.sst.dk). Last update: 10-10-2003. Access date: 29-10-2003.



- [8] The European Observatory on Health Care Systems. Health Care Systems in Transition. Norway: <http://www.euro.who.int/document/e68950.pdf>. Last update: 2000. Access date: 27-10-2003.
- [9] Ministry of Health. The Norwegian Hospital Reform—Central government assumes responsibility for hospitals: <http://www.odin.dep.no/shd/sykehusreformen/aktuelt/rapport/030071-990126/index-dok000-b-n-a.html>. Last update: 2001. Access date: 26-10-2003.
- [10] The Norwegian Medical Association. Statistics and Research on physicians in Norway in English: <http://www.legeforeningen.no/index.db2?id=8449>. Last update: 14-10-2003. Access date: 26-10-2003.
- [11] SOS Alarm. Annual Report 2002: [www.sosalarm.se/organization/files/pdf/arsredovisn2002.pdf](http://www.sosalarm.se/organization/files/pdf/arsredovisn2002.pdf). Last update: 2003. Access date: 31-10-2003.
- [12] Christensen EF, Hoyer CC. Pre-hospital tracheal intubation in severely injured patients: a Danish observational study. *BMJ* 2003;327:533–4.
- [13] Rewers M, Tilgreen RE, Crawford ME, Hjortso N. One-year survival after out-of-hospital cardiac arrest in Copenhagen according to the 'Utstein style'. *Resuscitation* 2000;47:137–46.
- [14] National Registry of Emergency Medical Technicians. EMTs & Candidates: [http://www.nremt.org/about/nremt\\_news.asp](http://www.nremt.org/about/nremt_news.asp). Last update: 12-2-2003. Access date: 20-10-2003.
- [15] Marelsson S, Þorgeirsson G. Sudden noncardiac arrest out-of-hospital in the Reykjavík area 1987–1999. *Læknablaðið*. 2001;87:973–8.
- [16] Blængsdóttir GH, Þorgeirsson G. Advanced cardiac life support in the pre-hospital setting in the Reykjavík area 1987–1990. *Læknablaðið*. 1994;80:381–6.
- [17] Einarsson O, Jakobsson F, Sigurdsson G. Advanced cardiac life support in the pre-hospital setting: the Reykjavík experience. *J Intern Med* 1989;225:129–35.
- [18] Sigurðsson G, Þorgeirsson G. Advanced cardiac life support in the pre-hospital setting in the Reykjavík area 1991–1996. *Læknablaðið*. 2000;86:669–73.
- [19] The Norwegian Medical Association: Norsk indeks for medisinsk nødhjelp. Stavanger: Laerdal 1994.
- [20] Statistics Norway. Specialist health service, ambulance service, 2002: <http://www.ssb.no/english/subjects/03/02/speshelseamb.en/>. Last update: 27-5-2003. Access date: 25-10-2003.
- [21] Statistics Norway. KOSTRA: Spesialisthelsetjenesten 2001: [http://www.ssb.no/emner/03/02/speshelse\\_kostr/](http://www.ssb.no/emner/03/02/speshelse_kostr/). Last update: 19-6-2001. Access date: 25-10-2003.
- [22] Slaatta OJ. Norges offentlige utredninger. Utdanning av ambulansepersonell. NOU 1976: 2. Oslo: Universitetsforlaget, Statens forvaltningstjeneste, Seksjon statens trykning, 1976.
- [23] Strømskag KE. Et fag på søyler. Anestesiens historie i Norge. Oslo: Tano Aschehoug; 2003.
- [24] Madsen P, Puntervoll SA, Soreide E. Norwegian air ambulance (NLA); the NLA HEMS concept—challenging conditions call for constructive thinking. *Scand J Trauma Emerg Med (Akuttjournalen)* 2000;7:5–12.
- [25] Johansen K, Karstensen A. Statens Luftambulans. Nøkkeltall 2000. Report No.: 1/01. 2001. Trondheim: SINTEF Norsk Institutt for Sykehusforskning.
- [26] Norges offentlige utredninger. Luftambulansetjenesten i Norge. NOU 1998:8. Oslo: Statens forvaltningstjeneste, Statens trykning; 1998.
- [27] Jones KM. Advanced paediatric life support. 3rd ed. London: BMJ Publishing; 1998.
- [28] Advanced trauma life support for doctors. 6th ed. Chicago: American College of Surgeons; 1997.
- [29] International Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care—An International Consensus on Science. *Resuscitation* 2000;46:1–448.
- [30] Jakobsen AM, Baklund C. National standard for rescue workers. *Scand J Trauma Emerg Med (Akuttjournalen)* 2003;11:12–5.
- [31] Ministry of Justice and Ministry of Health. Nasjonal standard for redningsmenn innen luftambulansetjenesten, redningshelikoptertjenesten og SAR Offshore: <http://odin.dep.no/jd/norsk/regelverk/veiledninger/012101-120015/index-dok000-b-n-a.html>. Last update: 2002. Access date: 7-11-2003.
- [32] Johansen K. 10 år med Statens Luftambulans. Aktiviteten i 1998 og sentrale utviklingstrekk. Report No.: 5/99. 1999. Trondheim: SINTEF Norsk Institutt for Sykehusforskning.
- [33] Sunde K. Cardiopulmonary resuscitation—Quality of performance and how to further improve haemodynamics. Institute for Experimental Medical Research, Ullevål University Hospital, Oslo; 1999.
- [34] Wik L. Cardiopulmonary resuscitation: effects of improving the early cardiopulmonary resuscitation and early advanced care links in the chain of survival for cardiac arrest victims. Institute for Experimental Medical Research, Ullevål University Hospital, Oslo; 1995.
- [35] Langhelle A. Out-of-hospital cardiac arrest—challenging the guidelines of cardiopulmonary resuscitation. Institute for Experimental Medical Research, Ullevål University Hospital, Oslo; 2003.
- [36] Lossius HM. Advanced life support by specially trained physicians in emergency medical teams. A study of effect, efficiency of team activation, and feasibility of methods for emergency medical research. Faculty of Medicine, University of Oslo; 2003.
- [37] Norges offentlige utredninger. Hvis det haster... Faglige krav til akuttmedisinsk beredskap. NOU 1998: 9. Oslo: Statens forvaltningstjeneste, Seksjon statens trykning; 1998.
- [38] Wisborg T, Strand T. Norway. In: Grande CM, editor. Textbook of trauma anesthesia and critical care. St. Louis: Mosby—Year Book, Inc.; 1993. p. 245–50.
- [39] Suserud BO, Wallman-C:son KA, Haljamae H. Assessment of the quality improvement of pre-hospital emergency care in Sweden. *Eur J Emerg Med* 1998;5:407–14.
- [40] Ersson A, Lundberg M, Wramby CO, Svensson H. Extrication of entrapped victims from motor vehicle accidents: the crew concept. *Eur J Emerg Med* 1999;6:341–7.
- [41] Suserud BO, Haljamae H. Nurse competence: advantageous in pre-hospital emergency care? *Accid Emerg Nurs* 1999;7:18–25.
- [42] Socialstyrelsen. The Swedish National board of health and welfare. Annual report 2002: [www.socialstyrelsen.com/](http://www.socialstyrelsen.com/). Last update: 2003. Access date: 31-10-2003.
- [43] Lippert FK, Soreide E. The role of the physician in pre-hospital trauma care. In: Soreide E, Grande CM, editors. Pre-hospital trauma care. New York: Marcel Dekker, Inc.; 2001. p. 61–7.