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Ambulance Transport and Services in the Rural Areas of Iceland, Scotland and Sweden

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Abstract

The University Hospital in Akureyri (Centre for Emergency Medical Service (EMS) Education) in Iceland, Emergency & Disaster Medical Centre (AKMC) in Sweden and National Health Service - Western Isles in Scotland have undertaken a project "*Ambulance Transport and Services in the Rural Areas*" (ATSRuAr); the object of this paper is to provide an overview of the present status of ambulance transport and services in the three participating regions. This is a project of the INTERREG III Northern Periphery Programme (NPP) who provided a grant for the work.

Methods: Each partner reviewed the current status of prehospital services in their country or region and presented the results at a project meeting in Iceland in March 2006.

Results and Conclusions: Geography and weather provide a challenge to the ambulance transport and services in sparsely populated northern rural areas. The Emergency Medical Services (EMS) systems in these three northern rural areas have many similarities. However, there are differences in the number and distribution of ambulances, the running of the service, education and training of ambulance personnel and first responder schemes. This collaboration will debate on the provision of ambulance transport. Research is needed to indicate how improvements in ambulance transport can improve patient outcome in rural areas.

Keywords: air-ambulance; ambulance; education; patient transport; prehospital services; rural medicine.

Introduction

Although paramedics routinely make some life and death decisions under extreme pressure, not all decisions are of a medical nature. Clinical problem solving can be influenced by the personal and interpersonal realm of culture, law and ethics. The clinical pathway and therefore outcome of a patient can depend on a variety of factors, including whether the patient provides or withholds consent to treatment. Given the primary nature of consent in determining a clinical pathway, it is vital that the concepts of consent and refusal be understood and skilfully applied appropriately in the prehospital environment.

Materials and methods

Each partner in this project reviewed the current status of prehospital services in their region and presented the results at a project meeting in Iceland in March 2006. The authors of this article reviewed pertinent literature on this subject as well as the reports from each partner. This overview describes the present status of ambulance transport and services in the three participating regions.

Ambulance transport and services

General information is shown in tables 1 - 4.

TABLE 1	**Iceland**	**Western Isles (Scotland)**	**Västerbotten (Sweden)**
Inhabitants (total in thousands)	**300**	**26**	**260**
Catchments area (km^2)	**103,000**	**14,400**	**55,432**
National curriculum for EMS physicians	**No**	**Not applicable**	**No**
Emergency medicine as a recognized specialty	**Yes**	**Yes**	**No**
National curriculum for Paramedics	**No**	**Yes**	**No**
National curriculum for EMS nurses	**No**	**No**	**Yes**

Table 2. The ground ambulance service.

TABLE 2	**Iceland**	**Western Isles (Scotland)**	**Västerbotten (Sweden)**
Dispatch centres	**2**	**1**	**1**
Emergency phone number	**112**	**999**	**112**
Operating ground ambulances	**77**	**7**	**21**
Number of basic life support (BLS) ambulances only	**76**	**2**	**0**
Number of advanced life support (ALS) ambulances – *physician, nurse or paramedic on board*	**1**	**5**	**21**
Personnel on board BLS ambulance	**2**	**2**	**-**
Personnel on board ALS ambulance	**3**	**2**	**2**
Assignments per 1000 inhabitants per year	**0.076**	**0.06**	**0.092**
Gross expense (million € per year**)**	**€10.0**	**€0.75**	**€8.8**

Table 3. The air ambulance service.

TABLE 3	**Iceland**	**Western Isles (Scotland)**	**Västerbotten (Sweden)**
National/regional	**Regional**	**National**	**Regional**
Ambulance helicopter bases	**1**	**2**	**1**
Search and Rescue (SAR) helicopter bases	**1**	**1**	**0**
Fixed-wing aircraft	**2 (3 during the winter months)**	**2**	**2**
Fixed-wing assignments annually	**450**	**340**	**76**
Rotor wing assignments annually	**130 - 160**	**24**	**586**

Table 4. Skill level of EMTs and nurses in the ambulance service.

TABLE 4	**Iceland**	**Western Isles (Scotland)**	**Västerbotten (Sweden)**
Automatic external defibrillation	**EMT-B, EMT-I, EMT-P***	**Paramedic & Technician**	**EMTs Nurses**
Manual defibrillation	**EMT-P and physician**	**Paramedic**	**Nurses**
Insertion of peripheral IV	**EMT-I EMT-P**	**Paramedic**	**EMTs Nurses**
Give adrenalin in cardiac arrest	**EMT-I EMT-P**	**Paramedic**	**Nurses**
Perform endotracheal intubation	**EMT-P**	**Paramedic**	**EMTs Nurses**
Needle cricothyroidotomy	**EMT-P**	**Paramedic**	**Yes**
Insertion of supraglottic airway (e.g. Laryngeal Mask airway, Fast-Trach, Laryngeal tube)	**All levels of EMTs**	**Paramedic**	**NA**

* **EMT-B** = Emergency Medical Technicians at basic level / **EMT-I** = Emergency Medical Technicians at intermediate level / **EMT-P** = Paramedic

Iceland

Over all

The Ministry of Health and Social Security (MHSS) is responsible for the overall administration of health affairs and matters relating to social security insurance. The health sector is regulated in accordance with the Health Service Act of 1990, by which all inhabitants have right of access to the best possible health service at any given time for the protection of their mental, social and physical health. The health service in Iceland is primarily financed by central government. The country is divided into health care regions, each with their own primary health care centres, some of which are run jointly with the local community hospital. The primary health care centres have the responsibility for general treatment and care, examination, home nursing and preventive healthcare.[1]

Geography

Iceland is the most sparsely populated country in Europe with an average of approximately three inhabitants per square km. Almost 4/5 of the country is uninhabited or mostly uninhabitable and the population is concentrated in a narrow coastal belt, valleys and the southwest corner of the country (vegetation: 23.8%, lakes: 2.8%, glaciers: 11.9%, wasteland 64.5%). The coastline is 4,970 km. In January 2006, the population of Iceland was 300,000, with an estimated total of 180,000 within that group living in the capital, Reykjavik, and surrounding areas.[2]

Accident and Emergency Service

Logistic and services

There is no national ambulance service in Iceland. All ground ambulances are owned and run by the Icelandic Red Cross. There are 77 ground ambulances in the country, 12 in Reykjavík. The most common type of ambulance is the Ford *Econoline 350*.

Personnel

MHSS issues directions for training and education of Emergency Medical Technicians (EMTs) and the Centre for EMS Education[3] carries out the training of basic and intermediate EMTs. In addition, 20 paramedics (EMT-P), trained in USA, work in the Emergency Medical Service (EMS), mostly in Reykjavík. The fire brigade is the usual EMS provider and there are approximately 400 licensed ambulance personnel in Iceland. EMTs in larger cities and towns, i.e. Reykjavík, Akureyri, Ísafjörður, Keflavík and Selfoss, work full time. Elsewhere, the EMTs work part-time and are on call from home.

Crew members in road ambulances in rural areas are mostly EMT-basic and only occasionally EMT-intermediate. The general rule is that there are two EMTs in each ambulance.[4] There is one ambulance in Reykjavík manned by a physician and an EMT-P. The General Practitioner (GP) on-call is community-based and responds to the scene of an accident or emergency, except in Reykjavík and surrounding communities, where there is an ambulance manned with a physician from the Emergency Clinic that responds to such calls. Rural GPs are not required to have any formal emergency medical training or certification.[6]

There is a lack of supporting or demanding legislation regarding EMS, for example, regarding delegation/qualifications to administer prescription medications. There is no dedicated medical director for the ambulance fleet, and according to health care regulations, local health care is responsible for ambulance service and therefore medical direction in each area.[7]

Air Ambulance Service

Patient transport by air is of great importance in Iceland because of its many sparsely populated areas, long distances and transportation difficulties during the winter. Until a few years ago, individual doctors contacted the most suitable aircraft company without any formal arrangements for the provision of on-call services.

The MHSS has contracted out the air emergency services since 2001. The service for the western, northern and eastern part of the country is now centred in Akureyri in the north, where the second largest hospital is located (Figure 1). There is one dedicated air ambulance plane in Iceland. The plane is well equipped and capable of transporting two patients on stretchers and is manned with an EMT-I or EMT-P from Akureyri Fire and Rescue Service and a physician, if needed, from FSA University Hospital in Akureyri (or the local health authority).

When ordinary airplanes cannot be used, the Icelandic Coast Guard emergency helicopters are available. The Coast Guard runs three rescue helicopters (Aerospatiale Dauphin and Aerospatiale Super Puma) based in Reykjavík. Their primary mission is to search and rescue both off shore and on land. All of the helicopters have a rescue winch and are capable of Instrument Flight Rules (IFR). They are staffed by two pilots, a winch man, a rescue man and a physician (Fig. 1).[4]

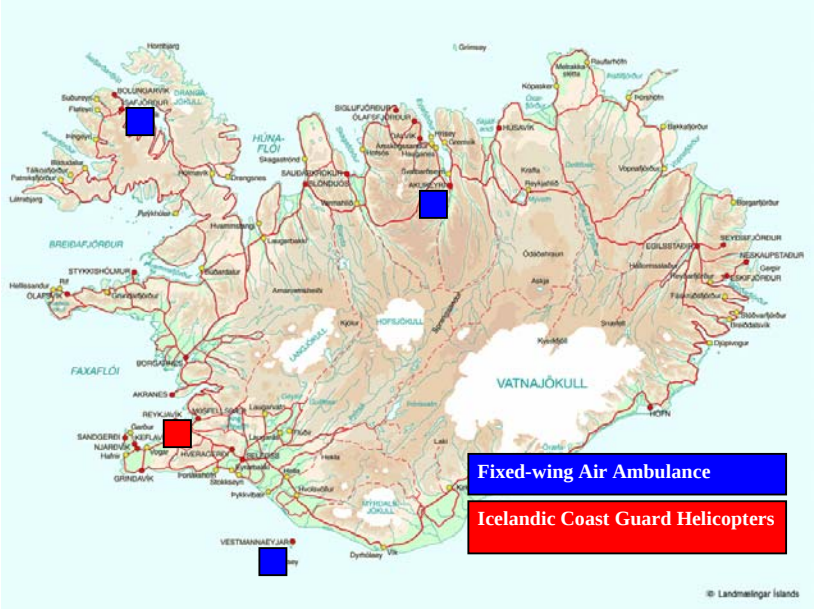


Figure 1. *Bases for helicopter and fixed-wing air ambulances*

There are approximately 450 fixed-wing ambulance missions annually. In addition to the fixed-wing plane in Akureyri there are planes stationed in Westman Islands and Ísafjörður. These planes are not dedicated for patient transport and are manned on an *ad hoc* basis. There are no national guidelines regarding the provision of medical care in air ambulances. It is an exception rather than rule to have a consultant in anaesthesia or emergency medicine on board the fixed-wing ambulance. Most physicians are within two years of graduation. However, they all receive training in aviation medicine and necessary emergency procedures, such as rapid sequence intubation with drugs, needle cricothyroidotomy and placement of a thoracostomy tube. However, there are difficulties in terms of skill maintenance because most patients transported by airplane from rural settings do not require these skills. All physicians on the coast guard helicopter have substantial experience in emergency medicine, and some hold formal specialization in the field.

Patient transport service

First responders

Independent associations in Iceland have taken on a particularly extensive role in prevention and rescue work. Rescue teams, accident prevention divisions and youth sections operate under the banner ICE-SAR (Icelandic Search and Rescue teams). Their joint mission is to save human lives and valuables and to prevent accidents. ICE-SAR has nearly 100 rescue teams, with over 4,000 volunteers throughout Iceland; they are always on standby for emergencies. The teams are specialised in search and rescue both on land and sea and members are trained and equipped to deal with extreme conditions. The teams own expensive rescue equipment, including super jeeps able to drive on snow and glaciers, snowmobiles and boats.[8]

The Western Isles (Scotland)

Over all

Health care in Scotland is the responsibility of the Health Minister sitting in the Scottish Parliament and is free at the point of delivery. Responsibility for managing this huge resource is devolved to Health Boards, which manage services locally. The Scottish Ambulance Service

is a Health Board which has a national remit to develop and provide high quality care throughout Scotland[9] and it is sub-divided into divisions which manage services locally. The Western Isles (Outer Hebrides) come under the auspices of the North and West division and is one of several remote and rural areas served by the Scottish Ambulance Service.

Geography

Geographically, the Highlands and Islands of Scotland cover a land mass equivalent in size to Belgium, (12,500 km^2) and are sparsely populated. There are 110 people/km^2 in Europe, 66 in Scotland, but in the Highlands and Islands it is only 10 people/km.[2,10] Seventy percent of Scotland's population of 5,078,400 live in urban areas with the remainder scattered throughout remote and rural areas throughout the country.[11] The population of the Western Isles is 26,260, slightly over 5% of the national total and statistics show that since 1994 the number of people under 16 years has decreased by 9% while the number of those over 75 years has increased by 16%.[12] (Fig. 2.)

Figure 2. *The Western Isles*

Accident and Emergency Service

Logistic and service

Accident and emergency service deals with emergency and urgent patients as well as more complex non-emergency admissions, discharges and inter-hospital transfers. Typically, each vehicle has a crew comprising of a Paramedic and an Ambulance Technician who are trained to work in vehicles which provide a clinical workplace with maximum mobility. The Mercedes *Sprinter 416 CDi* is typical of the vehicles used in this environment.

Personnel

The crews are highly trained in all aspects of prehospital care, and have access to a wide variety of equipment and drugs including thrombolytics.[9] Telemetry allows the transmission of 12-lead electrocardiogram (ECG) to a central location where a cardiologist gives advice regarding the administration of thrombolytics.

In the face of such geographic and demographic disadvantages, the challenges of ensuring appropriate numbers of highly trained practitioners with regular access to practice in order to maintain skills are as great as the challenges created by the remoteness of the area. The Scottish Ambulance Service provides transport and services at several levels in remote and rural areas.

Air Ambulance Service

Nationally, there are 2 helicopters (*Eurocopter 135*) and 2 fixed-wing pressurised aircraft (*King Air*) for the sole use of the Scottish Ambulance Service, which, when required, may be backed up with Ministry of Defence and Her Majesty's (HM) Coastguard helicopters and other shared aircraft. There are no ambulance service aircraft stationed in the Western Isles and access must be gained from either Inverness or Glasgow, which means that even in good weather conditions there is at least a minimum of a 45-minute delay in arriving at the islands. There is one HM Coastguard helicopter stationed on the Isle of Lewis – the most northerly and

most populous of the Western Isles - and it is called into service when required, although its primary function and first priority is to Maritime Search and Rescue. In 2001-2004 there were 1,110 patients in the Western Isles transported by air, 805 of those by fixed-wing aircraft.

The Eurocopter is staffed by a pilot and two paramedics, while the fixed-wing crews are a staffed by one pilot and one paramedic. In general, the helicopter is expected to perform the same function as a road emergency vehicle, whereas the fixed-wing is used to transport people who have previously been stabilised.

Patient transport services

This provides a wide range of non-emergency transport including Out Patients attending hospital appointments, Disablement Service Centre patients, geriatric and psycho-geriatric patients for day care, non-urgent inter-hospital transfers, and transport for those of any age with no other means of getting to hospital. Two ambulance care assistants who have comprehensive training in first aid, basic life support, specialist driving and patient moving and handling skills staff the vehicles used for this service. In the Western Isles in 2004 - 2005 a total of 6,008 patients were transported in such vehicles, mostly in *Renault Master PTVs*.

First Responders

Community first responders are volunteers living in remote areas who are trained to respond to patients who are critically ill or injured in the period between the emergency call being made and the ambulance arriving on the scene. They are trained and provided with equipment to clear airways, administer oxygen and defibrillate as well as basic life support and first aid, hence filling some of the time lost in the 'golden hour' where ambulances may have to travel some distances.[10]

Västerbotten (Sweden)

Over all

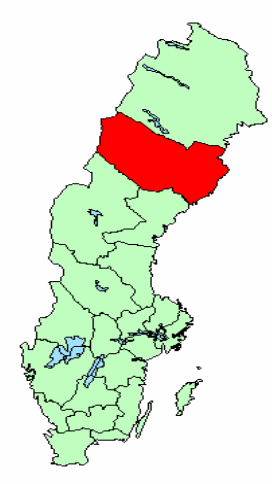
Health care in Sweden is free at the point of delivery and is the responsibility of the Health Minister sitting in the Swedish Parliament. The health care sector is divided into three levels: The Primary health care (GP), the Secondary health care (smaller and central hospitals with most medical specialities) and the Tertiary health care level (University Hospitals that are each responsible for one of the six main health care regions). Sweden is divided into several self-governed counties (landsting).[13] Västerbotten is one of these counties and has three hospitals. One of them, the Northern University Hospital in Umeå is the super specialized health centre for both the county of Västerbotten, and the three other northern counties of Sweden i.e. northern half of Sweden.[14,15]

Geography

The county of Västerbotten is one of the two northernmost counties in Sweden, covering a landmass of 55.432 km^2. The population is about 260000, and more than half of the population live on the coastline. The average population density is about 16 persons per km^2 on the coastline, but only 1.4 km^2 in the inland (Fig. 4).[16]

Figure 3. *The northern Region*

***Figure 4**. Map of Sweden (Västerbotten is coloured red).*

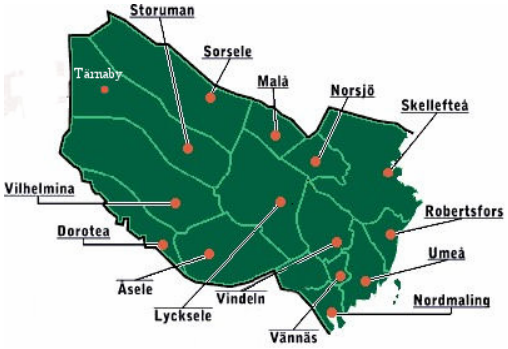


Accident and emergency service

Logistic and service

The ambulance service is the responsibility of the government for each county, in accordance with the Health Care Act and as such, can run the ambulance service or purchase the service from private companies.[17] It is the responsibility of the regional government to provide quality health care services. This, however, has different meaning to different people and the actual organisation and delivery of care may vary according to economy, demand for service and who are elected politicians in charge. This means that adjacent regions may have different levels of care provided by the ambulance service. The logistics of ambulance stations in Sweden varies according to geography and population density. There are fifteen ambulance stations in Västerbotten county, some run by the regional government and some by private companies. (Fig. 5).

***Figure 5**. Ambulance stations in Västerbotten region.*



All ground ambulances have the same equipment, most of which have room for one stretcher and another sitting patient. However, there are three ground ambulances which can take two stretchers at the same time. They are mostly used for secondary transports between hospitals or from health care centres to hospital. All ambulances are enabled with telemetry for transmission of 12-lead ECG as well as equipment for ventilation and defibrillation.

Personnel

There are no specific regulations for qualification of ambulance personnel. However, one has to be a registered nurse in order to be able to deliver medications according to standing orders.[18] The regional governments in Västerbotten have chosen to staff ambulances with a minimum of one registered nurse.

Air ambulance

The four northern counties of Sweden share two fixed-wing air ambulances, which are *Beech King-Air 200* models. The basic crew for each plane consists of two pilots and a registered nurse with basic education in anaesthesia and/or intensive care and special education in flight medicine service. An anaesthesiologist and an additional nurse can be added to the crew if necessary. On average, 1,400 patients from other counties are transported each year to the University Hospital in Umeå, and only one patient to date has been transported within Västerbotten. Seventy-four journeys have involved patients from Västerbotten, however, they were transported to or from the county).

The county of Västerbotten has a helicopter located near the hospital of Lycksele, which is used principally for primary transport. Approximately 580 patients are transported each year and most transfers go from the west part of the county to the hospital of Lycksele or to University hospital in Umeå. The helicopter is crewed by two pilots, one doctor and a nurse. The helicopter and the fixed-wing plane are equipped with what is needed to transport patients at an intensive care level. They can manage incubator transportation when necessary.[19]

Patient transport service

The patient transport service in each region is organised and run by private taxi companies. However, logistics are governed by the county. Taxicabs which are equipped to take a stretcher (~120) are also available, which the cab driver manages unaided.

First responder

In many regions in Sweden there is co-operation with the rural area fire departments to act as first responders, particularly for patients with chest pain. Fire department personnel are trained to administer oxygen, provide mouth-to-mouth ventilation, chest compressions and defibrillation. In the county of Västerbotten this operates in only one place (Jörn) but is expected to be extended to other areas of Västerbotten in the near future. The term is known as "In wait of ambulance", which in Swedish, translates to, "I väntan på ambulans" = IVPA).[20, 21]

Discussion

Certainly Iceland, Västerbotten and the Western Islands represent three quite different geographic areas, but they have much in common. All three areas have low population densities, are spread over wide areas and have unpredictable weather conditions with extreme wind and cold. All of these issues produce problems in designing a functionally effective transport system, which is especially true for ambulance and patient transport services.

In many ways the ambulance services in the three regions are alike. The Scottish Ambulance Service is a national system and is organised as such. In Iceland and Sweden the ambulance services are locally based. In Sweden the service is organised in close relationship, or together with the local health care centres. Whereas, a national organisation allows focus on a well-defined mission; local organisation incorporating the local health care centre can allow more flexibility and can open up the possibility of co-operating with other missions within the health care service, which can be especially valuable in rural areas.

Due to the large number of airports and the frequency of bad weather conditions, the air ambulance services in Iceland are usually served by fixed-wing planes. Ambulance personnel frequently deliver initial care to patients with critical illnesses or severe injuries. It is imperative and beneficial to have highly trained ambulance personnel, and as short response times as possible. Studies have shown that ambulance response time affects outcome in out-of-hospital cardiac arrest.[22] However, there is little data showing the value of higher level training of ambulance personnel responding to a cardiac arrest.[23] In one Swedish study it was suggested that the presence of a nurse on board the ambulance, in addition to two paramedics, might increase survival in out-of-hospital arrest, compared with two paramedics alone.[24] It has also been suggested that survival in this situation is better when patients are treated by paramedics rather than lower ranked ambulance personnel.[25] It is unclear how this applies to other situations. However, it seems logical that the more time that is required to transport a patient to

hospital, the more crucial the skill level of the ambulance crew. This is clearly one of the challenges facing EMS providers in northern rural areas.

Recruitment of qualified ambulance personnel is often difficult and sometimes impossible. Solutions differ between the partners of this study. In Sweden the ambulances are now staffed with highly trained nurses who sometimes also have other duties. In Iceland, the training of ambulance personnel in rural areas is limited in comparison to the Swedish model. Skill maintenance in rural areas is a common theme and this is no less true in the ambulance and patient transport services. Ambulance response times in rural Iceland are generally short and there is concern that there are too many ambulance stations. A seemingly obvious solution is to reduce the number of stations thus increasing the number of missions per station and permitting better skill maintenance. However, bad weather or difficult road conditions could lead to unacceptable long response times, a clear demonstration of the seemingly insoluble conundrum of low activity and skill maintenance.

Local volunteers play a valuable role in patient transportation and emergency health care in remote areas; this is clearly shown by ICE-SAR in Iceland, a volunteer organisation, and the network of community first responders in the Western Isles. In Sweden a similar service is provided by the police in rural areas, who recruit ski-patrols and mountaineers.

Conclusion

There are many similarities in the three regions studied, however, differences concerning number and distribution of ambulances, training of ambulance personnel and first responder schemes can be identified. This collaboration has provided an overview of areas of “best practice”, and furthermore, has allowed the opportunity to share information and seek understanding of the rationale for differing solutions to similar problems in different parts of Northern Europe. More research into patient transport and emergency services is required to inform future programme development in remote and rural areas.

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